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Table of Isotopes

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INTRODUCTION

THE following table represents a complete list of all the radioactive and stable isotopes of the elements, together with a number of their salient features, as recorded in the literature or by private communication by approximately February, 1958.

The system of references developed for the last edition* of the Table of Isotopes has been retained. Each paper is represented by the code symbol of the first-named author, followed by the year in which the paper was published. If two or more papers by one author have appeared during a single year, these are distinguished by the small letters a, b, c, etc., following the main reference. For example, 16H is the code symbol given to O. Hahn; thus, the references 16H41, 16H41a, and 16H41b represent three papers published in 1941 of which O. Hahn is the first author. The code symbols given to the authors are arranged alphabetically only with respect to the first letter of their names.

The format has been modified from that of the previous edition to conserve space. A description of the entries in the various columns is given below.

ISOTOPE

The first column contains the atomic numbers, chemical symbols, and mass numbers of the nuclear species. The symbols of those isotopes for which relative isotopic abundances are listed in column three are underlined to help the user locate quickly the naturally occurring isotopes. An individual entry has been made for each nuclear state whose half-life is long enough for the species to have been separated chemically or mechanically from other activities; the shortest half-life so listed is approximately 0.01 sec. Information about metastable states with half-lives shorter than ~0.01 sec is included with the other gamma-ray transition data. An exception to this policy is made when the mass assignment of a short-lived metastable state is not known; in this case a separate entry is made for the activity regardless of the half-life. Metastable excited states listed in this column are denoted by the superscript "m" following the mass number and, in those cases in which two isomeric states are listed, they are distinguished by use of superscripts "m_1" and "m_2".

HALF-LIFE

Half-life values are listed without qualification where the determination has been a direct measurement of decay rate. The half-lives of nuclear states not included as separate entries are given in column four. Unless otherwise stated, all half-lives are total half-lives of the nuclear levels. The symbols t_β and t_{EC} are sometimes used for partial beta and electron-capture half-lives. For half-life determinations other than by direct decay, the experimental methods are described with the following symbols:

sp act	Determination by measurement of the disintegration rate of a sample containing a known number of atoms.
delay coinc	Measurement of the time interval between two successive nuclear

* *Editor's note*—This table is the fifth in a series of compilations which have appeared at approximately equal time intervals whose increasing length supplies a beautiful example of the exponential way in which knowledge grows. References to the earlier compilations and their lengths are as follows:

(1) (17 pp.) J. J. Livingood and G. T. Seaborg, Revs. Modern Phys. **12**, 30 (1940).
(2) (32 pp.) G. T. Seaborg, Revs. Modern Phys. **16**, 1 (1944).
(3) (82 pp.) G. T. Seaborg and I. Perlman, Revs. Modern Phys. **20**, 585 (1948).
(4) (182 pp.) J. M. Hollander, I. Perlman and G. T. Seaborg, Revs. Modern Phys. **25**, 469 (1953).

events (such as β and γ emission) thus establishing the life-time of the state responsible for the second event. By this method, half-lives between 10^{-3} sec and 10^{-11} sec have been determined.

yield — Estimation of half-life from the amount of activity resulting from a nuclear reaction whose cross section (or yield) is known or estimated.

genet — Measurement of the half-life of a parent activity by determining the yield of a daughter activity as a function of time, where periodic chemical separations of daughter from parent have been performed.

nucl res fluor — The resonant scattering of gamma rays.

Coul exc — Determination from Coulomb excitation cross sections.

Doppler broadening — Determination of the lifetime of a gamma ray emitted from a moving nucleus by measuring the broadening of the line width due to the Doppler effect.

nuclear recoil — Determination of the lifetime of a gamma ray emitted from a moving nucleus by measuring the distance the nucleus travels before the gamma ray is emitted.

An attempt has been made to list the most precise value or values first. However, in a few cases where many values of comparable precision have been reported and no choice seemed obvious, an average value for the half-life has been listed; this is explicitly stated, and references are given to all the papers whose values contributed to that average. Also, among the natural radioactivities, an average value is often used which was taken from an international committee summary report (1C31).

TYPE OF DECAY

Since many classes of data are included in the third column, the entry denoting mode of decay is preceded by the special symbol for radiation, ☢. The observed modes of decay have been listed for all radioactive nuclei. In cases of branched decay between two or more modes, the branching ratios are listed wherever they are known. Symbols used are

β^- Negative beta-particle (negatron) emission.

β^+ Positive beta-particle (positron) emission.

α Alpha-particle emission.

EC Orbital electron capture. It may be assumed that x-rays have been observed or actually identified in virtually all cases of orbital electron capture listed. If the ratio of L electron capture to K electron capture has been determined, it is given here as L/K.

IT Isomeric transition (transition from upper to lower energy level of same nucleus).

n Neutron emission.

When experimenters have searched for and failed to find a particular mode of decay, this is indicated, for example, as "no β^+." Experimental upper limits frequently are given, but no theoretically predicted limits have been quoted.

Among the alpha-emitting isotopes of the heavy elements, calculations by means of closed radioactive decay cycles have shown that there are many isotopes which are thermodynamically stable against β^-, β^+, or EC decay. This has been indicated by the term "β-stable," followed by an abbreviation for the principle of conservation of energy, which underlies the calculations.

Spontaneous fission is not indicated as a mode of decay unless it occurs in greater than 1% of the disintegrations. Spontaneous fission partial half-lives are given in column two below the total half-life values.

CLASS AND IDENTIFICATION

The degree of certainty of each isotopic assignment is indicated by a letter in the third column according to the following code:

A Element and mass number certain.

B Element certain and mass number probable.

C Element probable and mass number certain or probable.

D Element certain and mass number not well established.

E Element probable and mass number not well established or unknown (mass number not listed means that it is unknown).

F Insufficient evidence.

G Assignment probably in error.

Data which have been shown to be in error have, in general, been eliminated from the table. A few isotopes have been quoted so widely in the literature, however, that it was felt some reference should be made to them. For these cases the G rating has been adopted, and reference is made both to the original work and to that which has supplanted it.

In some cases radiations have been ascribed to nuclides which occur in nature. The ratings given in these cases refer neither to the certainty of the existence of the isotope nor to the isotopic abundance measurements, but only to the degree of certainty of the mass assignments of the radiation.

The means by which the mass assignments were made are next tabulated. In general, several references are given here, the first of which denotes the probable discoverer of the isotope (except in the cases of the old natural radioactivities). Following this, references are given to the papers which contributed most significantly toward giving the isotope its best or present rating. Some indication of the experimental methods used in making the various assignments may be had from the following symbolism:

chem	Chemical separations, establishing uniquely the chemical identity (atomic number) of the isotope.
genet	Proven genetic relationships (by chemical or other means) with other isotopes whose mass assignments are known.
genet energy levels	Proof of isobaric relationship with an identified nuclide by observation of identical energy levels following decay of both, implying decay to the same product.
excit	Loosely refers to energetic considerations which have aided in making the mass assignment. Some of these might be (1) excitation or yield experiments to establish the nuclear reaction which produces the isotope, (2) bombardments with low energy particles, in which possible products are few, (3) mass calculations, or other estimates or measurements of Q values, (4) in a few cases, use of fission yield data in making assignments.
cross bomb	Studies of yields of the isotope in several different types of bombardments, in which the target elements as well as the projectiles have been varied.
n-capt	Cases where bombardments with slow neutrons ($n-\gamma$ reactions) have provided key evidence in the mass assignments.
sep isotopes	The use of target elements enriched or depleted in a certain isotope.
mass spect	Identification of the mass number by means of a mass spectrograph.
reso-nance neutron activa-tion	Identification of a nuclear isomer by observing both isomers upon irradiation with filtered neutrons.
decay charac	Identification of expected or predicted decay characteristics.

Data on genetic relationships are located in column three underneath the class-assignment information. The criterion for listing genetic relationships has been, with few exceptions, that these relationships be demonstrated experimentally; for example, by chemical "milking" of daughter activities, analysis of growth-decay curves, or, in the case of short-lived isomers, by delayed coincidence experiments. The listing of these parent-daughter relationships gives some warning to the reader as to what he may expect in the way of radiation from a given isotope, since the radiation of a sufficiently short-lived daughter may also be observed with that of the parent.

Because of a lack of space we omit information on the methods of production. References given in the various columns serve as a key to the literature where information on the methods of production can be found.

PERCENT ABUNDANCE

The relative isotopic abundances for the elements are given in accordance with the "best values" listed in the report (1B50) by K. T. Bainbridge and A. O. Nier, except as supplemented by more recent values. In some of the light elements references are made also to papers which discuss source variations in isotope abundances. The symbols, in column one, of those isotopes for which relative isotopic abundances are listed are underlined.

NUCLEAR MOMENTS

Measured values of the nuclear moments are also given in the third column. Unless otherwise stated, the measured value is that of the ground state. The mechanical or spin moment, I, is given in units of $\hbar$. The magnetic dipole moment, μ, is given in units of nuclear magnetons. The value is given without the diamagnetic correction (see 6IW53). In many cases, the absolute value of μ has been measured but not the sign. If the sign is not known, from any measurement, then the symbol $\pm$ is placed before the numerical values of μ. If the sign *is* known, from one determination, then no symbol is used before the numerical values of other determinations.

The electric quadrupole moment, q, is given in units of "barns" (10^{-24} cm^2). In selecting these data much use was made of the compilations of Mack (87M50), Walchli (61W53), Kopfermann (67K56), and the National Research Council (94W55). Higher order nuclear moments are not given, but references to papers where they may be found are included.

Experimental methods are described as follows:

atomic spec	Hyperfine structure from optical spectroscopy (includes both line and band spectra).

nucl induct	Nuclear resonance absorption or induction.
atomic beam	Atomic or molecular beam magnetic resonance.
paramag res	Paramagnetic resonance.
quad res	Quadrupole resonance.
microwave	Microwave absorption.
ang corr attenuation	Attenuation by a magnetic field of the angular correlation between successive nuclear events.
nucl alignment	Alignment of nuclei at low temperatures by a magnetic field.
decelerated cyclotron	Determination of magnetic moment by measurement of resonance frequency at which particles are decelerated in a cyclotron.

ENERGY OF RADIATION

The energies of particles and photons are included together in column four. Following the National Research Council (94W55) we use the symbol † to designate relative intensities of the various radiations within a given entry. Thus the symbol % will always denote absolute percentages of total decay.

The particle energies are followed by other relevant information pertaining to the decay scheme and by a description of the experimental methods used in obtaining the data. In cases of complex alpha structure or several partial beta spectra, the relative abundances of the various groups within that mode of decay are given in parentheses. Beta-particle energies correspond to the upper limits of the spectra.

The continuous internal bremsstrahlung endpoint is included in those cases where it has been measured. This value is preceded by the symbol EC.

Particle energies are quoted only where the investigator has actually measured them. When only the relative abundances of particle groups or the energy differences between groups have been determined, these are indicated as in the following example:

$$\alpha_0(10\%),\ \alpha_{50}(75\%),\ \alpha_{80}(15\%),$$

meaning that 75% of the alpha particles lead to a state 50 kev above the ground state, and that 15% of the alpha particles lead to a state 80 kev above the ground state.

The term "long-range α" is the classical designation for alpha-particle groups emitted from excited states of the listed nuclide, and the energies therefore are not included in the Q_α value, which applies to the ground-state to ground-state transition. These alpha groups occur in competition with gamma-ray emission, following the beta decay of the parent nuclide.

Experimental methods for the measurement of the properties of particles are described as follows:

abs	Absorption.
spect	Magnetic deflection (magnetic spectrograph or spectrometer or counter with magnetic field).
scint spect	Measurement of pulses produced by a scintillating crystal or solution.
ion ch	Measurement of pulse sizes in ionization chamber or proportional counter.
cl ch	Cloud chamber (with magnetic field in case of beta particles).
coinc abs, coinc spect, $\beta-\gamma$ coinc	Beta- and gamma-coincidence counters with absorbers or spectrometers.

Gamma transitions are described by the following information:

Energy of the nuclear transition.—This corresponds to the difference in energy between the initial and final nuclear states and is equal to the photon or gamma-ray energy (if a photon is emitted in the transition). When measurements of internal conversion electrons have formed the basis for the energy determination, the energy listed here is always the transition energy, not conversion electron energy. Energies of conversion electrons are rarely listed in this table; in those few cases it is explicitly stated.

Abundances of gamma rays.—Intensities given with the percent sign refer to the number of unconverted photons emitted per 100 disintegrations. Where an absolute abundance has not been determined, often the relative unconverted photon abundances have been measured. These are tabulated as $\gamma_1/\gamma_2/\gamma_3 \sim 2/1/5$, or, more often, as γ_1 (†2), γ_2 (†1), γ_3 (†5).

Internal conversion coefficients.—These are given as the ratio of the number of conversion electrons emitted to the number of unconverted gamma quanta emitted and are expressed as e/γ. Where conversion coefficients for individual electron shells have been determined, they are denoted as e_K/γ, e_L/γ, etc.

Conversion coefficient ratios.—Where the ratios of internal conversion coefficients in several electron shells have been measured, they are listed as K/L, L/M, $K/L+M$, $K/L/M$, $L_I/L_{II}/L_{III}$, etc. Note that $L_I/L_{II}+L_{III}$ is used instead of the correct mathematical form $L_I/(L_{II}+L_{III})$.

Gamma rays associated with short-lived isomers are listed as entries both of the isomer and of its parent. The half-lives of gamma rays, where measured, are included in this column. Unless otherwise indicated, the half-life value is that of the level from which the gamma ray emanates.

When an author has stated that gamma radiation is present, but has reported no energy determination, this is indicated by the symbol "γ." Conversely, when attempts to find gamma radiation have failed, this is indicated by "no γ."

Coulomb excitation.—The only nuclear reaction data included are those obtained from Coulomb excitation.

X-rays are mentioned only when they are the prominent radiation observed in measuring an activity, or when the observation and identification of x-rays has been crucial in the characterization of an isotope. When the x-rays are associated with electron capture, they are preceded by the symbol EC.

The symbols used to describe the methods employed for the determination of gamma-ray energies or for the elucidation of decay schemes are as follows:

spect conv	Internal conversion electrons observed with a magnetic spectrograph or spectrometer.
scint spect	Measurement of pulse heights produced in a scintillating crystal or solution.
spect	Secondary electrons observed with a magnetic spectrograph or spectrometer.
cryst spect	Measurement by diffraction of gamma rays with a bent crystal spectrometer.
abs	Absorption of gamma rays.
abs conv	Absorption of internal conversion electrons.
abs sec	Absorption of secondary electrons.
coinc	Studies of coincidences or absences of coincidences ($\gamma-\gamma$, $\beta-\gamma$, γ-conv, conv-conv, $\alpha-\gamma$, etc.) with coincidence counters and, in some cases, spectrometers.
sum scint spect	$\gamma-\gamma$ coincidence studies by the summation of gamma-rays in a scintillation crystal.
coinc abs	Coincidence studies using absorption techniques.
cl ch recoil	Secondary electrons observed in cloud chamber with magnetic field.
pair spect	Magnetic analysis of positron-electron pairs produced by gamma rays in a thin radiator.
$Be-\gamma-n$, $D-\gamma-n$, or $D-\gamma-p$	Measurements of neutron or proton energies from these reactions.

DISINTEGRATION ENERGY AND SCHEME

The disintegration energy, or Q value, of a nuclear transformation is defined as the mass difference (expressed in Mev) between the initial and final systems under consideration. For radioactive decay processes, Q is equal to the sum of the particle kinetic energy, nuclear recoil energy, and the energies of any gamma transitions necessary to de-excite the final nucleus to its ground state. In β^+ decay the Q value is given as Q_{EC}, to avoid ambiguity associated with the addition of $2m_0c^2$ to the positron energy. Where Q values have been estimated or calculated by the authors of this compilation, the special reference "SHS" is used; otherwise, reference is made to the paper from which the quoted value is taken. In most instances Q values have been obtained from decay data; where this is not the case, the method is indicated.

Energy-level diagrams have been drawn in many cases; these are not necessarily complete representations of the data, but include only those features which seem to be reasonably well established and unambiguous. Heights of the various energy levels above the ground state are indicated at the side of the drawing. Occasionally the energy value of a level is inferred from nuclear reaction data not given in the table. When we have altered a decay scheme in any significant way from that given in the original paper or papers, we include our own code reference (SHS).

Double arrows drawn from the ground state to a higher level of a nucleus show that the higher level has been Coulomb excited.

In many cases, the total angular momentum (spin) and parity of the states are given in the level schemes. When the spin of a state has been measured directly, it is denoted by underlining that quantum number in the decay scheme, i.e., $\underline{\frac{1}{2}}+$. If the spin is determined uniquely by other methods, it is designated by the quantum number without any other modification, i.e., $3-$. The $0+$ character of the ground states of even-even nuclei is in this latter category except in a few cases where direct measurements of the spin have been made. Probable spin values are indicated with parentheses around the quantum number, i.e., $(2+)$. Since parity assignments depend heavily upon theory, the foregoing nomenclature does not apply to them.

The percentage figures given in the decay drawings total 100% for the total decay. In some cases the symbol † is used to designate the relative branching of one mode of decay.

A few further abbreviations are listed below:

NNES–PPR	Volumes of the National Nuclear Energy Series, Plutonium Project Record, McGraw-Hill Book Company, Inc., New York.
[ ]	Properties listed in brackets have

	not been observed directly but have been inferred from other experimental data or from theoretical predictions.
est, calc	Estimated or calculated from theoretical or empirical considerations.
SHS	Refers to the authors of this compilation.
lim	Experimental upper limit.
emuls	Photographic emulsion.

On the next few pages some other tables and charts are given which may be helpful to users of this table. Portions of these tables have been reproduced with the kind permission of the authors cited.

ACKNOWLEDGMENTS

We are particularly indebted to the Nuclear Data Group of the National Research Council whose nuclear data cards were of much help in providing literature references in the period from 1953 to 1957. It is a pleasure to acknowledge the generous help and constructive criticism which we have received from our friends and colleagues, and to thank many of the authors whose measurements are cited for their aid in evaluating data familiar to them.

We also express our appreciation to Eileen Doyle for her typing of the manuscript and preparation of most of the drawings.

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TABLE I. Atomic constants.

The material in this table was obtained for the most part from Cohen, DuMond, Layton, and Rollett, Revs. Modern Phys. 27, 363 (1955), and J. A. Bearden and J. S. Thomsen, Nuovo cimento 5 (Suppl.), 267 (1957). The constants are arranged alphabetically according to the symbol used for the constant.

Symbol	Quantity	Value
$a_o = \hbar^2/me^2$	First Bohr Radius	5.29173×10^{-9} cm
$1/\alpha = \hbar c/e^2$	Fine Structure Constant	137.0372
c	Velocity of Light	2.997929×10^{10} cm sec^{-1}
ϵ	Base of Natural Logarithms	2.7182818
e	Electronic Charge	4.80290×10^{-10} esu
e^2		1.43985×10^{-7} ev cm
e/c		1.60208×10^{-20} emu
e/m	Charge to Mass Ratio of the Electron	5.27302×10^{17} esu gm^{-1}
e/mc		1.75889×10^{7} emu gm^{-1}
F = Ne/c	Faraday Constant (Phys. Scale)	9652.1 emu gm^{-1} mole^{-1}
γ_p	Gyromagnetic Ratio of Proton, uncorrected for Diamagnetism	2.67523×10^{4} radians sec^{-1} gauss^{-1}
h	Planck's Constant	6.6253×10^{-27} erg sec
$\hbar = h/2\pi$		1.05445×10^{-27} erg sec
h/e		1.37943×10^{-17} erg sec esu^{-1}
$H\rho$	Conversion of Electron Momentum into Relativistic Units	$1704.43\,\eta$ gauss cm
$k = R_o/N$	Boltzmann's Constant	1.38047×10^{-16} erg deg^{-1}
$\lambda_{ce} = h/mc$	Compton Wave-Length of Electron	2.42627×10^{-10} cm
$\lambda_{cp} = h/m_p c$	Compton Wave-Length of Proton	1.32141×10^{-13} cm
$\lambda_{cn} = h/m_n c$	Compton Wave-Length of Neutron	1.31959×10^{-13} cm
λ_g/λ_s	Conversion Factor from Siegbahn x-units to Milliångströms	1.00204
$M_e = Nm$	Atomic Mass of Electron (Phys. Scale)	5.48762×10^{-4}
M_H	Atomic Mass of Hydrogen (Phys. Scale)	1.008144
M_n	Atomic Mass of Neutron (Phys. Scale)	1.008983
M_p	Atomic Mass of Proton (Phys. Scale)	1.007595
M_p/M_e	Ratio of Proton to Electron Mass	1836.12
m	Electron Rest Mass	9.1085×10^{-28} gm = 0.510976 Mev
$m_n = M_n/N$	Neutron Rest Mass	1.67473×10^{-24} gm = 939.51 Mev
$m_p = M_p/N$	Proton Rest Mass	1.67242×10^{-24} gm = 938.21 Mev
$\mu = mM_p/M_H$	Reduced Mass of Electron in Hydrogen Atom	9.1035×10^{-28} gm
μ_e	Magnetic Moment of Electron	9.2839×10^{-21} erg gauss^{-1}
$\mu_n = he/4\pi m_p c$	Nuclear Magneton	5.0504×10^{-24} erg gauss^{-1}
$\mu_o = he/4\pi mc$	Bohr Magneton	9.2732×10^{-21} erg gauss^{-1}
N	Avogadro's Number (Phys. Scale)	6.0248×10^{23} mole^{-1}
π	Ratio of Circumference of Circle to its Diameter	3.141593
R_o	Ideal Gas Constant (Phys. Scale)	8.3170×10^{7} erg mole^{-1} deg^{-1}
r	Ratio of Physical to Chemical Scale of Atomic Weights	1.000275
$r_o = e^2/mc^2$	Classical Electron Radius	2.81785×10^{-13} cm

TABLE II. Energy conversion factors.

This table was expanded slightly from that given by Bearden and Thomsen, Nuovo cimento 5 (Suppl.), 267 (1957).

erg	Volt	Sec^{-1}	Cm^{-1}	^{o}K	gm	amu	Cal.
1 erg	6.2419×10^{11}	1.50935×10^{26}	5.0346×10^{15}	7.2438×10^{15}	1.112648×10^{-21}	6.7033×10^{2}	2.39006×10^{-8}
1.60209×10^{-12}	1 volt	2.41810×10^{14}	8.0659×10^{3}	1.16052×10^{4}	1.78256×10^{-33}	1.07393×10^{-9}	3.82909×10^{-20}
6.6254×10^{-27}	4.13547×10^{-15}	$1\ sec^{-1}$	3.335637×10^{-11}	4.79929×10^{-11}	7.3717×10^{-48}	4.44121×10^{-24}	1.58351×10^{-34}
1.98624×10^{-16}	1.23978×10^{-4}	2.997928×10^{10}	$1\ cm^{-1}$	1.43879	2.20999×10^{-37}	1.33144×10^{-13}	4.74723×10^{-24}
1.38049×10^{-16}	8.6168×10^{-5}	2.08364×10^{10}	0.69503	$1^{o}\ K$	1.53600×10^{-37}	9.2538×10^{-14}	3.29945×10^{-24}
8.98757×10^{20}	5.6099×10^{32}	1.35654×10^{47}	4.5249×10^{36}	6.5104×10^{36}	1 gm	6.0247×10^{23}	2.14808×10^{13}
1.49180×10^{-3}	9.3116×10^{8}	2.25164×10^{23}	7.51066×10^{12}	1.08063×10^{13}	1.65985×10^{-24}	1 amu	3.56549×10^{-11}
4.18400×10^{7}	2.61160×10^{19}	6.31510×10^{33}	2.10648×10^{23}	3.03080×10^{23}	4.65531×10^{-14}	2.80466×10^{10}	1 cal.

TABLE III. Some precise gamma-ray energies and $H\rho$ values.

Energy of Transition (Mev)	Parent Nuclide
0.01437	Co^{57}
0.05957	Am^{241}
0.08016	I^{131}
0.08426	Tm^{170}
0.0875	Cd^{109}
0.1150	Pb^{212} (ThB)
0.1220	Co^{57}
0.1364	Co^{57}
0.2386	Pb^{212} (ThB)
0.279	Hg^{203}
0.28431	I^{131}
0.36447	I^{131}
0.41177	Au^{198}
0.5108	Tl^{208} (ThC'')
0.510976	Annihilation Radiation (Na^{22}, etc.)
0.5697	Bi^{207}
0.5830	Tl^{208} (ThC'')
0.6616	Cs^{137}
0.729	Bi^{212} (ThC)
1.064	Bi^{207}
1.1728	Co^{60}
1.276	Na^{22}
1.3325	Co^{60}
1.368	Na^{24}
1.771	Bi^{207}
2.6143	Tl^{208} (ThC'')
2.754	Na^{24}

Line	Hρ (gauss - cm)	Electron Energy (Mev)	Parent Nucleus
A	534.20	0.024509	Th(B+C+C'') Pb^{212}
B	652.38	0.036150	"
F	1388.44	0.14808	"
I	1753.9	0.22222	"
Ia	1757.1	0.22290	"
J	1811.1	0.23461	"
L	2607.2	0.42284	"
X	9986.7	2.5263	"

TABLE IV. Atomic electron binding energies.

The following is a reproduction of the table given by Hill, Church, and Mihelich, Rev. Sci. Instr. **23**, 523 (1952). The energy units here are kilovolts. We have retained only the Cauchois values for the K-electron binding energies of the elements with $Z > 77$ (see 13H56a). For information about the sources of data and their accuracy, the original reference should be consulted.

	K	L_I	L_{II}	L_{III}	M_I	M_{II}	M_{III}	M_{IV}	M_V	N_I	N_{II}	N_{III}	N_{IV}	N_V	N_{VI}	N_{VII}	O_I	O_{II}	O_{III}	$O_{IV, V}$
3 Li	0.0547																			
4 Be	0.112																			
5 B	0.187																			
6 C	0.284																			
7 N	0.400																			
8 O	0.532																			
9 F	0.692																			
10 Ne	0.874																			
11 Na	1.08																			
12 Mg	1.303	0.0628		0.050			0.007													
13 Al	1.559	0.0870		0.072			0.005													
14 Si	1.838	0.118		0.098			0.007													
15 P	2.142	0.153		0.128			0.007													
16 S	2.469	0.193	0.163	0.162			0.005													
17 Cl	2.822	0.238	0.202	0.201	0.0297		0.007													
18 A	3.200	0.287	0.246	0.244	0.035		0.011													
19 K	3.606	0.341	0.295	0.292	0.041		0.016													
20 Ca	4.038	0.399	0.350	0.346	0.047		0.026													
21 Sc	4.496	0.462	0.411	0.407	0.054		0.037													
22 Ti	4.966	0.530	0.462	0.456	0.061		0.035													
23 V	5.467	0.604	0.523	0.515	0.068		0.041													
24 Cr	5.988	0.679	0.584	0.574	0.076		0.042													
25 Mn	6.542	0.762	0.656	0.644	0.085		0.052													
26 Fe	7.113	0.849	0.722	0.709	0.094		0.056													
27 Co	7.713	0.929	0.798	0.783	0.103		0.064													
28 Ni	8.337	1.015	0.877	0.858	0.111		0.073													
29 Cu	8.982	1.100	0.954	0.935	0.121		0.077													
30 Zn	9.662	1.200	1.047	1.024	0.137		0.091		0.012											
31 Ga	10.394	1.30	1.168	1.142	0.182		0.129		0.043											
32 Ge	11.100	1.42	1.244	1.212	0.175		0.119		0.024											
33 As	11.866	1.529	1.358	1.322	0.202		0.140		0.041											
34 Se	12.653	1.66	1.472	1.431	0.227		0.157		0.053											
35 Br	13.476	1.79	1.599	1.552	0.259		0.185		0.073											
36 Kr	14.32	1.92	1.73	1.67	0.289	0.215	0.210		0.091											
37 Rb	15.197	2.064	1.863	1.803	0.323	0.247	0.236		0.110		0.012									
38 Sr	16.101	2.212	2.004	1.937	0.356	0.277	0.266		0.132	0.034	0.018									
39 Y	17.053	2.387	2.171	2.096	0.411	0.329	0.316		0.176	0.064	0.039									

TABLE IV (*continued*)

	K	L_I	L_{II}	L_{III}	M_I	M_{II}	M_{III}	M_{IV}	M_V	N_I	N_{II}	N_{III}	N_{IV}	N_V	N_{VI}	N_{VII}	O_I	O_{II}	O_{III}	$O_{IV,V}$
40 Zr	17.998	2.533	2.308	2.224	0.432	0.345	0.331	0.183	0.181	0.052		0.029								
41 Nb	18.986	2.700	2.467	2.372	0.471	0.381	0.365	0.209	0.206	0.058		0.034								
42 Mo	20.003	2.869	2.630	2.525	0.509	0.414	0.396	0.235	0.232	0.069		0.039								
43 Tc	21.05	3.05	2.80	2.68	0.546	0.449	0.428	0.259	0.256	0.072		0.042								
44 Ru	22.117	3.227	2.968	2.839	0.584	0.485	0.463	0.285	0.281	0.075		0.045								
45 Rh	23.210	3.404	3.139	2.995	0.619	0.513	0.489	0.304	0.299	0.073		0.041								
46 Pd	24.356	3.614	3.338	3.181	0.677	0.569	0.540	0.348	0.342	0.094		0.060	0.010	0.010						
47 Ag	25.535	3.828	3.547	3.375	0.743	0.626	0.593	0.396	0.391	0.118		0.080	0.029	0.026						
48 Cd	26.712	4.019	3.731	3.541	0.775	0.652	0.616	0.414	0.407	0.111		0.061	0.014	0.012						
49 In	27.929	4.226	3.929	3.732	0.823	0.691	0.653	0.447	0.445	0.118		0.075	0.008	0.018						
50 Sn	29.182	4.445	4.139	3.911	0.868	0.739	0.695	0.477	0.467	0.119		0.072	0.008	0.005						
51 Sb	30.497	4.708	4.391	4.137	0.950	0.823	0.775	0.543	0.532	0.159		0.109	0.042	0.035						
52 Te	31.817	4.953	4.621	4.347	1.013	0.882	0.831	0.591	0.577	0.175		0.125	0.050	0.046						
53 I	33.164	5.187	4.855	4.559	1.074	0.930	0.874	0.634	0.620	0.187		0.148	0.054	0.053						
54 Xe	34.55	5.45	5.10	4.78	1.14	0.992	0.931	0.686	0.672	0.208	0.156	0.150	0.066	0.065						
55 Cs	35.974	5.706	5.360	5.014	1.215	1.056	0.990	0.741	0.728	0.231	0.164	0.151	0.079	0.077			0.026		0.003	
56 Ba	37.432	5.995	5.629	5.250	1.297	1.143	1.068	0.800	0.783	0.255	0.198	0.186	0.098	0.094			0.048		0.010	
57 La	38.923	6.264	5.902	5.490	1.371	1.201	1.120	0.857	0.839	0.280	0.204	0.189	0.113	0.106			0.041		0.012	
58 Ce	40.43	6.556	6.169	5.728	1.439	1.279	1.191	0.906	0.888	0.295	0.231	0.215	0.117	0.115			0.043		0.029	
59 Pr	41.99	6.837	6.446	5.968	1.514	1.339	1.245	0.956	0.934	0.310	0.239	0.221	0.124	0.118			0.042		0.022	
60 Nd	43.57	7.134	6.728	6.215	1.583	1.413	1.305	1.007	0.984	0.323	0.251	0.232	0.126	0.125			0.042		0.027	
61 Pm	45.2	7.43	7.02	6.46	1.65	1.48	1.36	1.06	1.03	0.336	0.261	0.242	0.131	0.130			0.041		0.027	
62 Sm	46.85	7.742	7.316	6.720	1.727	1.545	1.424	1.111	1.083	0.349	0.271	0.253	0.136	0.133			0.041		0.026	
63 Eu	48.51	8.059	7.624	6.984	1.808	1.622	1.488	1.169	1.138	0.370	0.297	0.266	0.145	0.143			0.039		0.030	
64 Gd	50.23	8.383	7.942	7.251	1.888	1.693	1.550	1.226	1.191	0.388	0.303	0.277	0.155	0.149			0.057		0.034	
65 Tb	52.00	8.713	8.258	7.520	1.970	1.768	1.613	1.279	1.245	0.399	0.319	0.289	0.155	0.152			0.048		0.024	
66 Dy	53.77	9.053	8.587	7.795	2.036	1.846	1.679	1.339	1.301	0.422	0.342	0.303	0.170	0.157			0.042		0.031	
67 Ho	55.61	9.395	8.918	8.074	2.130	1.921	1.739	1.393	1.354	0.436	0.349	0.308	0.170	0.163			0.048		0.020	
68 Er	57.47	9.754	9.270	8.362	2.221	2.005	1.814	1.457	1.413	0.451	0.371	0.323	0.189	0.171			0.054		0.038	
69 Tm	59.4	10.12	9.62	8.66	2.31	2.09	1.89	1.52	1.47	0.471	0.384	0.336	0.197	0.181			0.064		0.032	
70 Yb	61.31	10.493	9.985	8.949	2.402	2.180	1.958	1.582	1.533	0.491	0.399	0.350	0.204	0.193			0.075		0.026	
71 Lu	63.32	10.873	10.352	9.248	2.493	2.264	2.028	1.643	1.594	0.502	0.417	0.365	0.213	0.198			0.058		0.031	
72 Hf	65.37	11.283	10.750	9.567	2.608	2.379	2.115	1.724	1.669	0.544	0.444	0.388	0.234	0.221	0.027	0.024	0.076		0.046	
73 Ta	67.46	11.685	11.141	9.883	2.713	2.472	2.199	1.797	1.739	0.572	0.468	0.409	0.247	0.234	0.031	0.029	0.075		0.043	
74 W	69.51	12.094	11.538	10.200	2.814	2.570	2.274	1.867	1.804	0.588	0.489	0.421	0.254	0.239	0.031	0.027	0.073		0.039	
75 Re	71.7	12.52	11.96	10.53	2.93	2.68	2.36	1.95	1.88	0.619	0.516	0.442	0.271	0.256	0.040	0.035	0.078		0.042	
76 Os	73.9	12.97	12.38	10.86	3.05	2.79	2.45	2.03	1.95	0.650	0.542	0.464	0.288	0.272	0.048	0.043	0.084		0.044	
77 Ir	76.11	13.412	12.819	11.208	3.166	2.901	2.544	2.108	2.034	0.683	0.570	0.486	0.307	0.291	0.058	0.053	0.090		0.046	
78 Pt	78.379	13.865	13.260	11.552	3.285	3.013	2.632	2.188	2.108	0.710	0.597	0.506	0.318	0.303	0.061	0.058	0.087		0.045	
79 Au	80.713	14.351	13.731	11.916	3.424	3.147	2.741	2.289	2.202	0.758	0.642	0.542	0.350	0.333	0.084	0.079	0.106		0.056	
80 Hg	83.106	14.84	14.21	12.28	3.56	3.28	2.85	2.38	2.29	0.799	0.677	0.572	0.376	0.358	0.100	0.096	0.116		0.063	

TABLE IV (*continued*)

	K	L_I	L_{II}	L_{III}	M_I	M_{II}	M_{III}	M_{IV}	M_V	N_I	N_{II}	N_{III}	N_{IV}	N_V	N_{VI}	N_{VII}	O_I	O_{II}	O_{III}	$O_{IV, V}$
81 Tl	85.517	15.344	14.695	12.653	3.701	3.413	2.951	2.480	2.384	0.842	0.717	0.605	0.403	0.381	0.118	0.114	0.126	0.072		
82 Pb	88.001	15.861	15.200	13.033	3.852	3.558	3.067	2.584	2.482	0.893	0.760	0.642	0.437	0.414	0.143	0.136	0.148	0.087		0.022
83 Bi	90.521	16.386	15.709	13.417	4.000	3.695	3.177	2.688	2.578	0.938	0.805	0.676	0.464	0.440	0.162	0.156	0.157	0.119	0.092	0.024
84 Po	93.10	16.93	16.23	13.81	4.15	3.84	3.29	2.79	2.68	0.986	0.848	0.712	0.493	0.468	0.181	0.176	0.171	0.130	0.111	0.029
85 At	95.73	17.48	16.78	14.21	4.31	4.00	3.41	2.90	2.78	1.04	0.895	0.748	0.526	0.497	0.202	0.195	0.185	0.143	0.118	0.035
86 Rn	98.40	18.05	17.33	14.61	4.48	4.15	3.53	3.01	2.88	1.09	0.943	0.787	0.558	0.529	0.224	0.217	0.200	0.155	0.125	0.041
87 Fr	101.13	18.63	17.89	15.02	4.64	4.31	3.66	3.13	2.99	1.14	0.992	0.826	0.591	0.561	0.246	0.240	0.215	0.169	0.132	0.047
88 Ra	103.92	19.23	18.47	15.44	4.81	4.47	3.78	3.24	3.09	1.20	1.04	0.867	0.627	0.593	0.270	0.264	0.232	0.182	0.140	0.054
89 Ac	106.75	19.84	19.07	15.86	4.99	4.64	3.91	3.36	3.20	1.25	1.10	0.908	0.663	0.627	0.296	0.288	0.249	0.196	0.148	0.062
90 Th	109.630	20.452	19.673	16.278	5.163	4.810	4.025	3.469	3.310	1.306	1.147	0.944	0.692	0.656	0.322	0.315	0.266	0.212	0.156	0.069
91 Pa	112.58	21.10	20.30	16.72	5.36	5.00	4.16	3.60	3.43	1.37	1.21	0.992	0.738	0.699	0.353	0.343	0.294	0.229	0.172	0.082
92 U	115.591	21.757	20.944	17.163	5.546	5.179	4.301	3.723	3.546	1.439	1.269	1.040	0.781	0.737	0.387	0.375	0.322	0.248	0.189	0.095
93 Np	118.64	22.41	21.59	17.61	5.74	5.36	4.43	3.85	3.66	1.50	1.32	1.08	0.817	0.774						
94 Pu	121.75	23.10	22.25	18.06	5.93	5.56	4.56	3.98	3.78	1.56	1.38	1.13	0.857	0.815						
95 Am	124.92	23.80	22.94	18.52	6.14	5.75	4.70	4.11	3.90	1.63	1.45	1.18	0.901	0.856						
96 Cm	128.14	24.50	23.63	18.99	6.34	5.95	4.84	4.24	4.02	1.70	1.51	1.22	0.943	0.897						
97 Bk	131.43	25.23	24.34	19.47	6.55	6.16	4.99	4.38	4.15	1.77	1.58	1.27	0.986	0.941						
98 Cf	134.77	25.98	25.07	19.95	6.77	6.37	5.13	4.51	4.28	1.84	1.65	1.32	1.03	0.984						
99 E	138.17	26.74	25.82	20.44	6.99	6.58	5.28	4.65	4.41	1.91	1.72	1.37	1.08	1.03						
100 Fm	141.64	27.51	26.57	20.93	7.22	6.81	5.42	4.80	4.54	1.99	1.79	1.42	1.13	1.08						

TABLE V. Rapid method for calculating log (ft) values.

From S. A. Moszkowski, Phys. Rev. **82**, 35 (1951)

The following figures permit the rapid calculation of log (ft) for a given type of decay, given energy, half-life, etc. The notation is: E_0 for $\beta^{\pm}$ emission is the maximum kinetic energy of the particles in Mev; E_0 for K electron capture is the disintegration energy in Mev. When a β^+ emission and K electron capture go from and to the same level, E_0 for K capture $= E_0$ for β^+ emission $+1.02$ Mev. Z is the atomic number of the initial nucleus, t is the total half-life, and p is the percentage of decay occurring in the mode under consideration. When no branching occurs, $p = 100$.

Procedure for obtaining log (ft)

(1) First obtain log (f_0t), using Fig. 1. E_0 is read off the left-hand side of the E_0 column for K electron capture, and off the right-hand side for $\beta^{\pm}$ emission. Put a straight edge over the given values of E_0 and t and note where it crosses the column of log (f_0t) values.

(2) Then read off log (C) from Figs. 2, 3, and 4 for β^-, β^+, and K electron capture, respectively.

(3) Get Δ log (ft) from Fig. 5 if $p < 100$. When $p = 100$, Δ log (ft) $= 0$.

(4) Log (ft) $=$ log (f_0t) $+$ log (C) $+ \Delta$ log (ft).

Details concerning the construction, significance, and range of usefulness of these graphs are given in the original paper.

TABLE VI. Photon lifetime formula.

The photon transition probability of a single proton T_{SP} is defined as

$$T_{SP} = \frac{0.693}{t_{1/2}}.$$

In the following table, A is the mass number of the nuclide and $E\gamma$ is the energy of the transition in Mev. The statistical factor has been omitted. For more details see S. A. Moszkowski, in *Beta- and Gamma-Ray Spectroscopy*, edited by K. Siegbahn (Interscience Publishers, New York, 1955), Chap. XIII.

Multipolarity	T_{SP} in sec^{-1}
E 1	$1.5 \times 10^{14} A^{2/3} E_\gamma{}^3$
M 1	$2.8 \times 10^{13} \quad E_\gamma{}^3$
E 2	$1.6 \times 10^{8} A^{4/3} E_\gamma{}^5$
M 2	$1.2 \times 10^{8} A^{2/3} E_\gamma{}^5$
E 3	$1.1 \times 10^{2} A^{2} E_\gamma{}^7$
M 3	$1.8 \times 10^{2} A^{4/3} E_\gamma{}^7$
E 4	$5.0 \times 10^{-5} A^{8/3} E_\gamma{}^9$
M 4	$1.5 \times 10^{-4} A^{2} E_\gamma{}^9$
E 5	$1.6 \times 10^{-11} A^{10/3} E_\gamma{}^{11}$
M 5	$7.5 \times 10^{-11} A^{8/3} E_\gamma{}^{11}$

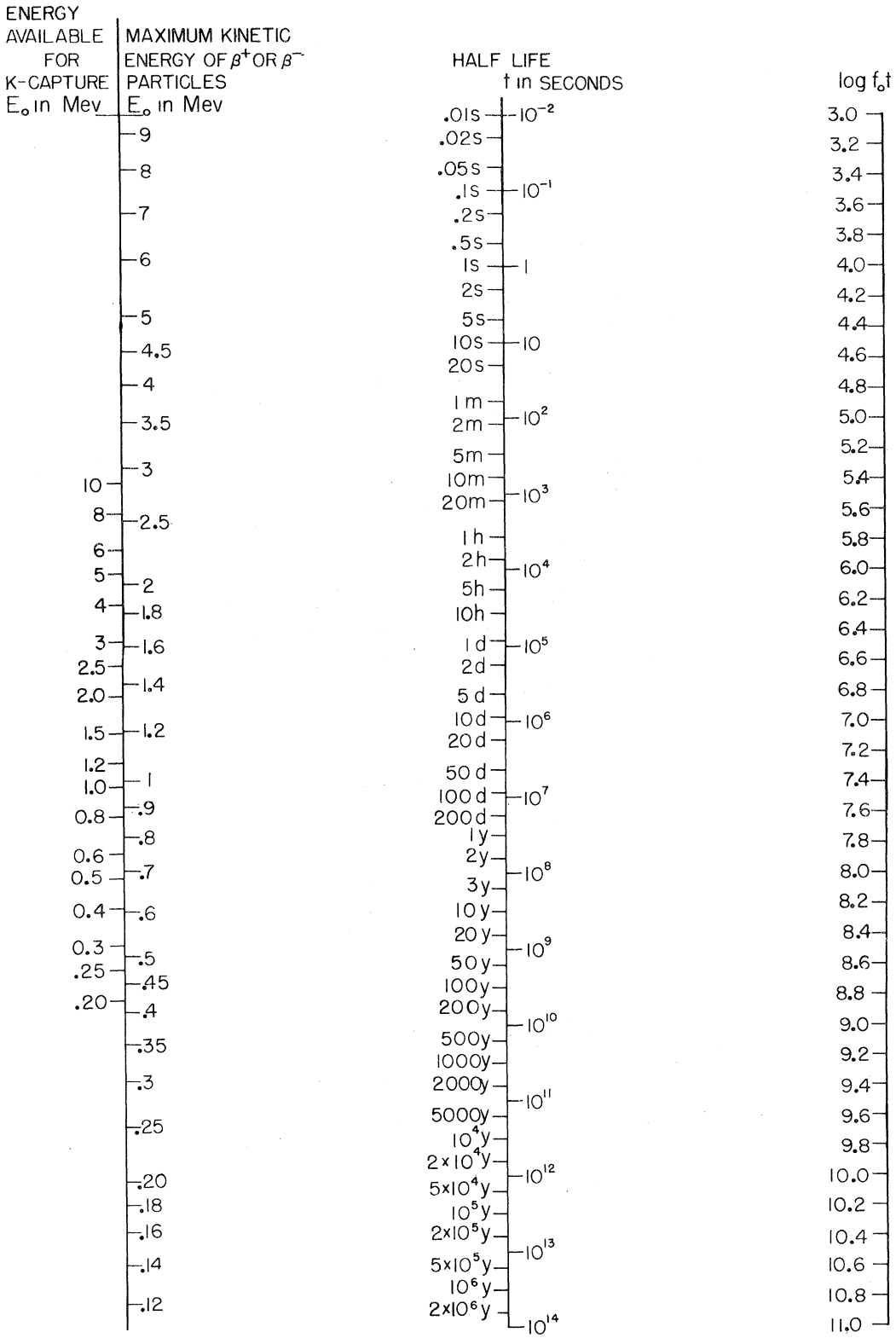


FIG. 1. Log (f_0t) as a function of E_0 and t.

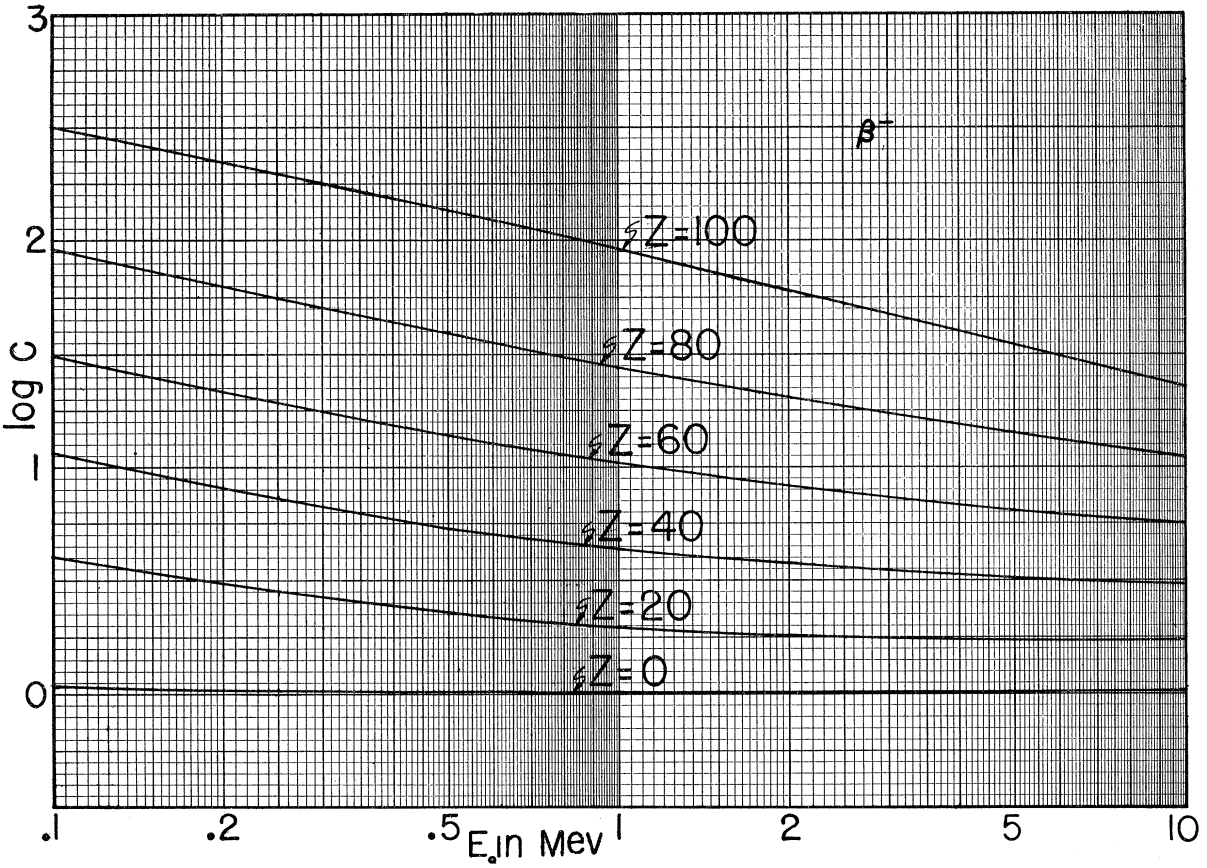


FIG. 2. Log (C) as a function of E_0 and Z for β^- emission.

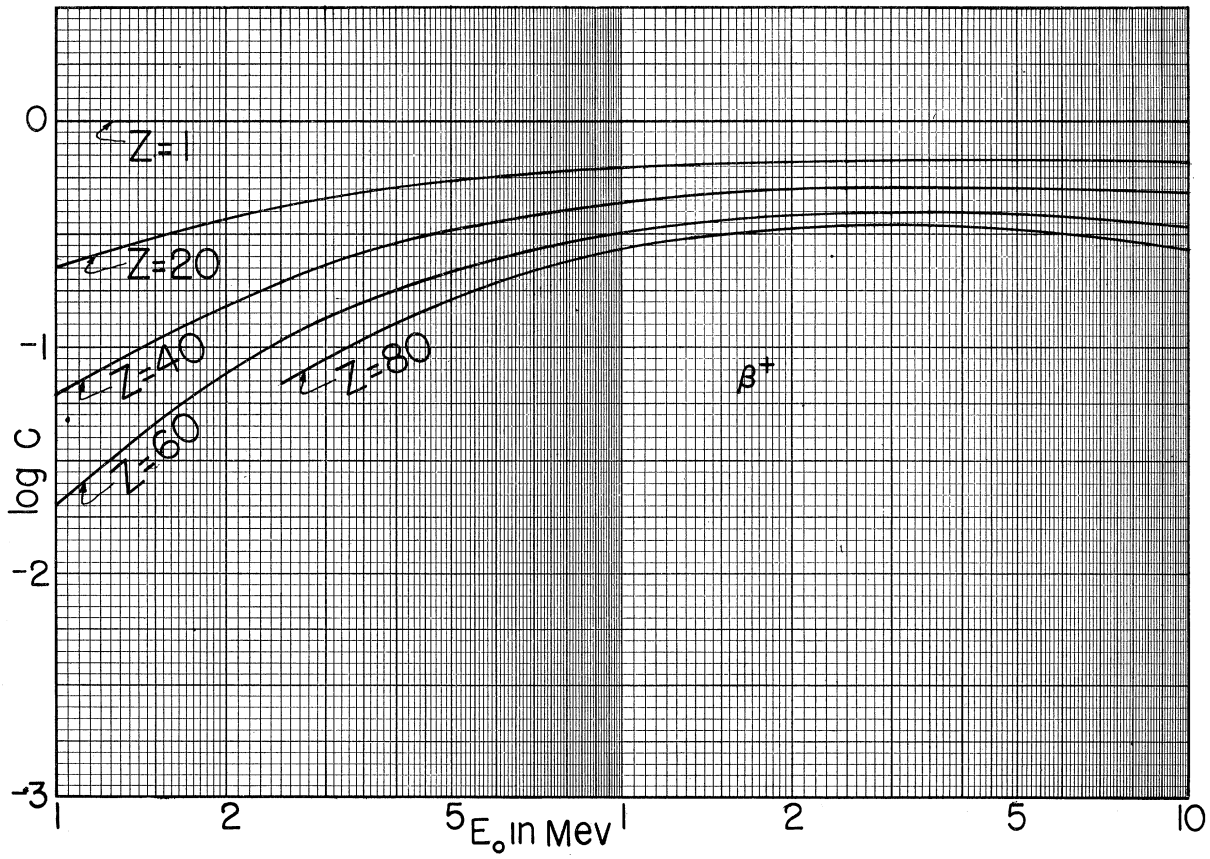


FIG. 3. Log (C) as a function of E_0 and Z for β^+ emission.

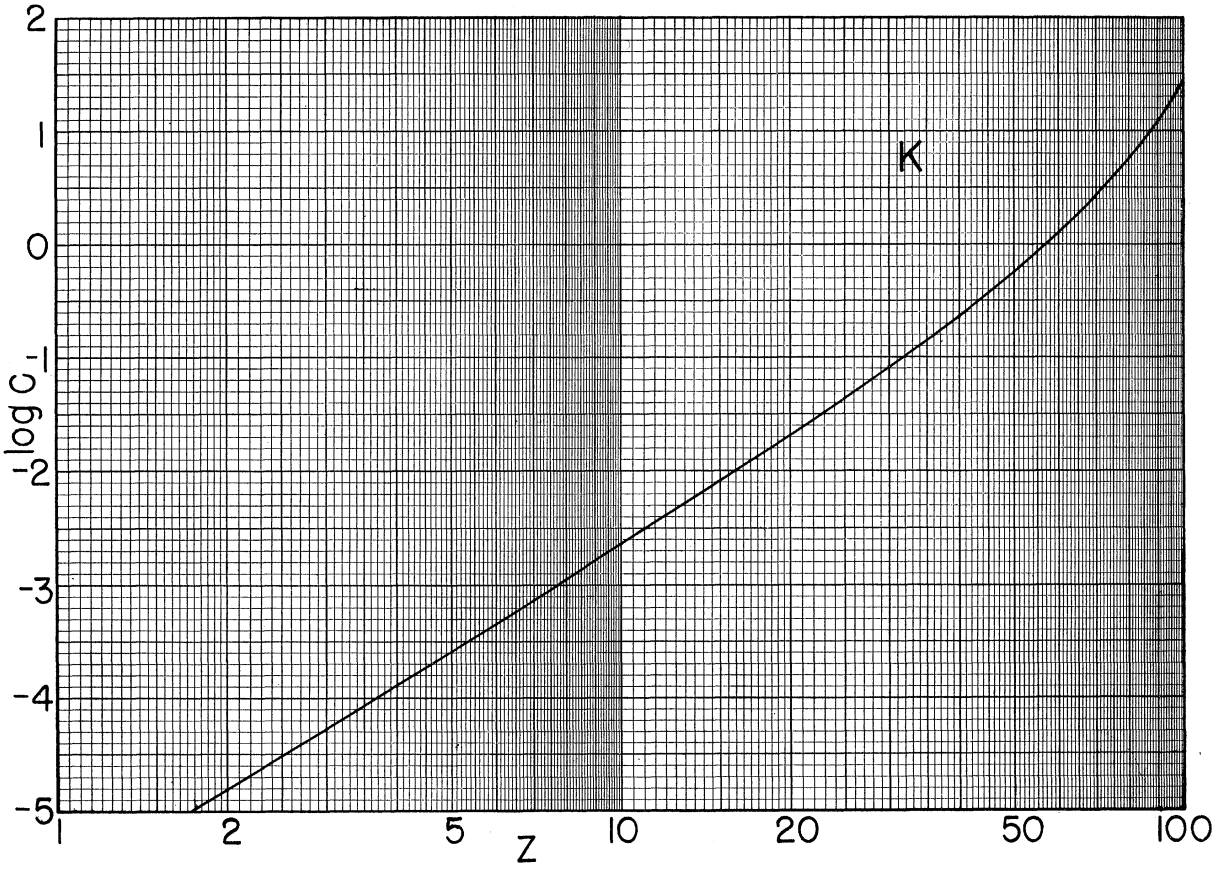


FIG. 4. Log (C) as a function of Z for K-electron capture.

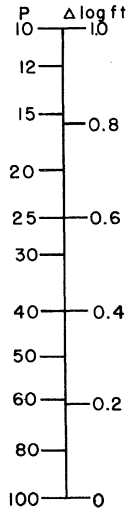
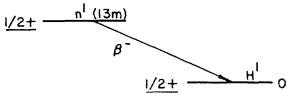
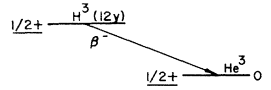
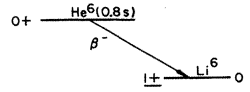
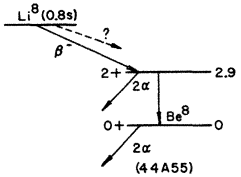


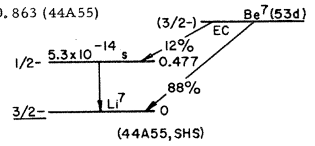
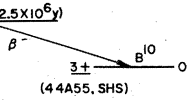
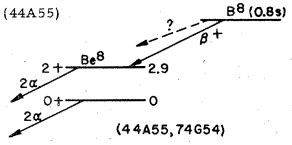
FIG. 5. Δ log (ft) as a function of p.

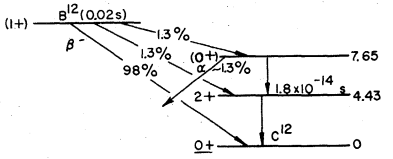
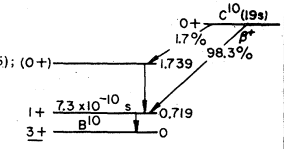
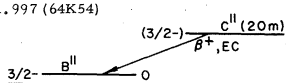
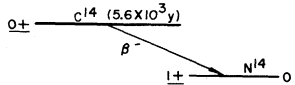
ERRATA

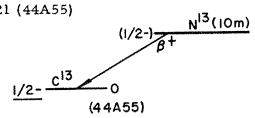
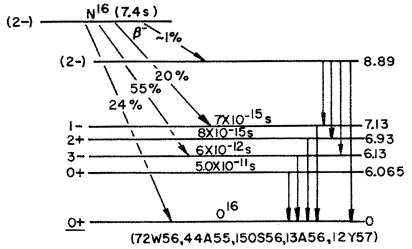
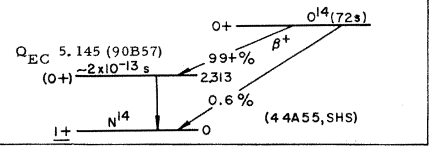
p. 771 Au^{192} col. 3, line 6: change "atomic spect" to "atomic beam"
p. 817 U^{234} col. 4, line 1: change "(78G55)" to "(70G55)"
p. 824 Pu^{242} col. 4, line 1: change "4.858" to "4.854"
p. 831 Bk^{249} col. 3, line 4: remove "mass spect"
p. 833 Cf^{253} col. 3, line 3: remove "mass spect"
p. 833 Cf^{254} col. 3, line 4: remove "mass spect"

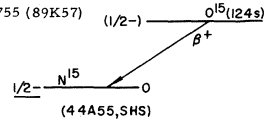
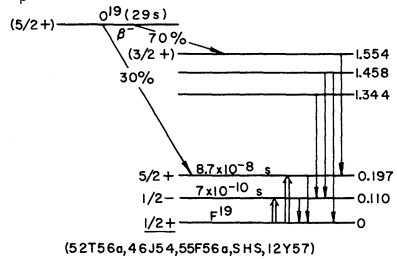
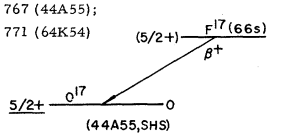
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_0n^1$	12.8 m (2R51); 12 m (115H56); 10-30 m (26S50)	☢ β^- (18C35, 26S50); A recoil nuclei, conservation of momentum (18C32); observation of n-α reaction (4F32, 87H33); parent H^1 (26S50, 2R50); others (92H39, 27A39, 118S39); I 1/2 atomic beam (139S54); 1/2 nucl scattering (87M50); μ -1.91316 atomic beam (calc from 100C56); others (67K56, 61W53, 87M50)	β^- 0.78 p-β^- spect coinc (2R51); others (2R55, 123M56, 227B57)	Q_{β^-} 0.7823 (16L51) 
$_1H^1$		% 99.9849-99.9861 (diff sources) (52K51); 99.9851 (1V38); I 1/2 specific heat, atomic spect (87M50); μ +2.79270 decelerated cyclotron (223B57); others (75K55, 48T56, 67K56, 61W53, 87M50, 48F56, 102C55, 62R54)		
H^2		% 0.0139-0.0151 (diff sources) (52K51); 0.0149 (1V38); I 1 ortho-para conversion, atomic spect (87M50); μ +0.857393 nucl induct (calc from 69W53); others (148B52, 67K56, 61W53, 87M50) q +0.00273 atomic beam (67K56, 76K52, 87M50)		
H^3	12.262 y genet (11J55); 12.46 y genet (12J50); others (11J51, 8N47, 6A39, 6A40a, 28H48, 4O40, 20C41)	☢ β^- (6A39, 6A40a); A chem, sep isotopes, excit (6A39, 6A40a); I 1/2 nucl induct, atomic spect (87M50); μ +2.9788 nucl induct (67K56, 61W53, 87M50)	β^- 0.0180 spect (10L52b); 0.0183 ion ch (21C49); 0.0176 spect (26H53, 26H51); 0.0189 ion ch (24H49); others (72S49a, 12J49, 17G49, 22B49, 21C48, 35K51b, 5I51); γ no γ (18G46)	Q_{β^-} 0.0181 (64K54) 
$_2He^3$		% 1.3×10^{-4} (atmos), 1.7×10^{-5} (wells) (7A46, 19C49); I 1/2 atomic spect (87M50); μ 2.1274 nucl induct (67K56, 61W53, 87M50); negative, nucl induct (118K57)		
He^4		% ~100; I 0 atomic spect (87M50)		

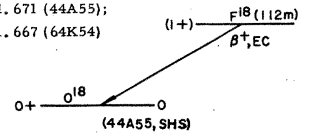
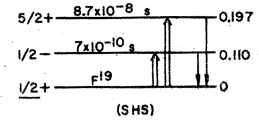
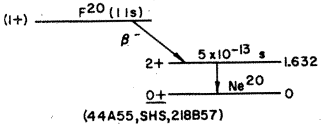
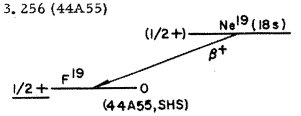
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_2He^6$	0.823 s (9A50); 0.799 s (77K54); 0.85 s (20V56); 0.82 s (27H49); others (12R49, 27S46, 63R55, 149B53, 5V52, 44S52a, 9P37, 25B47, 36D52)	☢ β^- (23B36b); A chem (23B36, 23B36a); cross bomb, excit, chem (27S46)	β^- 3.50 spect (16W52); 3.2 abs (12R49); 3.5 abs (27S46); others (23B36b, 16K48, 2P50, 35A50, 50A54, 51A53); γ no γ (16K48, 27S46)	Q_{β^-} 3.50 (64K54); Q_{β^-} 3.55 (44A55) 
$_3Li^4$	not observed lim $t_{1/2}$ >1 m, <0.025 s (44S52a); ~0.4 s (39T54)	G excit (44S52a, 39T54)		
Li^6		% 7.42 (116H55, 25O55); 7.29-7.42 (diff sources) (103C55); others (117H54, 64W56, 17L38); I 1 atomic beam (87M50); μ +0.82193 atomic beam, nucl induct (67K53, 87M50, 61W53); q (78K53, 104C53)	γ (52R57)	
Li^7		% 92.58 (116H55, 25O55); 92.71-92.58 (diff sources) (103C55); others (117H54, 64W56, 17L38); I 3/2 atomic spect (87M50); μ +3.2560 atomic spect, atomic beam, nucl induct (67K53, 87M50, 61W53); q (78K53, 104C53)	γ 0.477 level of Li^7: $t_{1/2} = 5.3 \times 10^{-14}$ s Doppler broadening (151B56); $t_{1/2} = 5.2 \times 10^{-14}$ s Doppler broadening (4E49); others (16L54, 88S54); see also gammas of Be^7	see Be^7
Li^8	0.841 s (77K54); 0.83 s (11R51); 0.88 s (26B37, 3O47, 10B49); 0.87 s (152B53); 0.85 s (44S52a); others (28H47, 67W54a, 151B53, 120K57, 71B57)	☢ β^-, 2α (11L37); A excit (22C35, 11L37); n-capt, sep isotopes, genet (28H47)	β^- 13 (~90%), ~6 (~5%), ~3 (~5%) spect (1H50); no β <13 (49F55, 52A56); 12 cl ch (26B37); abs (3O47); α two α's: total energy 3.2, 7-9 cl ch (27B48); γ no γ lim 0.2% β-γ coinc (51T56); no γ (13R37, 26B37); γ (very weak) β-γ coinc (5V51a); others (91C53, 138H54, 15K36, 10P46, 5D35, 1F37, 1Y50, 13W50, 40T52, 18L39, 70W53, 74G54)	see B^8 Q_{β^-} 15.99 (44A55) 
Li^9	0.168 s (20G51, 64R53); 0.170 s (78H52); 0.19 s (44S52a); 0.15 s (153B55)	☢ β^-, n (20G51, 78H52); B excit, cross bomb (20G51)	β^- ~8 range emuls (50F53)	Q_{β^-} 14.1 (44A55)
$_4Be^6$	~0.4 s (39T54)	F excit (39T54)		

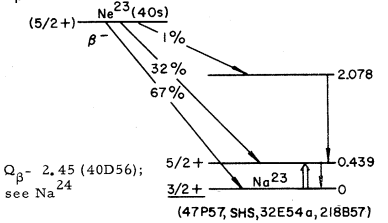
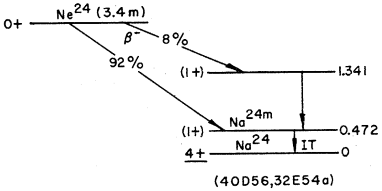
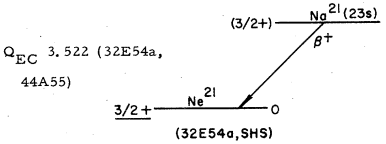
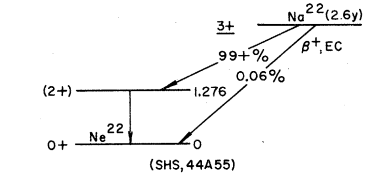
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_4Be^7$	53.61 d (58K53a); 52.93 d (24S49); 53.0 d (55B56, 55B47); 53.5 d (109W57)	☢	EC (13R38);	γ	0.4773 spect (34D57, 44A55); 0.479 spect (4E48, 11T49); γ (e/γ 6-17 x 10^{-7}) spect conv (60L58); γ (11%) (14W49), (10-13%) (10T49) (Be^7 formation yield-γ ratio); others (17K48, 4Z42, 5Z48a, 15R46, 7S47b, 14R38, 14R38a, 39H39, 39H40, 17M39, 4D50, 74M51, 1H49); $t_{1/2}$ of 0.43 level of Be^7: 2 x 10^{-13} s Doppler broadening (151B56); see also gammas of Li^7	Q_{EC} 0.863 (44A55) 
		A	chem, cross bomb, excit (13R38)			
Be^8	>1.4 x 10^{-16} s α-α scattering (97H56); <4 x 10^{-15} s p-B^{11} scattering (49T55); others (18M53, 119H52, 26W51, 15W41)	☢	2α	α	energy of each α in center of mass system: 0.047 spect (45J53a, 108C57); 0.045 ion ch (49T55); 0.045 spect (12T49); others (41C51, 54A53, 1F56, 75G55, 40H49, 23C50, 53L52, 18M51)	$Q_α$ 0.094 (108C57); $Q_α$ 0.096 (44A55)
		A	observation of Be-γ-n reaction (18C35)			
Be^9		%	100 (6N37);			
		I	3/2 atomic spect, nucl induct (100S51, 77H51);			
		μ	-1.1773 atomic beam, nucl induct (61W53, 67K56, 87M50); others (157B56);			
		q	~±0.02 nucl induct (79K53)			
Be^{10}	2.5 x 10^6 y sp act + mass spect (12M47); 2.9 x 10^6 y yield (28H47a)	☢	$β^-$ (12M46a);	$β^-$	0.555 spect (15F52); 0.560 spect (13A50); abs (12M46a, 12M47); 0.553 ion ch (11F49a); others (28H49, 16W49, 41H49, 11B50a);	$Q_{β^-}$ 0.556 (44A55); $Q_{β^-}$ 0.557 (64K54) 
		A	chem (12M46a); chem, mass spect (11P46); others (9E48)	γ	no γ (12M47, 19L47, 28H49)	
$_5B^8$	0.78 s (59D56); 0.6 s (44S52a)	☢	$β^+$, 2α (6A50);	$β^+$	13.7 abs (6A50); others (74G54)	Q_{EC} 17.8 (44A55) see Li^8 
		A	excit, cross bomb (6A50)			
B^{10}		%	18.45-18.98 (13T48); 19.58 (183S55);	γ	0.719 level of B^{10}: $t_{1/2}$ = 7.3 x 10^{-10} s delay coinc (108B57); $t_{1/2}$ = 5 x 10^{-10} s nuclear recoil (50T53); $t_{1/2}$ = 6 x 10^{-10} s nuclear recoil (142S56); see also gammas of C^{10}	
		I	3 microwave (87M50);			
		μ	+1.8006 atomic beam, nucl induct (67K56, 61W53, 87M50);			
		q	+0.074 quad res (59W53a calc from 47D53, 47D52)			
B^{11}		%	81.02-81.55 (13T48); 80.42 (183S55);	γ	4.46 level of B^{11}: $t_{1/2}$ 7 x 10^{-16} s nucl res fluor (124S57); 2.14 level of B^{11}: $t_{1/2}$ 3.2 x 10^{-15} s nucl res fluor, Doppler broadening (66R58)	
		I	3/2 microwave (87M50);			
		μ	+2.6880 nucl induct, atomic beam (67K56, 61W53, 87M50);			
		q	+0.0355 atomic beam (59W53a); others (47D53, 47D52, 87M50)			

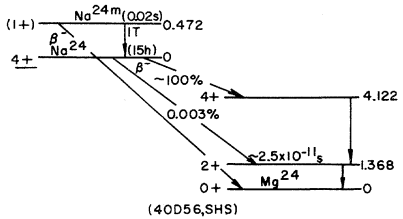
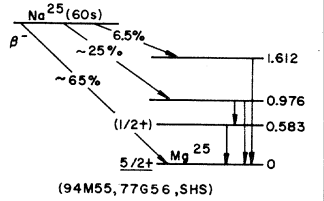
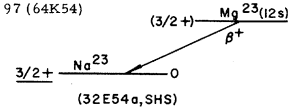
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_5B^{12}$	0.019 s delay coinc (47N56); 0.022 s delay coinc (152B53, 25B39); 0.027 s delay coinc (3J48a, 30B51); 0.018 s (135C56, 135C57)	☢ β^- (22C35a); α 1.3% (108C57); A excit (22C35a, 1F36); others (32H50b)	α 0.195 spect (1F56); β^- 13.43 spect (1H50); β_0 (†100), $\beta_{4.43}$ (†1.7) β-γ coinc, ion ch (51T56); $\beta_{4.43}$ (1.3%) β-γ coinc, scint spect (159B55); 13.3 abs (30H48); others (26B37, 5V51a) γ ~4.5 β-γ coinc abs (5V51); others (51T56, 159B55, 5V51a, 160B55, 1H56, 154S57a, 78G57); see also gammas of C^{12}	Q_{β^-} 13.37 (44A55); Q_{β^-} 13.43 (64K54)  (44A55, SHS, 1F56, 108C57)
B^{13}	~0.035 s delay coinc (47N56); not observed, lim $t_{1/2}$ >0.5 h, <5×10^{-4} s (121H53)	☢ β^- (47N56); F excit (121H53, 47N56)		
$_6C^{10}$	19.1 s (28S49)	☢ β^+ (28S49); A chem, sep isotopes (28S48, 28S49); others (44S52a)	β^+ 2.1 abs (28S53); γ 0.72 (99%), 1.03 (1.7%), no 1.43γ (lim 0.2%), no 2.15γ (lim 0.024%) scint spect (28S53) see also gammas of B^{10}	Q_{EC} 3.64 (44A55); Q_{EC} 3.8 (64K54)  (28S53, 44A55, SHS)
C^{11}	20.4 m (30S41); 20.5 m (29S41, 12P48, 25C50); 20.3 m (98M52); 20.7 m (29K53, 29K52a, 1P52a); 20.0 m (7S44a, 4D51)	☢ β^+ (99+%), EC(K) 0.19% (229S57a); A excit (22C34); chem, excit (33B39); others (26C35, 2Y35, 1F36, 22C34a, 10B46, 55S51, 22E52, 44S52a, 1P37, 110S51, 30B52, 6T47, 27C47, 82H52, 16K47, 21T51a, 85H52, 57G51)	β^+ 0.968 spect (73W54); 0.99 spect (7S44a); 0.981 spect (14T41); 0.95 cl ch (5D50); γ no γ, β-γ coinc (7S46a)	Q_{EC} 1.980 (44A55); Q_{EC} 1.997 (64K54)  (44A55, 229S57a)
$\underline{C^{12}}$		% 98.892 (limestone CO_2) (6N50); I 0 atomic spect (87M50)	γ 4.43 level of C^{12}: $t_{1/2}$ 1.8×10^{-14} s Doppler broadening (8D56); $t_{1/2}$ 5×10^{-14} s nucl res fluor (124S57); others (125M54, 124H56, 44A55, 154S57a); see also gammas of B^{12}	see B^{12}
$\underline{C^{13}}$		% 1.108 (limestone CO_2) (6N50); I 1/2 atomic spect, atomic beam, microwave (87M50); μ 0.702205 nucl induct (calc from 67R54); + atomic beam, nucl induct (67K56, 61W53, 87M50)		
C^{14}	5568 y weighted average of 3E50, 11J49, 21M50, and 20M51, all by sp act + mass spect (3L55); 5400 y (20M51); others (31H49, 17R46, 31H48, 10N48, 1Y48, 77C54)	☢ β^- (1K40); A chem, cross bomb, excit (16R41); others (16R40, 19M47); I 0 atomic spect, microwave (87M50)	β^- 0.155 spect (15F49, 18W50, 51F54); 0.156 spect (28C48); 0.154 spect (2L47a), abs (29S47); 0.159 spect (38P55); 0.155 ion ch (10A49); E (average) 0.045 calorimetric (12J52); others (127M54, 16W53a, 128M52, 115M53); γ no conv, spect (2L47a); no γ (16R41)	Q_{β^-} 0.155 (44A55, 64K54)  (90B52, 90B52a)

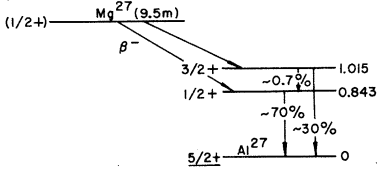
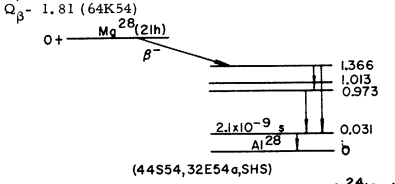
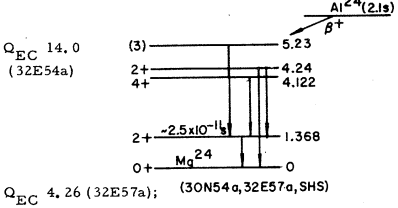
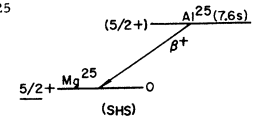
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_6C^{15}$	2.25 s (61D56a); 2.4 s (32H50a)	☢ β^- (32H50); C excit, sep isotopes (32H50); others (1Y50)	β^- 9.5 (20%), 4.5 (80%) scint spect (61D56a); 8.8 abs (32H50a); γ 5.3 scint spect (61D56a); ~5.3 scint spect (148S54); others (32H52, 44A55)	Q_{β^-} 8.64 (44A55); Q_{β^-} 9.5 (61D56a)
$_7N^{12}$	0.0125 s delay coinc (6A49)	☢ β^+, β^+ 3α (6A50); B excit, sep isotopes (6A49); others (33P52)	α ~4 total energy of three α's (6A50); β^+ 16.6 abs (6A49)	Q_{EC} 17.7 (44A55); Q_{EC} 17.6 (64K54)
N^{13}	10.05 m (109C53); 10.08 m (72W55); 9.93 m (5W39a); 9.96 m (51D57b)	☢ β^+ (22C34); A excit (4C34, 22C34); others (8E35, 18R37, 33H35, 2Y35, 26C35, 1F36, 11A50, 1P37, 34H43, 34B42, 10B46, 12P48, 22E52, 44S52a, 16K47, 85H52, 74M52)	β^+ 1.19 spect (51D57b); 1.24 spect (7S45); 1.25 spect (28C48a); 1.20 spect (1H48, 1H50); 1.22 spect (14T41); others (21L39, 53K43, 79G54, 51D57b, 138H57); γ no γ >0.135, <0.700 (10L47, 7S46a, 79G54)	Q_{EC} 2.21 (44A55) 
N^{14}		% 99.635 (6N50); I 1 atomic spect, microwave (87M50); μ +0.40357 atomic beam, nucl induct (67K56, 61W53, 87M50); q +0.02 microwave (67K56, 87M50); others (163B55, 125H54, 149S50)	γ 2.313 level of N^{14}: $t_{1/2}$ ~2 x 10^{-13} s Doppler broadening (50T55); others (28S55)	see O^{14}
N^{15}		% 0.365 (6N50); I 1/2 atomic spect (87M50); μ -0.2830 atomic beam, nucl induct (67K56, 61W53, 87M50)		
N^{16}	7.35 s (35B47); 7.38 s (80M54); 7.3 s (27S46)	☢ β^- (22L34, 16F34); A excit (22L34, 16F34); others (41F52, 1F36, 7C37, 3N36, 2N36, 9P37)	β^- 10.40 (28%), 4.39 (54%), 3.32 (18%) spect (28K57); 10.3 (24%), 4.27(55%), 3.28 (21%) spect (167M57); ~10.3 (~20%), ~4.3 (~40%), ~3.8 (~40%) cl ch (35B47); γ γ_1 6.13 (†100), γ_2 7.10 (†8) pair spect (18M51a); scint spect (164B57); γ_1 (†100), γ_2 7.12 (†7) scint spect (52T56); γ_1 (†100), γ_3 1.72 (†0.15), γ_4 1.90 (†0.05), γ_5 2.75 (†1.3), γ_2 coinc with γ_3 and γ_4; γ_1 coinc with γ_5, γ-γ coinc, scint spect (72W56); γ_5 (†1.3), 8.88 (†0.11) pair spect, F^{19} (p, α) (170M57); γ_5 (†1.3), 8.87 (†0.09) pair spect, F^{19} (p, α) (160B57); 0.120 level of N^{16}: $t_{1/2}$ 6.7 x 10^{-6} s N^{15} (d, p) delay coinc (55F57); others (56B53, 35B46, 72W57, 112W57); see also gammas of O^{16}	Q_{β^-} 10.40 (44A55) 
N^{17}	4.14 s (18K48); 4.15 s (32S51)	☢ β^-, n (18K48); A chem, cross bomb (6A49a, 18K48, 27C48); others (31S51, 83C49, 44S52a)	β^- 3.7 β-recoil coinc abs (6A49a); n 0.9 (mean) O^{16} recoil in ion ch (6A49a); 1.0 (mean) p recoil in cl ch (36H49)	Q_{β^-} 8.8 (44A55, 64K54)
$_8O^{14}$	72.1 s (80G54); 76.5 s (28S49); 72 s (90B57)	☢ β^+ (28S49); A chem, excit (28S49); genet energy levels (28S53); others (44S52a)	β^+ 1.84 (99+%), ~4.1 (0.6%) spect (28S55, 80G54); 1.83 (97%), ~4.1 (3%) scint spect (47P54); γ 2.30 scint spect (28S53); see also gammas of N^{14}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_8O^{15}$	124 s (47P57, 77K54); 118 s (2P49); 121 s (154B55a, 89K57); others (12M35, 37B39, 35D51)	☢ β^+ (22L34a); A chem, excit (22L34a, 12M35); excit (1F36, 19K39); others (2D38, 34H43, 10B46, 12P48, 22E52, 44S52a, 1P37)	β^+ 1.723 spect (89K57); 1.683 spect (36B50); 1.68 abs (28S49); γ no γ (2P50b)	Q_{EC} 2.755 (89K57)  (44A55,SHS)
O^{16}		% 99.759 (air O_2) (6N50); O^{16}/O^{18} variation ≤ ~4% (13T49, 1K46); I 0 atomic spect (87M50)	γ 6.065 level of O^{16}: $t_{1/2}$ 5.0×10^{-11} s nuclear recoil (8D54); 6.13 level of O^{16}: $t_{1/2}$ 6×10^{-12} s nuclear recoil (81K56); 6.93 level of O^{16}: $t_{1/2}$ 8×10^{-15} s nucl res fluor (124S57a); 7.13 level of O^{16}: $t_{1/2}$ 7×10^{-15} s nucl res fluor (124S57a); others (8D55, 124S56, 8D56)	see N^{16}
O^{17}		% 0.037 (air O_2) (6N50); I 5/2 nucl induct (3A51); 5/2 microwave (55G52); μ −1.8930 nucl induct (67K56, 61W53); q −0.027 paramag res (130K57); −0.026 microwave (184S57); others (165B54)	γ 0.872 level of O^{17}: $t_{1/2}$ 2.5×10^{-10} s nuclear recoil (50T53)	
O^{18}		% 0.204 (air O_2) (6N50); I 0 microwave (91M51)		
O^{19}	29.4 s (11F44a); 29.5 s (28H46a); 27.0 s (35B47a)	☢ β^- (22M43); A excit (3N36); n-capt (22M43); others (2S46, 2S47, 12A35)	β^- 4.5 (30%), 2.9 (70%) abs (35B47a); ~3.2 abs (34H45); γ γ_1 0.112 (†4), γ_2 0.200 (†100), γ_3 1.366 (†67), γ_2 coinc with γ_3 (46J54); γ_2: 8.7×10^{-8} s delay coinc (48J56); see also gammas of F^{19}	Q_{β^-} 4.781 (44A55);  (52T56a, 46J54, 55F56a, SHS, 12Y57)
O^{20}	not observed lim $t_{1/2}$ <10 m >150 y (32K56a)			
$_9F^{17}$	66 s (60K54, 73W54, 46L51); 63 s (71W54); 70 s (12N35, 2P50c); 60 s (86H52); 72 s (12P48); 74 s (2D38)	☢ β^+ (12N35); A cross bomb (19W34, 8E34a); chem, excit (12N35, 37H35, 2D38); others (18R37, 1F36, 10B46, 36B49)	β^+ 1.748, no 0.87 β^+ (lim 1%) spect (73W54); 1.76 abs (60K54); 1.72 spect (2P50c); 1.7 abs (46L51); others (17K36); γ no γ (2P51, 51R51, 71W54); 0.500 level of F^{17}: $t_{1/2}$ 3×10^{-10} s delay coinc, O^{16} (p, γ) (59L57)	Q_{EC} 2.767 (44A55); Q_{EC} 2.771 (64K54)  (44A55,SHS)

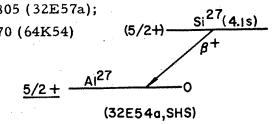
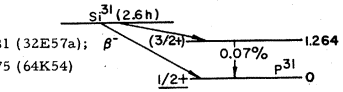
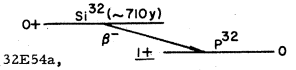
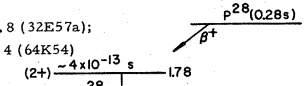
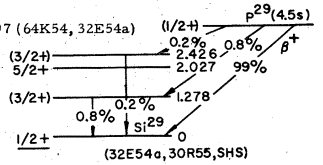
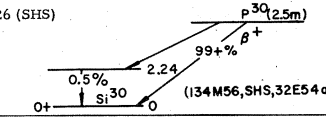
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_9F^{18}$	112 m (26S37, 12P48, 47B49); 111 m (47J55); 115 m (34H43); 107 m (2D38)	☢ β^+ 97%, EC 3% (62D56); A chem (26S37); chem, sep isotopes, excit (2D38); others (2T47a, 3Y38, 3D40, 20W41, 1P37, 9K41, 34B42, 34H43, 10B46, 22E52, 86H52, 85H52, 74M52, 74M52a, 57G51)	β^+ 0.649 spect (19R51); 0.635 spect (47B49); others (3Y38, 9K41, 38H48); γ no γ (16K48, 47B49, 62D56)	Q_{EC} 1.671 (44A55); Q_{EC} 1.667 (64K54) 
F^{19}		% 100 (1A20); I 1/2 atomic spect, microwave (87M50); μ (ground level) +2.6275 atomic spect, atomic beam, nucl induct (67K56, 87M50, 61W53); μ (0.197 level, assuming I = 5/2) +3.5 ang corr attenuation (49P56); +3.7 ang corr attenuation (59L56, 59L56a); +3.0 ang corr attenuation (151S56); +4.5 ang corr attenuation (49T55a, 49T57); others (12S56)	γ Coulomb excitation (in F^{19}): 0.109, 0.196 scint spect (28S54); 0.112, 0.195 scint spect (46J54a); 0.113, 0.196 scint spect (97H54, 27T56, 27T54a); 0.109 (e_K/γ 0.0021), 0.197 (e_K/γ 0.0019) scint spect, spect conv (125M55); 0.110, 0.198 scint spect (159B55a); others (48P54a, 121C54, 46J54, 81G55, 44A55, 52T55, 52T56a, 150S56, 41A56a, 55F56a); $t_{1/2}$ of 0.110 level: 7×10^{-10} s nuclear recoil (50T54); $t_{1/2}$ of 0.197 level: 8.7×10^{-8} s delay coinc (48J56); 8.5×10^{-8} s delay coinc, F^{19} (p, p') (54F55, 59L56)	see O^{19} 
F^{20}	10.7 s (33S50); 12 s (22C35)	☢ β^- (22C35); A excit (22C35, 1F36, 3N36); others (13N50, 2S47, 21K50)	β^+ 5.41, no ~7 β^- (lim 1%) spect (13A52b, 13A52d); 5.42, no ~7 β^- (lim 0.04%) spect (73W54a); 5.33 (97%), 6.7 (3%) spect (47L50); others (3J50, 38B40); γ 1.627 spect (73W54a); 1.631, no 2.5 γ (lim 0.2%) spect, Be-γ-n reaction (13A52b, 13A52d); 1.64, no 2.5 γ, γ-γ coinc (47L50); γ (coinc with 5.0 β^-) β-γ coinc (21C40, 3J50); others (38B40); see also gammas of Ne^{20}	Q_{β^-} 7.052 (44A55); Q_{β^-} 7.04 (64K54) 
F^{21}	5 s (24C52b)	F cross bomb (24C52b)		
$_{10}Ne^{18}$	1.6 s (82G54)	☢ β^+ (82G54); B excit, cross bomb (82G54)	β^+ 3.2 spect (82G54)	Q_{EC} 4.2 (64K54)
Ne^{19}	17.7 s (47P57); 18.2 s (28S49); 18.5 s (34S52); 20.3 s (21W39); 19 s (3N54)	☢ β^+ (21W39); A cross bomb, excit (21W39); others (47B51a)	β^+ 2.23 scint spect (57A57); 2.18 spect (34S52); 2.2 cl ch (21W39); 2.3 abs (28S49); β_0^+ (100%) (46J54); others (57A54, 162H58, 129M55, 25G57, 57A57); γ no γ (21W39, 34S52, 46J54); 0.242 level of Ne^{19}: $t_{1/2}$ 1.8×10^{-8} s delay coinc, F^{19} (p, n) (122B57a)	Q_{EC} 3.256 (44A55) 
Ne^{20}		% 90.92 (6N50a); variations in Ne^{21}/Ne^{20} and Ne^{22}/Ne^{20} (74W54); I 0 atomic beam (75W52); μ $<2 \times 10^{-4}$ atomic beam (75W52)	γ 1.63 level of Ne^{20}: $t_{1/2} = 5 \times 10^{-13}$ s Doppler broadening (8D56); see also gammas of F^{20}	see F^{20}

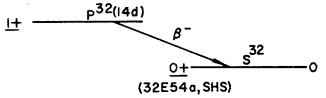
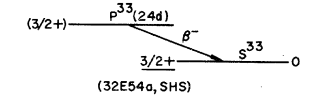
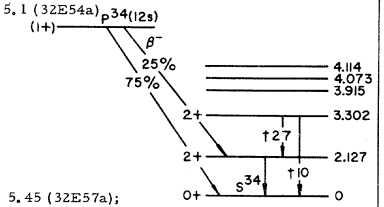
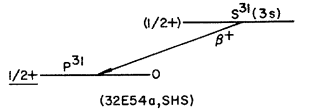
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{10}Ne^{21}$		% 0.257 (6N50a); I 3/2 atomic spect (87M50); 3/2 atomic beam (102H56); μ -0.66140 atomic beam (calc from 90L57)		
Ne^{22}		% 8.82 (6N50a); μ ~0 atomic spect (87M50)		
Ne^{23}	40.2 s (36B50a); 37.6 s (47P57); 40.7 s (34H44a); 40 s (12A35, 23B37)	☢ β^- (14P40); A excit (12A35); chem (23B37, 9P37); others (41F52, 22W40, 3N36)	β^- β_1 2.4 (1%), β_2 3.95 (32%), β_3 4.39 (67%), β-γ coinc, scint spect (47P57); 1.18 (~7%), 4.21 (~93%) spect (36B50a); 4.3 abs (35B46a, calc from 14P40); others (83G56, 14P40); γ 0.436 (†100, coinc with β_2), 1.65 (†3, coinc with β_1 and 0.436 γ), β-γ, γ-γ coinc, scint spect (47P57); 0.440 (36%) β-γ coinc, scint spect (83G56); 0.440, no other γ (lim 2%) (28O56); others (2P50a); see also gammas of Na^{23}	Q_{β^-} 4.388 (44A55); Q_{β^-} 4.39 (47P57) 
Ne^{24}	3.38 m (40D56)	☢ β^- (40D56); B chem, genet (40D56); parent Na^{24}, parent Na^{24m} (40D56)	β^- 1.10, (8%), 1.98 (92%), β-γ coinc, scint spect (40D56); γ 0.472 (†100), 0.878 (†8) scint spect (40D56)	Q_{β^-} 2.45 (40D56); see Na^{24} 
$_{11}Na^{20}$	0.385 s (102B52a); 0.23 s (44S51a)	☢ β^+, α (6A50, 44S51a); B excit (6A50); others (44S52a)	α >2 ion ch (6A50); β^+ >3.5, <7.3 est (44S51a)	Q_{EC} 15.3 (32E57a)
Na^{21}	22.8 s (34S52); 23 s (29C40a)	☢ β^+ (14P40); A excit (29C40a); others (40B47, 39B48)	β^+ 2.50 spect (34S52); 2.5 scint spect (52B53); γ no γ (34S52)	Q_{EC} 3.522 (32E54a, 44A55) 
Na^{22}	2.58 y (131M57); 2.60 y (23L49); 2.8 y (36S39)	☢ β^+ 89%, EC 11% (58A55, 82K54, 168H57a); β^+ 90%, EC 10% (28S54a); others (152S54, 1H53, 55C55, 94M54, 21G46); A chem, excit (17F35); others (23L37, 24M37, 40B47, 92M51, 45R52, 42B51a); I 3 atomic beam (87M50); μ +1.746 atomic beam (67K56, 61W53, 87M50)	β^+ 0.542 spect (23M50); 0.540 (†100), 1.83 (†0.06) spect (56W53); 0.540 spect (73W54a); ~1.8 (0.004%) cl ch (25M49); others (21G46, 23L37, 2O39, 24M41, 175S57, 69P57, 171H58); γ 1.277 spect (13A49); 1.275 spect conv (44A55); 1.30 (coinc with β^+) spect, β-γ coinc (21G46); γ (e/γ 6.7×10^{-6}) spect (60L54); others (2O39, 85S51)	Q_{EC} 2.840 (32E57a, 64K54) 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{11}Na^{23}$		%	100 (37S36a, 64W56);	γ	Coulomb excitation (in Na^{23}): 0.446 scint spect (27T56, 27T54a); 0.44 (e_K/γ 4.9 x 10^{-5}) spect, spect conv (167B56); others (41A56, 41A56a, 83K56, 124S56a); 0.439 level of Na^{23}: $t_{1/2}$ ~10^{-12}-10^{-13} s Doppler broadening (83K56a); see also gammas of Ne^{23}	see Ne^{23}
		I	3/2 atomic spect (87M50);			
		μ	+2.2161 nucl induct, atomic beam, (67K56, 61W53, 87M50, 61W54);			
		q	+0.10 atomic beam (50P55); +0.10 atomic spect (153S54)			
Na^{24m}	~0.02 s est (40D56)	☢	IT, β^- (40D56);	β^-	~6 scint spect (40D56);	Q_{β^-} 5.98, Q_{IT} 0.472 (SHS) see Ne^{24}
		B	genet (40D56); daughter Ne^{24} (40D56)	γ	with IT: 0.472 scint spect (40D56)	
Na^{24}	14.97 h (55L53); 15.06 h (39S51); 14.90 h (22T55); 15.04 h (29S50); 15.10 h (31C50); others (38S51, 23W49, 56F52, 109W57)	☢	β^- (1L35);	β^-	1.394 spect (19P57); 1.390 spect, coinc (7S46b, 7S47); 1.40 spect (24L39, 108H55a); 4.17 (0.003%), no 5.5 β^-, spect (15T51); no 4.15 (lim 0.01%) spect (22G50); others (42H48);	Q_{β^-} 5.511 (64K54); Q_{β^-} 5.514 (32E57a); see Al^{24}
		A	chem, excit (16F34, 1L35); others (2V36a, 12A35, 2S47, 35H35, 10B46, 42H47, 22E52, 74M52, 30C46, 30C47, 42S42, 82H52, 39F52, 45R52, 42B51a, 57G51, 42B51);	γ	γ_1 1.368, γ_2 2.754 spect (12H52); γ_1 1.380, γ_2 2.758 spect (7S46b); γ_1 (†100), γ_2 (†102) spect (16D56); γ_2 2.753 pair spect (21K53); 3.9, 5.3 scint spect (53T55); γ_2 (e/γ 3 x 10^{-6}) (7S50b);	
		I	4 atomic beam (101S51);			
		μ	+1.69 atomic beam (98B53); others (6W50, 28E53, 7S52, 9B50, 4I41, 26M43, 41M50, 85B50a, 85S51, 55C50, 33E56, 20R49, 30N54a)		γ_1 (pair e/γ 6 x 10^{-5}), γ_2 (pair e/γ 7.1 x 10^{-4}) pair spect (108B52); γ_1 (pair e/γ 3 x 10^{-5}), γ_2 (pair e/γ 8 x 10^{-4}) pair spect (7S52); γ_1 coinc with γ_2 spect, β-γ, γ-γ coinc (4E43); γ-γ coinc abs (28C46); 3.7 (0.04%) D-γ-p ion ch (101B51); ~4 (0.05%) spect (15T51); γ_1 $t_{1/2}$ ~2.5 x 10^{-11} s delay coinc (111C55)	
Na^{25}	60 s (average of 3N54a, 9I55, 35B47a, 12P48, 10B46, 34H43a, 21R44)	☢	β^- (34H43a);	β^-	3.7 (~55%), 2.7 (~45%) abs (35B47a); 4.0 (65%), β_{583} (~3.5%), β_{976} (25%), ~2.6 (6.5%) β-γ coinc, scint spect (94M55); no β_{583} (lim 1%) (77G56); 3.7 (~50%), 3.0 (~50%) abs (3N54a); others (34H44a, 21R44);	Q_{β^-} 4.0 (32E57a)
		A	excit (34H43a); genet energy levels (94M55); others (34H44a, 22E52, 42S52)	γ	0.40 (†10), 0.58 (†9), 0.98 (†10), 1.61 (†3), 1.96 (†<0.3) scint spect (77G56); 0.38 (†10), 0.58 (†13), 0.98 (†23), 1.60 (†9) scint spect (94M55); 0.37 (†10), 0.58 (†13), 0.98 (†9), no 0.46 γ, no 1.6 γ scint spect (3N56); 0.41, 0.46 (?), 0.59, 0.98 scint spect (9I55); others (35B47a, 3N54a)	
$_{12}Mg^{22}$	0.13 s (39T54)	F	excit (39T54)			
Mg^{23}	11.9 s (34H43); 12.3 s (52B51a); 11.6 s (21W39); 10.7 s (127H54)	☢	β^+ (21W39);	β^+	2.95 scint spect (127H54); 2.99 scint spect (52B51a); 2.8 cl ch (21W39);	Q_{EC} 4.059 (32E57a); Q_{EC} 3.97 (64K54) 
		A	excit, cross bomb (21W39); others (34H42, 10B46, 25B47, 27M49, 22E52)	γ	no γ (21W39)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{12}Mg^{24}$		% 78.60 (24W48); 78.8 (64W56); μ ~0 atomic spect (87M50)	γ 1.37 level of Mg^{24}: $t_{1/2}$ ~2.5×10^{-11} s delay coinc (111C55); $t_{1/2}$ (photon) ~1.3×10^{-12} s electron scattering (124H56)	
Mg^{25}		% 10.11 (24W48); 10.2 (64W56); I 5/2 atomic spect (87M50); μ -0.8547 nucl induct, atomic spect (67K56, 61W53, 87M50)		
Mg^{26}		% 11.29 (24W48); 11.1 (64W56); μ ~0 atomic spect (87M50)		
Mg^{27}	9.45 m (3S53); 9.39 m (55L53); 9.51 m (51D53); 9.6 m (10E43, 56F52); others (32C39, 35H35)	☢ β^- (35H35); A chem, excit (12A35, 35H35); others (2S47, 16F34, 74M52, 35B45, 9V52a)	β^- 1.75 (58%), 1.59 (42%), no 2.6 β-γ coinc, spect (51D53, 107M54, 51D54); 1.80 (80%), 0.9 (20%) spect (43B48); 1.8 cl ch (10E43, 32C39); others (28M40, 35B47a); γ γ_1 0.834 (coinc with 1.75 β^-), γ_2 1.015 (coinc with 1.59 β^-), γ_1 not coinc with γ_2, β-γ, γ-γ coinc, spect, scint spect (51D54, 51D53, 107M54); γ_1 (†70), γ_2 (†30), γ_3 0.18 (†0.66), γ_1 not coinc with γ_2, γ-γ coinc, scint spect (35L56); γ_1 0.84, γ_2 1.01, γ_1 coinc with γ_2, spect, γ-γ coinc, (43B48); others (4I41, 10E43, 60K54, 32E54a, 124S56a, 126H56, 49A57)	Q_{β^-} 2.594 (32E57a); Q_{β^-} 2.59 (64K54)  (32E54a, 51D54, SHS)
Mg^{28}	21.2 h (37L53); 21.3 h (44S53); 21.8 h (9I53); 22.1 h (28J53); 20.8 h (74M53); 21.4 h (47W53a)	☢ β^- (37L53, 44S53); A chem, genet (37L53, 44S53); parent Al^{28} (37L53, 44S53)	β^- 0.42 spect (74M53); 0.46 spect (22O54); 0.39 abs (47W53a); 0.40 abs (44S54, 44S53); γ γ_1 0.032 (†96, e_K/γ 0.032), γ_2 0.40 (†31), γ_3 0.95 (†29), γ_4 1.35 (†70), γ_1 coinc with γ_2, γ_3, and γ_4; γ_2 coinc with γ_3, γ-γ coinc, scint spect (44S54); 0.391, ~0.95, ~1.35 scint spect (9I53); see also gammas of Al^{28}	Q_{β^-} 1.810 (32E57a); Q_{β^-} 1.81 (64K54)  (44S54, 32E54a, SHS)
$_{13}Al^{23}$	0.13 s (39T54)	F excit (39T54)		
Al^{24}	2.10 s (84G53); 2.0 s (169B54); 2.3 s (102B52)	☢ β^+, α ~10^{-2}% (84G55); A excit, decay charac (102B52)	α ~2 scint spect (84G55); β^+ ~8.5 (weak) scint spect (84G55); γ 1.39 (†40), 2.73 (†32), 4.2 (†15), 5.4 (†6), 7.1 (†7) scint spect (84G55); 1.38, 2.70, 4.2, 5.4, 5.7 (?), 7.0 scint spect (169B54); others (30N54a); see also gammas of Na^{24} and Mg^{24}	 Q_{EC} 14.0 (32E54a) (30N54a, 32E57a, SHS)
Al^{25}	7.6 s (128H54, 109C53); 7.3 s (39B48); 7.2 s (85G54)	☢ β^+ (39B48); B excit, sep isotopes (39B48)	β^+ 3.24 scint spect (31E55); 3.2 abs (128H54a); γ 1.58 (weak) scint spect (94M55); no γ (31E55, 156S56, 114C56, 19V56)	Q_{EC} 4.26 (32E57a); Q_{EC} 4.25 (114C56); see Na^{25}  (SHS)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{13}Al^{26m}$	6.7 s (128H54, 109C53); 6.5 s (30K51, 49H54); 6.3 s (39B48); 6.4 s (85G54); 7.0 s (12W39, 14A48, 12P48); 7.2 s (25W48)	☢ β^+ (17F34); A excit (17F34); cross bomb (34H43, 39B48); others (24M37, 21C39, 16T46, 34H41, 34H42, 10B46, 25B47, 22E52)	β^+ 3.21 spect (31E55); 3.20 spect (85K55); others (14A48, 21W39, 35B46a, 17F34, 49H54); γ no γ (31E55, 106S53a, 94M55)	Q_{EC} 4.244 (32E57a); Q_{IT} 0.23 (86G56)
Al^{26}	8×10^5 y sp act + mass spect (2K57)	☢ β^+ 84%, EC 16% (2K57); A chem, decay charac (157S54); chem, cross bomb, mass spect (2K57); others (86G56, 32E54)	β^+ 1.17 scint spect (61L55); 1.13 spect (49J57); 1.16 abs (2K57); scint spect (77F57); γ 1.83 (96%), 2.96 (0.3%), 1.12 (3.7%), no 0.72 γ scint spect (2K57); 1.84, 2.98, 1.10, 0.74 (coinc with β^+) scint spect, γ-γ coinc (49J57); 1.84 (†100), 1.10 (†5, coinc with 1.84 γ) scint spect, γ-γ coinc (77F57); others (29H55)	Q_{EC} 4.016 (32E57a) (106S53, 32E54a, 2K57)
Al^{27}		% 100 (1B50, 64W56); I 5/2 atomic spect, atomic beam (87M50); μ +3.6385 atomic beam, nucl induct (67K56, 61W53, 87M50, 157B56); q +0.149 atomic beam (62L53); others (128K52)		
Al^{28}	2.27 m (106B53); 2.31 m (115C56); 2.07 m (40S48); 2.30 m (10E43); others (9I53)	☢ β^- (12M35a); A chem, excit (4C34a, 4C34b, 16F34); chem, cross bomb (12A35); daughter Mg^{28} (37L53); others (8E36, 18R37, 2S47, 9O49, 50H51, 10B46, 42H47)	β^- 2.87, no 4.6 spect (29M52); 2.85 spect (74M53); 2.88 spect (22O54); 2.75 (coinc with γ) coinc abs (35B47a); others (43B48, 3N54b); γ 1.78 spect (29M52); 1.80 spect (43B48); 1.82 spect (4I41); 1.77 scint spect (44S54, 44S53); others (35B47a, 107M54, 3N54b, 8D56, 124H56); 0.031 level of Al^{28}: $t_{1/2} = 2.1 \times 10^{-9}$ s nuclear recoil (142S56); see also gammas of P^{28}, Si^{28}, and Mg^{28}	Q_{β^-} 4.65 (32E54a, 64K54) (32E54a, SHS)
Al^{29}	6.56 m (41S49); 6.7 m (32B39); others (132M37, 9I53)	☢ β^- (32B39); A excit, cross bomb (32B39); others (8E36, 14H39, 10B46, 42H47, 12P48)	β^- 2.5 (~70%), 1.4 (~30%) (both coinc with γ) β-γ coinc abs (41S49); 1.6 (~25%, coinc with 2.42 γ) abs, β-γ coinc (3N54b); others (32B39, 132M37); γ 1.28 (85%), 2.43 (15%), no 2.03 (lim 4%), no 1.15 (lim 11%) scint spect (30R55); 1.31, 2.42 (coinc with 1.6 β^-) scint spect, β-γ coinc (3N54b, 3N54c); 1.28 (†15), 2.43 (†1) no 2.03 γ scint spect (90B57a); 1.2 (~80%, coinc with 2.5 β^-), 2.3 (~20%) coinc abs sec (41S49); others (90B56)	Q_{β^-} 3.98 (32E57a) (32E54a, SHS, 30R55)
$_{14}Si^{26}$	1.7 s (39T54)	F excit (39T54)		

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{14}Si^{27}$	4.14 s (126K57); 4.45 s (158S53); 4.9 s (12E41, 29C40a); 4.1 s (127H54); others (25W48, 52B51a)	☢ β^+ (30M40); A excit (22K39); others (76C51, 34H44, 25B47)	β^+ 3.76 scint spect (127H54); 3.5 scint spect (52B51a); 3.5 cl ch (33B40); 3.7 cl ch (30M40)	Q_{EC} 4.805 (32E57a); Q_{EC} 4.70 (64K54)  (32E54a,SHS)
Si^{28}	% 92.18 (28R53); 92.27 (1B50); q ~0 microwave (87M50)	γ 1.78 level of Si^{28}: $t_{1/2}$ (photon) ~4 x 10^{-13} s electron scattering (124H56)		
Si^{29}	% 4.71 (28R53); 4.68 (1B50); I 1/2 nucl induct (77W54, 23O54); 1/2 microwave (78W53, 87M50); μ ±0.5548 nucl induct (67K56, 61W53); q $<10^{-4}$ microwave (78W53)			
Si^{30}	% 3.12 (28R53); 3.05 (1B50); q ~0 microwave (87M50)			
Si^{31}	2.62 h (33C38, 55W51, 25V52); 2.65 h (29M52a); 2.6 h (48L50); others (12N37, 15A40, 56F52)	☢ β^- (12N35a); A n-capt (12A35); chem, excit (12N35a); others (17K36, 2S47, 1P37, 42S36, 45R52)	β^- 1.471 spect (29M52a); 1.49 spect (47W52, 47W53); 1.48 abs (55W51); γ 1.26 (0.07%), no other γ, scint spect (35L54); no γ (12N37); others (9V56)	Q_{β^-} 1.481 (32E57a); Q_{β^-} 1.475 (64K54)  (SHS,9V56)  Q_{β^-} 0.1 (32E54a, 64K54) (32E54a,SHS)
Si^{32}	~710 y yield (37L53) others (21T53, 87R57a)	☢ β^- (37L53); B chem, genet (37L53, 21T54); parent P^{32} (37L53, 21T54)	β^- ~0.10 abs (37L53)	
$_{15}P^{28}$	0.28 s (84G55); 0.29 s (169B54); 0.27 s (39T54)	☢ β^+, no α (84G55, 84G53, 169B54); B excit, decay charac (84G53, 169B54)	β^+ 10.6 (~50%), others (~50%) scint spect (84G55); γ 1.79 (75%), 2.6 (?), 4.44 (10%), 4.93 (?), 6.1, 6.7, 7.0, 7.6 (5%) scint spect (84G55); 1.78, 2.67, 3.01 (?), 4.3 (?), 4.6, 4.89, 5.2 (?) 5.5 (?), 6.7, 7.1, 7.4 (?), 7.7 (?), 8.1 (?) scint spect (169B54); see also gammas of Al^{28} and Si^{28}	Q_{EC} 13.8 (32E57a); Q_{EC} 13.4 (64K54)  (32E54a,SHS)
P^{29}	4.45 s (30R55, 30R53); 4.6 s (21W41)	☢ β^+ (21W41); A excit (21W41); genet energy levels (30R55); others (10B46, 3N53)	β^+ 3.95 spect (30R55, 30R53a, 30R53); 3.9 scint spect (3N53); 3.6 cl ch (21W41); γ 1.28 (0.8%), 2.43 (~0.2%), no 2.03 (lim 0.2%) scint spect (30R55); see also gammas of Al^{29}	Q_{EC} 4.97 (64K54, 32E54a) 
P^{30}	2.55 m (18R37, 60K54); 2.52 m (194B52); 2.18 m (33C38)	☢ β^+ (4C34); A excit (4C34, 17F34); others (33B39, 6A39, 1P37, 37B39, 10B46, 12P48, 42S36, 85H52)	β^+ 3.24 spect (58G56, 58G54); 3.23 abs (60K54); others (24M41, 35B46a, 17F34, 33B40); γ 2.16 (0.5%) scint spect (134M56); no γ (58G56, 60K54, 106S53a)	Q_{EC} 4.26 (SHS) 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{15}P^{31}$		% 100 (1A20, 87K54); I 1/2 atomic spect (87M50); μ +1.1305 nucl induct, atomic spect (67K56, 61W53, 61W54, 87M50)		
P^{32}	14.22 d (90A57); 14.30 d (12C38, 45B50); 14.35 d (23K48); 14.50 d (55L53); 14.07 d (31M40); 14.60 d (38S51)	☢ β^- (21L37); no β^+ (lim 1.3 x 10^{-7}%) (87G56); others (79W54, 135M54, 112M55, 112M56); A chem, n-capt (12A35); daughter Si^{32} (37L53, 21T54); others (18F35, 12N37, 2S47, 42S36, 85H52, 45R52, 32M48, 42B51a); I 1 nucl induct (74F57); μ -0.2523 nucl induct (74F57)	β^- 1.707 spect (average of 44S51, 29M52a, 13J52b, 16A50, 18W50a, 10L49, 7S46b, 38P56, 51D54, 44A56, 59A56, 31A54, 19P57); E (average) 0.70 ion ch (77C52, 195B53); E (average) 0.69 calorimeter (227S56); others (8H51b, 63L55, 45G54, 17Z54, 19P57, 30R53a, 60W57, 56R57, 96G58); internal bremsstrahlung (132B53, 25R53, 75L57b, 145M57); γ no γ (17K36, 7S46b, 45G53)	Q_{β^-} 1.704 (32E57a) 
P^{33}	24.4 d (33N54); 24.8 d (13J52b); 25 d (58W52, 44S51, 93R58)	☢ β^- (13J52b, 44S51); A chem, cross bomb (44S51)	β^- 0.249 spect (33N54); 0.251 spect (31E54); 0.246 abs (58W52); 0.238 spect (93R58); others (44S51, 13J52b); γ no γ (44S51, 58W52)	Q_{β^-} 0.249 (SHS) 
P^{34}	12.4 s (35B46b); 12.7 s (10C40a); others (34H45)	☢ β^- (6Z45); B excit (10C40a); chem, excit, cross bomb (35B46b)	β^- 5.1 (75%), 3.2 (25%) abs (35B46b); γ 2.10, 4.0 (0.2%), no 3.22 γ (lim 0.4%) scint spect (134M56); see also gammas of Cl^{34}	Q_{β^-} 5.1 (32E54a) 
$_{16}S^{31}$	2.66 s (49H52); 3.18 s (12E41); 2.40 s (127H54); 3.2 s (21W41, 52B51a); 2.6 s (27M49)	☢ β^+ (21W41); A excit, cross bomb (21W41, 12E41); others (19K40, 12E41a, 34H41, 34H42, 34H43, 25B47, 27M49, 86L57)	β^+ 4.1 scint spect (52B51a); 4.5 scint spect (127H54); 3.9 cl ch (21W41, 12E41a)	Q_{EC} 5.45 (32E57a); Q_{EC} 5.5 (64K54) 
S^{32}		% 95.018 (meteoritic sulfur) (76M50a); 95.0 (170B56); terrestrial S^{32}/S^{34} variation ≤5% (41T50); S^{32}/S^{34} variation (88K56); I 0 atomic spect (87M50)	γ 2.237 level of S^{32}: $t_{1/2}$ ~1 x 10^{-13} s electron scattering (124H56); see also gammas of Cl^{32}	
S^{33}		% 0.750 (meteoritic sulfur) (76M50a); 0.760 (170B56); I 3/2 microwave (87M50); μ +0.6427 atomic spect, microwave, nucl induct (67K56, 61W53); q -0.064 microwave (165B54); others (47D53a, 197B53, 87M50)		

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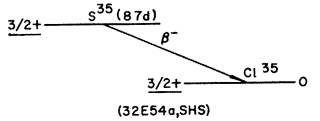
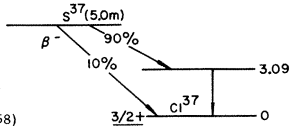
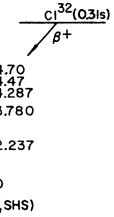
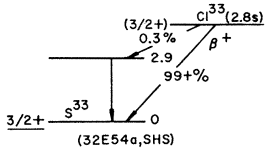
$_{16}S^{34}$		% 4.215 (meteoritic sulfur) (76M50a); 4.22 (170B56); q $<2 \times 10^{-3}$ microwave (87M50);		
S^{35}	87 d (44H43); 88 d (26L40, 1K41); others (2S47, 34C39, 26L40, 3M49, 45R52)	☢ β^- (3L39); A chem, excit (17A36); chem, cross bomb, excit (1K41); sep isotopes (1K42); I 3/2 microwave (87M50); μ ±1.0 microwave (171B54); q +0.045 microwave (165B54); others (87M50, 67K56)	β^- 0.1674 spect (139C57); 0.167 spect (10L50c, 45H51); abs (29S47); 0.169 spect (46B48); abs (1Y48a); 0.168 spect (23G50); ion ch (56C49); E (average) 0.0488 calorimeter (139C57); others (18A48, 49R54, 51P53, 127M54, 44F54, 150H57a, 75L57a, 227S56); internal bremsstrahlung (160S55, 75L57b)	Q_{β^-} 0.167 (SHS)  (32E54a,SHS)
S^{36}		% 0.017 (meteoritic sulfur) (76M50a); 0.014 (170B56); q <0.01 microwave (87M50)		
S^{37}	5.04 m (35B46b)	☢ β^- (6Z45); B chem, excit, cross bomb (6Z45, 35B46b)	β^- 1.6 (90%), β_0^- (10%) scint spect (134M56a); 1.6 (90%), 4.3 (10%) abs (6Z45, 35B46b); γ 3.09 scint spect (156S56a); 3.1 scint spect (134M56a)	Q_{β^-} 4.7 (SHS) 
S^{38}	2.87 h (37N58)	☢ β^- (37N58); B chem, genet (37N58); parent 37 m Cl^{38}, not parent 1 s Cl^{38} (37N58)	β^- 1.1 (95%, coinc with 1.88 γ), 3.0 (5%) abs, scint spect, β-γ coinc (37N58); γ 1.88 (~70%) scint spect, β-γ coinc (37N58)	Q_{β^-} 3.0 (37N58) (SHS)
$_{17}Cl^{32}$	0.306 s (84G53); 0.32 s (169B54); 0.28 s (39T54); others (86L57)	☢ β^+, α $\sim 10^{-2}$% (84G55); B excit, genet energy levels (84G53, 84G55, 39T54)	α 2-3 scint spect (84G55); β^+ 9.5 (~50%), others (~50%) scint spect (84G55); γ 2.21 (70%), 3.79 (?) (~10%), 4.27 (7%), 4.77 (14%) scint spect (84G55); 2.25, 3.79 (?), 4.33, 4.82 scint spect (169B54); others (32E56, 32E54a)	 Q_{EC} 13.0 (32E57a) (32E56, 32E54a,SHS)
Cl^{33}	2.8 s (46H40, 45S48); 2.4 s (21W41); 1.8 s (52B51a)	☢ β^+ (21W41); A excit (46H40, 21W41);	β^+ 4.2 scint spect (3N53); 4.1 cl ch (21W41); 4.4 scint spect (52B51a); γ 2.9 (0.3%) scint spect (47M54)	Q_{EC} 5.58 (32E57a); Q_{EC} 5.2 (64K54)  (32E54a,SHS)

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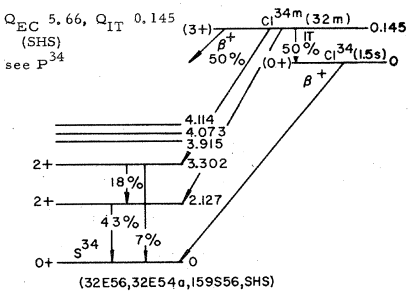
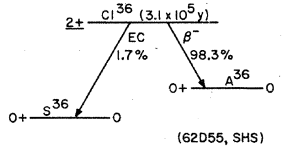
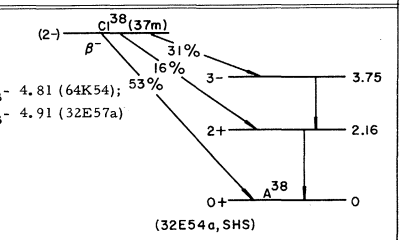
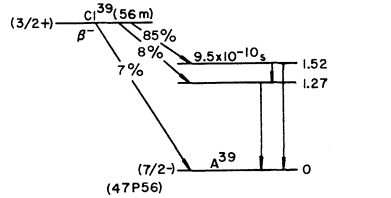
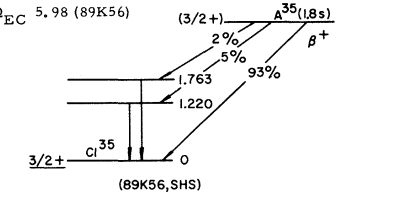
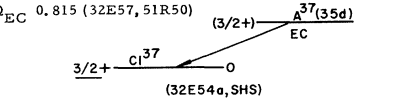
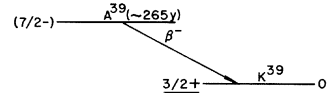
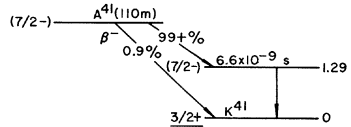
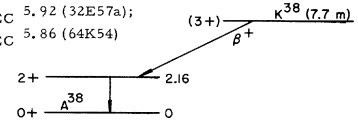
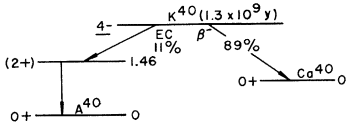
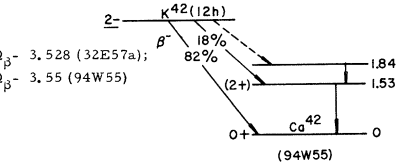
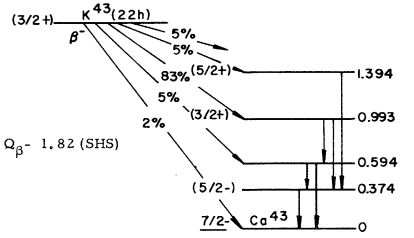
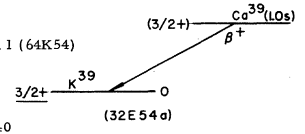
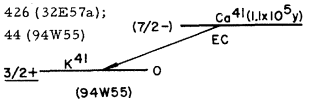
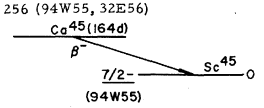
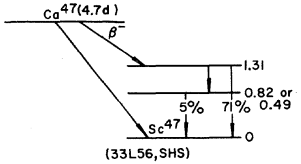
$_{17}Cl^{34m}$	32.40 m (58G56); 32.5 m (82H52a); 33.2 m (25W48); 33.0 m (12P48); 33 m (42S36, 44B38)	☢ β^+ ~50%, IT ~50% (60A53a, 106S53b); A chem, excit (17F34, 42S36); parent Cl^{34} (60A53); others (28S40, 4M50, 18R37, 1P37, 37B39, 34H43, 12P48, 22E52, 45R52, 42B51a)	β^+ 1.3 (†26), 2.48 (†26), 4.50 (†47, with Cl^{34}) spect (58G56); 1.3 (†26), 2.6 (†28), 4.5 (†46, with Cl^{34}) spect (19R51); 2.4 (†20), 5.1 (†~80, with Cl^{34}) cl ch (38H46); γ with β^+: 3.22, 2.10, 1.16 scint spect (18T51); 4.0 (0.2%), 3.22, 2.10 scint spect (134M56); γ_1 2.10, γ_2 1.15, γ_1 coinc with γ_2 γ-γ coinc, scint spect (130H56); others (19R51, 38H46, 32E56, 32E54a, 159S56, 9V56, 75F57, 20D57a); with IT: 0.145 (e/γ 0.13) scint spect (106S53b, 60A53b); 0.145 spect, spect conv (19R51); γ not coinc with β^+ or other γ, γ-γ coinc, scint spect (107M54)	Q_{EC} 5.66, Q_{IT} 0.145 (SHS) see P^{34}  (32E56, 32E54a, 159S56, SHS)
Cl^{34}	1.53 s (77K54); 1.58 s (106S53a, 60A53)	☢ β^+ (106S53b, 60A53a); B genet (60A53, 106S53b); daughter Cl^{34m} (60A53)	β^+ 4.45 scint spect (60A53a, 106S53b); see also β^+ of Cl^{34m}	Q_{EC} 5.52 (64K54)
Cl^{35}		% 75.53 (172B55); 75.4 (6N36); Cl^{35}/Cl^{37} variation <0.2% (24O55); I 3/2 microwave (87M50); μ 0.82091 nucl induct (61W54); + nucl induct, atomic beam (87M50, 67K56, 61W53, 44T53); q -0.0789 microwave, atomic beam (67K56, 87M50); others (128K52)		
Cl^{36}	3.08 x 10^5 y sp act + mass spect (106B55); 2.6 x 10^5 y sp act, yield (109W57); 4.4 x 10^5 y sp act (16W49a); others (2S47)	☢ β^- 98.3%, EC (K) 1.7% (62D55); no β^+ (lim 0.03%) (14J49); A chem, n-capt (31G41); I 2 microwave (87M50, 27J51); μ +1.2839 nucl induct, (calc from 62S55); +1.32 microwave (61A55); q -0.0168 microwave (67K56, 87M50, 61A55)	β^- 0.714 spect (15F52); scint spect (49J56); 0.64 abs (31G41); others (16W49b, 16W51); EC S K-x ion ch (62D55); γ no γ (16W49a, 62D55)	Q_{EC} 1.2 (32E57a); Q_{β^-} 0.714 (64K54)  (62D55, SHS)
Cl^{37}		% 24.47 (172B55); 24.6 (6N36); Cl^{35}/Cl^{37} variation <0.2% (24O55); I 3/2 microwave (87M50); μ +0.6833 atomic beam, nucl induct (67K56, 87M50, 61W53, 44T53); q -0.0621 microwave, atomic beam (67K56, 87M50); others (128K52)		

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{17}Cl^{38}$	1.0 s (17S54)	C	n-capt, sep isotopes (17S54)	γ	0.66 scint spect (17S54)	
Cl^{38}	37.29 m (31C50); 37.5 m (47H37, 21C40a); 37.0 m (2V36a, 5S45); 38.5 m (15H46); others (137M55, 137M54)	☢ A	β^- (17K36); chem, n-capt (12A35); chem, sep isotopes (14K40); others (19A41, 2S47, 45R52, 29W52, 32M48, 42B51, 42B51a); daughter S^{38} (37N58)	β^- γ	4.81 (53%), 2.77 (16%), 1.11 (31%) spect (10L50); 5.0, 2.8, 1.1 spect, coinc abs (27W39, 27W41); 5.2 (53%), 2.70 (11%). 1.19 (36%) spect (15H46); γ_1 2.15 (†130), γ_2 1.60 (†100) spect (15H46); γ_1 2.19, γ_2 1.64 (γ_1 coinc with γ_2) spect, coinc (4I41); 2.15, 1.65 spect (21C40a); no 3.75 γ (lim 0.03%) Be-γ-n reaction (33M49); others (58K54, 137M54)	Q_{β^-} 4.81 (64K54); Q_{β^-} 4.91 (32E57a) (32E54a, SHS)
Cl^{39}	55.5 m (49H49); ~1 h (32M48a)	☢ A	β^- (49H49); chem (32M48a); chem, excit (49H49); others (45R52, 29W52, 42B51a)	β^- γ	1.91 (85%), 2.18 (8%), 3.45 (7%) spect (47P56); 1.65 (93%), 2.96 (7%) abs (49H50); γ_1 0.246 (†90), γ_2 1.27 (†100), γ_3 1.52 (†85), γ_1 coinc with γ_2, 1.91 β^- coinc with γ_1, γ_2 and γ_3 β-γ, γ-γ coinc, scint spect (47P56); γ_1 and γ_3: $t_{1/2} = 9.5 \times 10^{-10}$ s delay coinc (47P56); 1.35, 0.35 (coinc with 1.65 β^-) coinc abs sec (49H50)	Q_{β^-} 3.45 (47P56) 
Cl^{40}	1.4 m (134M56c)	☢ B	β^- (134M56c); chem, genet energy levels (134M56c)	β^- γ	~3.2, ~7.5 scint spect (134M56c); 1.46 (†100), 2.75 (†100), 6.0 scint spect (134M56c); see also gammas of K^{40}	Q_{β^-} ~7.5 (134M56c); see K^{40}
$_{18}A^{35}$	1.83 s (89K56); 1.88 s (12E41a); 1.84 s (45S48)	☢ A	β^+ (12E41a, 21W41); excit (21W41, 19K40); others (162H57)	β^+ γ	4.96 (93%), others (7%) spect (89K56); 4.38 cl ch (21W41); 4.41 cl ch (12E41a); 1.19 (†~3), 1.73 (†1) scint spect (89K56); others (161S56, 9V56, 32E56, 162H58)	Q_{EC} 5.98 (89K56) 
$\underline{A^{36}}$		% μ	0.337 (6N50); A^{36}/A^{38} variations (74W54, 58F53); ~0 atomic spect (87M50)			
A^{37}	35.0 d (56M52, 12P53); 34.1d (28W44); 32 d (38A53)	☢ A	EC (28W44, 46R52); EC (L/K 0.092) (64L55); EC (L/K 0.087) (17P49); chem, cross bomb (28W41); others (47B51a)	EC γ	internal bremsstrahlung endpoint: 0.82 scint spect (163S54, 38A53); 0.81 nucl recoil (35K54, 26S55); others (165S56, 65L55, 56M54, 46R52); Cl $K_α$-x (28W44); no γ (28W44)	Q_{EC} 0.815 (32E57, 51R50) 
$\underline{A^{38}}$		%	0.063 (6N50); A^{36}/A^{38} variations (74W54, 58F53)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{18}A^{39}$	~265 y sp act (8Z52)	☢ β^- (48B50); B chem, excit (8Z52)	β^- 0.565 spect (48B50); γ no γ >0.3 (lim 0.1%) (48B50); 1.52 level of A^{39}: $t_{1/2}$ 9.5 x 10^{-10} s delay coinc (47P56); see also gammas of Cl^{39}	Q_{β^-} 0.565 (64K54)  (32E54a, SHS)
$\underline{A^{40}}$		% 99.600 (6N50); μ ~0 atomic spect (87M50)		
A^{41}	110 m (143H51, 32K52, 26S36); 109 m (35B46c); 111 m (166S56a)	☢ β^- (26S36); A chem, excit (26S36); mass spect (43A54); others (47H37)	β^- 1.20 (99+%), 2.48 (0.9%) spect (166S56a); 1.25 (~100%) spect (36B50); 1.18 (99+%), 2.5 (0.7%) abs, coinc abs (35B46c); others (26S36, 17K36); γ 1.29 scint spect (166S56a); 1.30 scint spect (90K55); 1.3 (coinc with 1.2 β^-) β-γ coinc, abs sec (35B46c); others (23R36, 36B49); 1.29 γ: $t_{1/2}$ 6.6 x 10^{-9} s delay coinc (28E53); $t_{1/2}$ 6.7 x 10^{-9} s delay coinc (4E52)	Q_{β^-} 2.524 (32E57a); Q_{β^-} 2.49 (166S56a)  (166S56a)
A^{42}	≥3.5 y (32K52)	☢ β^- (32K52); B chem, genet (32K52); parent K^{42} (32K52)		
$_{19}K^{37}$	1.2 s (167S56, 52B51a); 1.3 s (27L48)	☢ β^+ (52B51a); C excit (27L48)	β^+ 5.1 spect (167S56); 4.6 scint spect (52B51a)	Q_{EC} 6.1 (167S56)
K^{38}	7.7 m (47H37, 18R37, 58G56); 7.5 m (24R47); 7.6 m (12P48)	☢ β^+ (47H37); A chem, cross bomb (47H37, 14H37); others (34H42, 34H43, 22E52)	β^+ 2.68, no 4.9 (lim 0.6%) spect (58G56); 2.5 abs (24R47); others (18R37); γ 2.16 scint spect (18T51); ~2.1 abs sec (24R47)	Q_{EC} 5.92 (32E57a); Q_{EC} 5.86 (64K54)  (32E54a, SHS)
K^{38}	0.95 s (106S53); 0.94 s (77K54)	☢ β^+ (106S53a, 106S53); C excit (106S53a, 106S53, 77K54)		
$\underline{K^{39}}$		% 93.08 (6N50); others (64W56, 70R56, 70R52, 81C43); I 3/2 atomic beam (87M50); μ +0.3909 nucl induct, atomic beam (67K56, 87M50, 61W53); others (173B54, 157B55); q +0.11 nucl induct (168S57, 69R55); +0.07 atomic beam (174B56, 174B57)		

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{19}K^{40}$	1.25 x 10^9 y calc from weighted average t_{β^-} and EC/β^- (SHS); t_{β^-} sp act (uncorr. for EC): 1.39 x 10^9 y weighted average from references listed below; specific activity (β's/sec gm natural K) 29.6 (169S55); 27.5 (138M56); 29.2 (91K55); 28 (74W56, 46S50); 27 (76H50); others (132H54, 48S50, 19F50, 47S49, 20F49, 27G48, 17D51, 17D51a, 138M55)	☢	β^- 89%, EC 11% (138M56, 138M55, 3I50, 27G51); β^- 91%, EC 9% (169S55, 48S50); β^- 88%, EC (K) 12% (46S50); β^- 93%, EC (K) 7% (36C50); β^- 90%, EC 10% (19F50, 76H50); β^- 94%, EC 6% (65M52); others (170S54, 80W55, 7A56, 80W54, 71R53, 170S54a, 74W56, 26R50);	β^-	1.33 spect (15F52); 1.32 scint spect (91K55); 1.36 spect (13A50a); 1.36 scint spect (11B50c); 1.35 spect coinc (16D46); others (42H46, 42H48, 25G51, 139M53);	Q_{β^-} 1.32, Q_{EC} 1.48 (32E57a); Q_{β^-} 1.33, Q_{EC} 1.51 (94W55)
				γ	1.46 scint spect (11B50b, 25G51a, 138M56); 1.48 scint spect (55H50); 1.47 scint spect (18P50); 1.54 (with EC) abs, coinc (42H46); 1.55 abs (26G47); others (34M47, 16P52); γ/β^- 0.12 sp act (average of 74W56, 138M56, 169S55, 19F50, 47S49, 48S50, 25G51, 20F49, 27G48, 46S49, 76H50); EC/γ ~1 (35M51, 46S50, 16P52); others (133H54, 134B55a, 23J52a, 175B53)	 (SHS)
		no β^+ (lim 0.002%) (11B50b); no β^+ (37C51, 25G51b);				
		A	chem (1T05, 54C06); chem, mass spect (15S37); others (27G50, 25G51, 20A48, 111S50);			
		%	0.0119 (6N50); 0.0118 (70R52, 70R56, 64W56);			
		I	4 atomic beam (87M50);			
		μ	-1.2964 atomic beam (67K56, 87M50, 61W53, 94W55)			
K^{41}		%	6.91 (6N50); others (70R52, 64W56, 70R56);	γ	1.29 level of K^{41}: $t_{1/2}$ 6.6 x 10^{-9} s delay coinc (28E53); see gammas of A^{41}	
		I	3/2 atomic beam (87M50);			
		μ	+0.2151 atomic beam (67K56, 87M50); 0.2145 nucl induct (173B54);			
		q	±0.1 atomic beam, (calc from 173B54, 168S57)			
K^{42}	12.52 h (175B53); 12.44 h (7S47c, 93K53); 12.46 h (109W57); others (38S51, 47H37)	☢	β^- (17K36);	β^-	3.55, 1.99, ~0.5 (?) spect (38P56); 3.56, 1.97 spect (92K54); 3.58 (75%), 2.04 (25%) spect (7S47c); others (35B47a, 26H53a);	Q_{β^-} 3.528 (32E57a); Q_{β^-} 3.55 (94W55)
		A	chem, n-capt (12A35); chem, cross bomb (71H35, 71H36); mass spect (43A54); daughter A^{42} (32K52); others (11O49, 2S47, 35B47a, 29W52, 57G51);	γ	γ_1 1.53 (†100, coinc with 1.99 β^-), γ_2 0.320 (†0.8), spect, β-γ coinc (38P56); γ_1 1.51 spect (7S47c); γ_1 1.51 (20%) scint spect, ion ch (93K53); γ_2 0.309 (weak) scint spect (56L54); γ_1 (11%) ion ch (24E55); γ_1 coinc with γ_2, γ-γ coinc (112C54)	 (94W55)
		I	2 atomic beam (98B53);			
		μ	-1.137 atomic beam (98B53)			
K^{43}	22.4 h (11O49, 43A54); 22.0 h (65L54)	☢	β^- (11O49);	β^-	0.24 (5%), 0.46 (5%), 0.83 (83%), 1.22 (5%), 1.84 (2%) spect (65L54); 0.24, 0.81 spect, abs (11O49);	Q_{β^-} 1.82 (SHS)
		A	chem, excit (11O49); mass spect (43A54)	γ	0.220 (†<5), 0.371 (†100), 0.388 (†14), 0.394 (†16), 0.591 (†23), 0.614 (†91), 1.01 (†4) spect, scint spect, β-γ, γ-γ coinc (176B57); 0.219 (†1.5), 0.374 (†100), 0.393 (†9), 0.619 (†150, e_K/γ ~2 x 10^{-4}), 1.02 (†6) (0.374 γ coinc with 0.219 γ, 0.619 γ, and 1.02 γ) spect, spect conv, scint spect, γ-γ coinc (65L54, 128B57a); others (22N55, 28N57, 65L57c); see also gammas of Sc^{43}	 (176B57, SHS, 178B57)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{19}K^{44}$	22.0 m (101C54); 20 m (43A54); 18 m (30W37); others (30W40)	☢ β^- (30W37); A chem, excit (30W37); chem, sep isotopes, cross bomb (101C54); mass spect (43A54)	β^- 1.5, 4.9 scint spect (101C54); γ 1.13, 2.07, 2.48, 3.6 (?) scint spect (101C54); see also gammas of Sc^{44}	Q_{β^-} ~6.1 (94W55); see Sc^{44}
K^{45}	34 m (43A54)	E mass spect (43A54)		
$_{20}Ca^{38}$	0.66 s (142C57)	☢ β^+ (142C57); C excit, decay charac (142C57)	γ 3.5 scint spect (142C57)	
Ca^{39}	1.00 s (158S53, 177B53); 0.90 s (77K54); 1.06 s (34H43)	☢ β^+ (34H43); B excit (34H43, 27M49); others (25W48)	β^+ 6.1 scint spect (127H54); 5.1 scint spect (52B51a); 6.7 abs (177B53)	Q_{EC} 7.1 (64K54) 
Ca^{40}		% 96.97 (6N38a); μ ~0 atomic spect (87M50)	γ 3.348 level of Ca^{40}: $t_{1/2}$ ~1.4×10^{-9} s delay coinc, Ca^{40} (n,n') (61K57); 3.730 level of Ca^{40}: $t_{1/2}$ ~5×10^{-11} s electron scattering (124H56); others (178B56)	see Sc^{40}
Ca^{41}	1.1×10^5 y yield (60B53)	☢ EC (60B51); B chem, n-capt, sep isotopes (60B51); others (49S51)	EC potassium K_α-x (60B53)	Q_{EC} 0.426 (32E57a); Q_{EC} 0.44 (94W55) 
Ca^{42}		% 0.64 (6N38a)		
Ca^{43}		% 0.145 (6N38a); I 7/2 atomic spect (94K54); 7/2 nucl induct (29J53); μ -1.3153 nucl induct (61W53, 29J53); others (94K54)		
Ca^{44}		% 2.06 (6N38a)		
Ca^{45}	164 d (64D53); 152 d (36M47); 153 d (64T57); 180 d (30W40)	☢ β^- (30W40); A chem, excit, cross bomb (30W40); others (2S47, 63H48, 45R52, 42B51a, 11G49)	β^- 0.254 spect (23M50a); 0.261 spect (74M53a); 0.255 scint spect (24K50); 0.260 abs (29S48, 50S50); E (average) 0.075 ion ch (77C52); γ no γ (29S48, 37M49)	Q_{β^-} 0.256 (94W55, 32E56) 
Ca^{46}		% 0.0033 (6N38a)		
Ca^{47}	4.7 d (33L56); 4.8 d (42B51a); 4.3 d (74M53a); 5.4 d (10C53)	☢ β^- (36M47); A (36M47); chem, genet (42B51a); parent Sc^{47} (42B51a, 116C53); others (45R52)	β^- 1.94 (17%), 0.66 (83%) spect (33L56); 2.06 (19%), 0.69 (81%) spect (74M53a); 1.9 (24%), 0.70 (76%) abs (35L55); others (25A53, 10C53, 42B51a, 36M47); γ γ_1 1.31 (†65), γ_2 0.83 (†5), γ_3 0.48 (†5), γ_2 coinc with γ_3, γ-γ coinc, scint spect (33L56); γ_1 1.29 (71%), γ_2 0.81 (5%), γ_3 0.50 (5%), γ_2 coinc with γ_3, 0.70 β^- coinc with γ_1, γ_2, and γ_3, β-γ, γ-γ coinc, scint spect, ion ch (35L55); 1.30, 0.80, 0.495, 0.234, 0.150 spect, spect conv (10C53)	Q_{β^-} 2.00 (94W55) 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{20}Ca^{48}$	t_{β^-} >1.1 x 10^{18} y sp act (62A56); others (28J52, 72M55, 59F52, 89D57)	%: 0.185 (6N38a)		
Ca^{49}	8.8 m (8O56); 8.9 m (140M56); 8.5 m (38M50)	☢: β^- (38M50); A: chem, n-capt, sep isotopes (38M50)	β^-: 1.95 (†100), 0.9 (†14) scint spect (8O56); 2.1, ~1.0 abs, β-γ coinc (140M56); γ: 3.10 (†89), 4.05 (†10), 4.68 (†0.3) scint spect, γ-γ coinc (8O56); 3.07 (89%, coinc with 2.1 β^-), 4.04 (10%, coinc with ~1.0 β^-), 4.7 (0.8%) scint spect, β-γ coinc (140M56)	Q_{β^-} 5.05 (8O56) Ca^{49}(8.8m) β^-; 4.68, 4.05, 3.10; 89%, 0.6%, 10%; Sc^{49}; (7/2-); 0 (8O56,SHS)
$_{21}Sc^{40}$	0.22 s (84G55); ~0.35 s (39T54)	☢: β^+ (84G55); C: excit (84G55)	β^+: 9.0 scint spect (84G55); γ: 3.75 scint spect (84G55); see gammas of Ca^{40}	Q_{EC} 14.6 (94W55); Q_{EC} 13.9 (32E57a) Sc^{40}(0.22s) β^+; (3-) ~5x10^{-11} s; 3.730; 0+ ~1.4x10^{-9} s; 3.348; 0+ Ca^{40}; 0 (SHS,178B56)
Sc^{41}	0.873 s (98M52); 0.87 s (12E41)	☢: β^+ (12E41a); B: excit (12E41)	β^+: 4.94 cl ch (12E41)	Q_{EC} 5.96 (12E41, 94W55)
Sc^{42}	0.68 s (140C57); 0.62 s (134M55)	☢: β^+ (134M55); C: decay charac (134M55); excit (140C57)	β^+: 4.8 scint spect (140C57) γ: no γ (140C57)	Q_{EC} 6.7 est (94W55) (7/2-) Sc^{41}(0.87s) β^+; (7/2-) Ca^{41}; 0 (94W55)
Sc^{43}	3.92 h (53H45); 3.95 h (65D53); 3.84 h (43A54); 4 h (30W40a)	☢: β^+ (17F35); A: chem, excit (17F35); mass spect (43A54); others (2D38, 45R52, 29W52, 42B51a)	β^+: 1.20 (†79), 0.82 (†17), 0.39 (†4) spect (65L54a); 1.18 (†72), 0.77 (†28) spect (93H52); others (53H45, 30W37a, 30W40a); γ: 0.25 (†10), 0.369 (†160, coinc with 0.82 β^+), 0.627 (†40), 0.84 (weak) spect, scint spect, β-γ coinc (65L54a); 0.375 (25% of β^+) scint spect (34N53); 0.375 spect (93H52); others (53H45, 30W40a, 28N57); see also gammas of K^{43}	Q_{EC} 2.20 (32E57); Q_{EC} 2.21 (94W55) see K^{43} (3/2+) 0.993; 0.594; (5/2-) 0.374; 7/2- Ca^{43}; 0; (7/2-) Sc^{43}(3.9h) β^+
Sc^{44m}	2.44 d (53H45); 2.46 d (43A54); 2.4 d (49B50); 2.2 d (30W40a)	☢: IT (30W40a); A: chem, excit, cross bomb (30W37a); mass spect (43A54); others (53H43, 2D38, 31B38, 30W37b, 45R52, 29W52, 42B51a)	γ: γ_1 0.271 spect, spect conv (49B50); γ_1 0.269 spect conv (51S42); γ_1 (e/γ 0.14) scint spect (179B55); others (2H41, 53H45)	Q_{IT} 0.271 (SHS) (176B57,SHS,178B57)
Sc^{44}	3.92 h (53H45); 3.90 h (43A54); 4.0 h (49B50); 4.1 h (30W40a, 51S42)	☢: β^+, EC (53H45); EC ~7% (179B55); A: chem, excit (10C38); mass spect (43A54); others (75L54, 53H43, 30W37a, 2D38, 31B38, 37B39, 53H44, 29W52, 42B51, 42B51a); daughter Ti^{44} (174S54, 81H57)	β^+: 1.471 (93%) spect (179B55); 1.463 spect (49B50); others (51S42, 39C50, 30W40a); γ: 1.159 (~100%, e/γ 6.3 x 10^{-5}, coinc with 1.47 β^+), 2.54 (0.12%) spect conv, scint spect, β-γ coinc (179B55); 1.16 spect, spect conv (49B50); 1.18 coinc abs sec (39C50)	Q_{EC} 3.64 (32E57, 94W55) Sc^{44m}(2.4d) 0.271 IT; Sc^{44}(3.9h) 0; β^+,EC; 2.54; (2+) 1.159; 99+% 0.1%; 0+ 0 (94W55,SHS)

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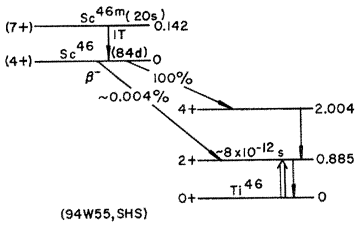
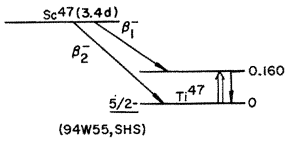
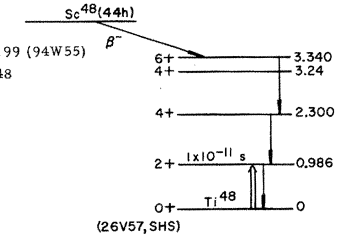
$_{21}Sc^{45}$		%	100 (28L50, 64W56);	γ	Coulomb excitation (in Sc^{45}): no γ (141M55, 27T54)	
		I	7/2 atomic spect (87M50);			
		μ	+4.749 nucl induct, atomic spect (67K56, 87M50, 61W53, 94W55)			
Sc^{46m}	19.5 s (38M51); 20 s (68H52a)	☢	IT (18G48);	γ	0.142 (K/L ~10) spect conv (82B52); 0.135 scint spect (38M51)	Q_{IT} 0.142 (SHS)
		A	n- capt, resonance neutron activation (18G48)			
Sc^{46}	83.9 d (93G57); 84.1 d (53S56); 84.2 d (109W57); 84 d (19P51); others (142M54, 42A55a, 30W39)	☢	β^-, no EC (40M47); β^-, EC (weak) (30W39); no β^+ (lim 0.0016%) (41M51);	β^-	β_1 0.357 spect (10Y53); β_1 0.36 spect (22F47, 40M47, 20P48); abs (52S50); β_2 1.48 (0.004%) spect (6W56); β_2 1.25 (0.1%) spect (95K54a); others (14N50, 19P51, 39M50, 40F57a, 56B57b);	Q_{β^-} 2.362, Q_{EC} 1.7 (94W55)  (94W55, SHS)
		A	n-capt, chem (71H36); chem, excit, cross bomb (30W37c); others (30W40a, 2S47, 30W37b, 63H48, 45R52, 42B51a)	γ	γ_1 0.885, γ_2 1.119 spect (65L53); γ_1 0.892, γ_2 1.118 scint spect (36J56); γ_1 (e/γ 1.8×10^{-4}) spect conv, average of (39M50, 82W53, 95K54, 172S54); γ_2 (e/γ 0.9×10^{-4}) spect conv, average of (39M50, 82W53, 95K54, 172S54); γ_1 (coinc with β_1^- and γ_2) β-γ, γ-γ coinc (15J48, 52S50, 26M48); γ_1 (coinc with β_2^- and γ_2) delay coinc (14N50); γ_1 $t_{1/2}$ ~7×10^{-12} s delay coinc (15A55); others (20P48, 22F47, 40M47, 19P51a, 105H55, 81W53, 96K53, 108B56, 66D56, 180B57a, 130B57); see also gammas of Ti^{46}	
Sc^{47}	3.43 d (26K49); 3.44 d (74M53a, 65D53); 3.40 d (10C53)	☢	β^- (53H45a);	β^-	β_1 0.439 (60%), β_2 0.600 (40%) spect (88G56); β_1 0.45 (74%), β_2 0.610 (26%) spect (33L56); β_1 0.435 (~66%), β_2 0.622 (~34%) spect (70C53); β_1 0.430 (64%), β_2 0.60 (36%) spect (33N55); others (74M53a, 35L55a, 10C53, 26K49);	Q_{β^-} 0.605 (SHS)  (94W55, SHS)
		A	chem, cross bomb (53H45a); sep isotopes (26K49); mass spect (43A54); daughter Ca^{47} (42B51a); others (22E52, 63H48, 45R52)	γ	0.159 (coinc with β_1^-) β-γ coinc, delay coinc, scint spect (88G56); 0.167 (coinc with β_1^-) β-γ coinc, scint spect (33N55); 0.160 (K/L+M ~10) spect conv, spect (10C53); 0.160 scint spect (33L56); 0.157 scint spect (35L55a); others (70C53, 26K49, 74M53a); see also gammas of Ti^{47}	
Sc^{48}	44 h (30W40a, 26M42, 26K49, 53H45a)	☢	β^- (30W37b);	β^-	0.65 spect (26V57a); 0.64 spect (51S42); others (53H45a, 26K49);	Q_{β^-} 3.99 (94W55) see V^{48}  (26V57, SHS)
		A	chem, excit (30W37b); sep isotopes (26K49); mass spect (43A54); others (53H43, 51S42, 26M42, 1P37, 53H44, 45R52)	γ	0.986 (e/γ 1.2×10^{-4}), 1.040 (e/γ 1.1×10^{-4}), 1.314 (e/γ 0.7×10^{-4}) spect conv (26V57a); γ_1 0.99 (†100), γ_2 1.04 (†100), γ_3 1.32 (†100), γ_1 coinc with γ_2 and γ_3; γ_2 coinc with γ_1 and γ_3, scint spect γ-γ coinc (117C53); 0.99 (†100), 1.05 (†100), 1.33 (†100) scint spect (173S53); 0.98, ~1.0, 1.33 scint spect, γ-γ coinc (68H52); 0.99, 1.32, no 2.3 γ (lim 0.1%) scint spect (69M52); others (6P46, 26M42, 26M43a, 53H45a, 81W53a, 26V56); see also gammas of Ti^{48} and V^{48}	

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$_{21}Sc^{49}$	57 m (30W40a, 8O56, 60K54)	☢ β^- (30W40a); A chem, excit, cross bomb (30W40a); sep isotopes (60K54, 8O56); others (42H47, 22E52, 38M50)	β^- 2.05 scint spect (8O56); 2.00 abs (60K54); 1.8 abs (140M56, 30W40a); γ no γ (30W40a, 8O56, 60K54)	Q_{β^-} 2.05 (8O56) Sc^{49}(57m) β^- Ti^{49} 7/2 0 (94W55)
Sc^{50}	1.5 m (134M55a)	☢ β^- (134M55a); E decay charac, excit (134M55a)	β^- ~3.5 (134M55a); γ 1.56 (~100%) (134M55a)	
$_{22}Ti^{43}$	0.6 s (45S48); 0.58 s (39T54)	E excit (45S48)		
Ti^{44}	~10^3 y yield (81H57)	☢ [EC] (174S54); B chem, genet (174S54, 81H57); parent Sc^{44}, not parent Sc^{44m} (174S54); parent Sc^{44} (81H57)	γ 0.072 (complex, coinc with 0.072 γ) γ-γ coinc, scint spect (81H57); 0.16 scint spect (174S54)	Q_{EC} ~0.18 (174S54)
Ti^{45}	3.09 h (27K50); 3.05 h (11T50); 3.08 h (21A41)	☢ β^+, EC (27K50); A chem, cross bomb, excit (21A41); mass spect (43A54); others (34H43b, 34H44, 25W48, 22E52, 45R52, 42B51a, 74M52)	β^+ 1.02 spect (11T50); 1.00 spect (27K50); 1.2 cl ch (21A41); γ no 0.45 γ (lim 1.5%) (34N53); 0.45 (weak), no 0.8 γ spect (11T50); 0.80 spect, abs (27K50)	Q_{EC} 2.058 (32E57) Ti^{45}(3.1h) β^+,EC 7/2- Sc^{45} 0 (94W55)
Ti	1.4×10^{-3} s (86L57)	E excit (86L57)	γ ~1.0 scint spect (86L57)	
Ti^{46}		% 7.99 (134H54); 7.95 (6N38a)	γ Coulomb excitation (in Ti^{46}): 0.890 scint spect (27T56a); 0.890 level of Ti^{46}: $t_{1/2}$ 9×10^{-12} s Coul exc (27T56a); $t_{1/2}$ ~7×10^{-12} s delay coinc (15A55); others (135B53); see also gammas of Sc^{46}	see Sc^{46}
Ti^{47}		% 7.32 (134H54); 7.75 (6N38a); I 5/2 nucl induct (29J53b); μ -0.7871 nucl induct (29J53b)	γ Coulomb excitation (in Ti^{47}): 0.160 scint spect (27T54a, 27T54); see also gammas of Sc^{47}	see Sc^{47}
Ti^{48}		% 73.99 (134H54); 73.45 (6N38a)	γ Coulomb excitation (in Ti^{48}): 0.99 scint spect (27T56a); 0.99 level of Ti^{48}: $t_{1/2}$ 1.0×10^{-11} s Coul exc (27T56a); $t_{1/2}$ ~4×10^{-12} s delay coinc (111C56); nucl res fluor (119K58); see also gammas of Sc^{48} and V^{48}	see Sc^{48} and V^{48}

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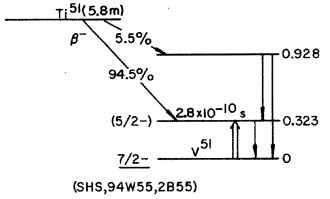
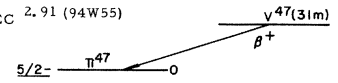
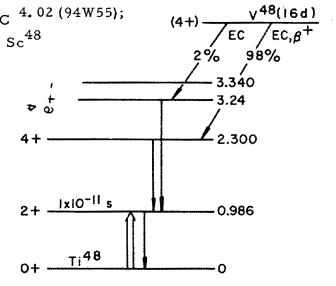
$_{22}Ti^{49}$		%	5.46 (134H54); 5.51 (6N38a);	γ	Coulomb excitation (in Ti^{49}): 1.4 scint spect (27T56a)	
		I	7/2 nucl induct (29J53b);			
		μ	-1.1023 nucl induct (29J53b)			
Ti^{50}		%	5.25 (134H54); 5.34 (6N38a)	γ	Coulomb excitation (in Ti^{50}): no γ (27T56a)	
Ti^{51}	5.79 m (3S53); 5.80 m (2B55); 5.8 m (25A53a); 6 m (24S49a, 38M50, 2S47)	☢	β^- (2S47);	β^-	β_1^- 1.50, β_2^- 2.13 scint spect, β-γ coinc (2B55); 2.13 spect (107M55); 2.17, no 2.55 β^-, scint spect, β-γ coinc (173S55); β_1^- 1.8, β_2^- 2.3 abs. β-γ coinc (37J54a); others (60K52);	Q_{β^-} 2.45 (SHS); see Cr^{51}
		A	n-capt (2S47); cross bomb (135H53)	γ	γ_1 0.323 (†96, coinc with γ_2 and β_2^-), γ_2 0.605 (†1.4), γ_3 0.928 (†4.2, coinc with β_1^-) β-γ coinc, γ-γ coinc, scint spect (2B55); γ_1 0.32 (†96, coinc with γ_2 and β_2^-), γ_2 0.61 (†1), γ_3 0.92 (†4.8, coinc with β_1^-) β-γ coinc, γ-γ coinc, scint spect (37J54a); γ_1 0.325 (†96), γ_3 0.94 (†5.8) scint spect (173S55); γ_1: $t_{1/2}$ 2.8×10^{-10} s delay coinc (14S57b); others (34N53, 107M54, 107M55, 38M51a, 60K52); see also gammas of V^{51} and Cr^{51}	 (SHS, 94W55, 2B55)
$_{23}V^{46}$	0.40 s (98M52); 0.37 s (86L57); 0.4 s (39T54)	☢	β^+ (98M52);	β^+	≥6.0 scint spect (98M52)	
		E	excit (98M52)			
V^{47}	31.1 m (60K54); 33 m (26K49, 12O42, 30W37b); 31 m (51D54a)	☢	β^+ (30W37b);	β^+	1.89 spect (51D54a); 1.90 abs (60K54); 1.7 abs (26K49); others (35B46a, 12O42, 30W37b);	Q_{EC} 2.91 (94W55)  (94W55)
		A	chem, excit, cross bomb (12O42); chem, sep isotopes (26K49) mass spect (43A54); other (45R52)	γ	no γ (25A53a, 60K54, 33L56); γ (26K49)	
V^{48}	16.0 d (97K56, 30W37b); 16.3 d (50B54); 16.4 d (143M53); 16.2 d (26V57a)	☢	β^+ 56%, EC 44% (26V57a, 168H57a); β^+ 58%, EC 42% (21G46); β^+ 49%, EC 51% (117C53); β^+, EC (30W39, 53H44, 173S53);	β^+	0.692, no 0.82 β^+ (lim 0.2%) spect (74M53a); 0.694 spect (98K55); 0.698 (56%) spect, β-γ coinc (26V57a); others (6P46, 53H44, 30W37b, 43R52);	Q_{EC} 4.02 (94W55); see Sc^{48}  (26V57, SHS)
		A	chem, excit, cross bomb (30W37c, 30W37b); daughter Cr^{48} (45R52); others (32M48, 42B51a)	γ	γ_1 0.986 (γ/β^+ 0.89, e/γ 1.3×10^{-4}), γ_2 1.314 (γ/β^+ 0.88, e/γ 0.6×10^{-4}), γ_3 2.25 (γ/β^+ 0.023, e/γ 1.5×10^{-5}), no 0.94 γ (lim γ/β^+ 0.05), no 1.04 γ (lim γ/β^+ 0.05) scint spect, spect conv, γ-γ coinc (26V57a); γ_1 coinc with γ_2 and γ_3, γ-γ coinc (117C53, 69M52, 111C56); β^+ coinc with γ_1 and γ_2, β-γ coinc (43R52, 69M52); γ_1 (†100), γ_2 (†100), γ_3 (†2) scint spect, spect (69M52, 43R52, 173S53); γ_1 (e/γ 2×10^{-4}), γ_2 (e/γ 8×10^{-5}) spect conv (7Z52); γ_1 $t_{1/2}$ $\sim 4 \times 10^{-12}$ s delay coinc (111C56); no 2.3 γ (lim 0.5%) (18T52); others (34J52, 143M53, 28E53, 44A56, 41A53, 6P46, 20R49); see also gammas of Sc^{48} and Ti^{48}	

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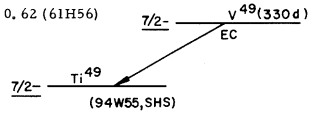
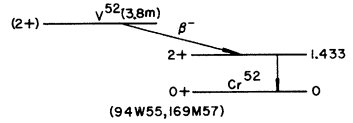
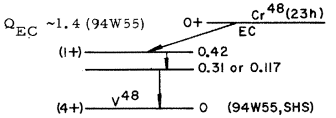
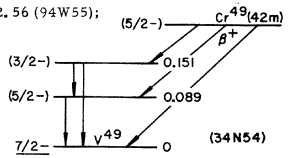
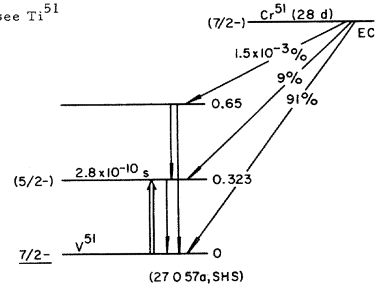
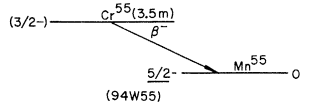
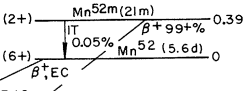
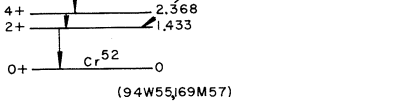
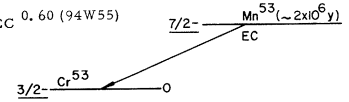
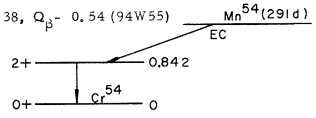
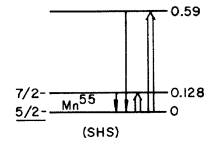
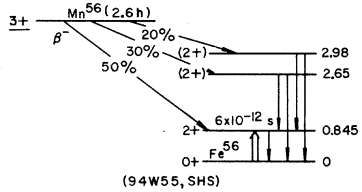
$_{23}V^{49}$	330 d (61H56, 35L55b)	☢ EC (30W39); B chem (30W39, 29T40); chem, excit (61H56, 35L55b); others (10C49, 43H49); I 7/2 paramag res (83W57); μ ±4.46 paramag res (83W57)	EC internal bremsstrahlung endpoint: 0.62 scint spect (61H56) γ no γ, no conv (61H56, 35L55b)	Q_{EC} 0.62 (61H56) 
$\underline{V^{50}}$	4×10^{14} y sp act (106G57b); others (133H55, 63C52a, 182B56)	☢ EC, no β^- (108G57b); % 0.25 (64W56); 0.24 (43H49, 28L49); I 6 paramag res (181B52, 56K53, 56K52); μ 3.3413 nucl induct (61W54); + (61W52, 56K53, 181B52)	γ Coulomb excitation (in V^{50}): 0.226 scint spect (52F56); 0.225 scint spect (27T56a)	Q_{EC} 2.40, Q_{β^-} 1.18 (94W55)
$\underline{V^{51}}$		% 99.75 (64W56); 99.76 (43H49, 28L49); I 7/2 atomic spect, nucl induct (87M50); 7/2 paramag res (97B51c, 56K52); μ +5.139 nucl induct (67K56, 61W53, 87M50); q ~+0.3 atomic spect (88M56, 88M53)	γ Coulomb excitation (in V^{51}): 0.320 scint spect (27T56a, 27T54a); 0.325 scint spect (141M55); 0.320 scint spect (41A56a, 41A56); 0.323 level of V^{51}: $t_{1/2}$ 2.8×10^{-10} s delay coinc (14S57b); $t_{1/2}$ 1.0×10^{-10} s nucl res fluor (175S56); see also gammas of Ti^{51} and Cr^{51}	
V^{52}	3.76 m (3S53); 3.77 m (60K54); 3.75 m (67L54); 3.74 m (42M47); 3.75 m (12A35); 2.6 m activity not found (84W54, 67L54; 25R50); 16 h activity not found (67L54, 54W53, 10C49)	☢ β^- (12A35); no IT (84W54, 67L54); A chem, n-capt (12A35); cross bomb, excit (30W37b); others (1P37, 2S47, 9O49, 25R50, 50H51, 42H47, 15N50)	β^- 2.47 abs (60K54); ~2.6 abs, β-γ coinc (67L54); 2.6 cl ch (4Y42); others (25R50); γ 1.44 scint spect (67L54); 1.44 (53K42); others (42M47, 25R50, 9V58); see also gammas of Mn^{52}	Q_{β^-} 4.2 (94W55); see Mn^{52} 
V^{53}	2.0 m (177S56) 23 h activity not found (44S55, 44S54a)	☢ β^- (177S56); C decay charac (177S56)	β^- 2.50 scint spect (175S56); γ 1.00 (strong) scint spect (175S56); others (9V58)	
V^{54}	55 s (177S56)	☢ β^- (177S56); C decay charac (177S56)	β^- 3.3 scint spect (177S56); γ 0.835 (↑~100), 0.99 (↑~100), 2.21 scint spect (177S56); see also gammas of Mn^{54}; others (9V58)	see Mn^{54}
$_{24}Cr^{46}$	1.1 s (39T54)	F excit (39T54)		
Cr^{47}	0.4 s (39T54)	F excit (39T54)		

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{24}Cr^{48}$	23 h (69L55); 24 h (44S55a)	☢	EC, no β^+ (lim 2%) (69L55, 44S55a);	γ	γ_1 0.116 (†95, e/γ 0.02), γ_2 0.31 (†100, e/γ 0.006), γ_1 coinc with γ_2 scint spect, spect conv, γ-γ coinc (69L55); γ_1 0.118 (†100), γ_2 0.31 (†100) γ_1 coinc with γ_2 scint spect, sum scint spect (44S55a)	Q_{EC} ~1.4 (94W55) 
		A	chem, genet (45R52); parent V^{48} (45R52, 69L55)			
Cr^{49}	41.9 m (12O42); 41.7 m (118C53)	☢	β^+ (12O42);	β^+	1.54 (†50), 1.39 (†35), 0.73 (†15) spect (118C53); 1.46, no 0.73 β^+ spect (34N54); others (34N53, 12O42);	Q_{EC} 2.56 (94W55); 
		A	chem, excit, cross bomb (12O42); others (34H44, 12P49, 45R52, 29W52, 32M48, 42B51a, 74M52, 48H50)	γ	0.063 (γ/β^+ 0.15, e/γ 0.14), 0.089 (γ/β^+ 0.30, e/γ 0.06), 0.150 (γ/β^+ 0.14, e/γ 0.16) no 0.61 γ scint spect, spect conv (34N54); 0.153 (e_K/γ 0.02), 0.61 spect, spect conv (118C53)	
Cr^{50}		%	4.31 (24W48)			
Cr^{51}	27.8 d (53S56, 35L52, 109W57); 27.9 d (97K56)	☢	EC (16B45a, 30W40b); no β^+ (16B45a, 28K49, 35L52);	EC	internal bremsstrahlung endpoint: 0.75 scint spect (115B55, 33V56); 0.73 scint spect (63C55, 27O57a);	Q_{EC} 0.75 (94W55); see Ti^{51} 
		A	chem, excit, cross bomb (30W40b); chem, genet (50B50); daughter Mn^{51} (50B50); others (22A40, 2S47, 45R52, 32M48, 42B51a, 48H50)	γ	γ_1 0.325 (9%, coinc with γ_2), γ_2 0.320 (10^{-3}%), γ_3 0.65 (5 x 10^{-4}%) scint spect, γ-γ coinc (27O57a); γ_1 0.325 (e/γ 0.0015) spect, spect conv (21O56); γ_1 0.330 (~3%, e_K/γ ~0.02) spect, spect conv (16B45a); γ_1 0.32 (8%) scint spect, x-γ coinc (35L52); γ_1 0.323 spect, spect conv (28K49); γ_1 (9.8%, e/γ 0.0016) scint spect, spect conv (2B55); γ_1 (9.8%), γ_3 0.624 (0.026%) scint spect (115B55); γ_1 (21%, e_K/γ 0.0015) scint spect, spect conv (94M52); γ_1 (8%) scint spect (33V56); γ_1 (e/γ 0.0031) spect, spect conv (33E55); others (34N53, 21C52, 17K48, 43M46, 38M51a); see also gammas of Ti^{51} and V^{51}	
Cr^{52}		%	83.76 (24W48)			
Cr^{53}		%	9.55 (24W48);	γ	Coulomb excitation (in Cr^{53}): 0.155 (?) scint spect (141M55)	
		I	3/2 paramag res (97B51, 185B52, 70L57, 166M56a); 3/2 nucl induct (136H54);			
		μ	-0.47354 nucl induct (calc from 29J53a); -0.47355 nucl induct (calc from 3A53)			
Cr^{54}	$t_{\beta\beta}$ >6 x 10^{15} y sp act (59F52)	%	2.38 (24W48)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{24}Cr^{55}$	3.52 m (9F52b); 3.6 m (186B54); 2 h activity not found (15N50, 32M50, 18D40, 22A40, 2S47)	☢ β^- (9F52b) B chem, cross bomb (9F52b)	β^- 2.85 abs (9F52b); ~2.8 abs (186B54) γ no γ (lim 10%) (9F52b)	Q_{β^-} 2.85 (94W55)  (94W55)
$_{25}Mn^{49}$	0.4 s (39T54)	F excit (39T54)		
Mn^{50}	0.28 s (98M52); 0.27 s (39T54)	☢ β^+ (98M52); E excit (98M52)	β^+ >6.3 scint spect (98M52)	Q_{EC} ~7.5 (94W55)
Mn^{51}	45.2 m (60K54); 44.3 m (50B50); 46 m (12L38)	☢ β^+ (12L37); A chem, cross bomb (12L37, 12L38); chem, genet (50B50); parent Cr^{51} (50B50); others (2D38, 5D39, 42S52, 45R52, 32M48, 42B51a, 74M52)	β^+ 2.16 abs (60K54); 2.0 abs (12L38); others (35B46a) γ no γ (60K54, 25A53a)	Q_{EC} 3.1 (94W55)
Mn^{52m}	21.3 m (40H40); 21 m (12L38, 19D37)	☢ β^+ 99+%, IT (?) ~0.05% (1O47); A chem, (19D37); chem, excit, cross bomb (12L37, 12L38); daughter Fe^{52} (32M48); others (22E52, 42S52)	β^+ 2.63 spect (59A56); 2.66 spect (1O47); γ with β^+: 1.46 (coinc with β^+) spect, β-γ coinc (1O47); with IT: 0.392 (0.05%) (?) spect conv (1O47); see also gammas of V^{52} and Mn^{52}	Q_{EC} 5.10 (SHS) 
Mn^{52}	5.60 d (50B54); 5.69 d (97K56); 5.72 d (187B55); others (84H51, 12L38, 32M48)	☢ EC 65%, β^+ 35% (21G46); EC 67%, β^+ 33% (152S54); A chem, excit, cross bomb (12L37, 12L38); others (40H40, 45R52, 29W52, 42B51a, 74M52, 48H50); I 6 or 7 paramag res (65A57c); μ (assuming I = 6) ±3.08 paramag res (65A57c)	β^+ 0.58 spect (6P46); 0.77 cl ch (40H40) γ γ_1 0.73, γ_2 0.94, γ_3 1.46 (γ_1 coinc with γ_2 and γ_3, all coinc with β^+) spect, β-γ coinc (6P46); γ_1 (e/γ 3.0×10^{-4}), γ_2 (e/γ 1.8×10^{-4}), γ_3 (e/γ 7.2×10^{-5}) spect conv (95K54); others (137H56, 137H57); see also gammas of V^{52}	Q_{EC} 4.74 (94W55)  (94W55,69M57)
Mn^{53}	~2×10^6 y yield (44S57, calc from 85W55, 67D56)	☢ EC (85W55); B chem, decay charac (85W55); I 7/2 paramag res (67D56); μ ±5.050 paramag res (67D56)	EC K-x (85W55); γ no γ (85W55)	Q_{EC} 0.60 (94W55)  (94W55, SHS)
Mn^{54m}	no 2 m activity observed (114G55, 111M57); 2.1 m (40C51)	☢ β^- (40C51); G sep isotopes (40C51)		
Mn^{54}	291 d (187B55); 278 d (53S56); 290 d (97K56); 300 d (109W57); 324 d (179S53)	☢ EC (6A38); no β^+, no β^- (12L38, 20D44); A chem, excit, cross bomb (12L37, 12L38); others (45R52, 52B51a)	EC internal bremsstrahlung endpoint: 0.53 scint spect (38J56); γ 0.840 scint spect (94M54a); 0.84 spect, x-γ coinc (20D44) others (12L38, 179S53, 7G54, 9B54); see also gammas of V^{54}	Q_{EC} 1.38, Q_{β^-} 0.54 (94W55)  (94W55)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{25}Mn^{55}$		% 100 (37S36a, 64W56); I 5/2 atomic spect (87M50); 5/2 paramag res (97B51a); μ +3.4614 atomic spect, nucl induct (67K56, 87M50, 61W53); ~+0.55 microwave (51J54); +0.4 atomic spect (88M55a, 88M53); +0.3 atomic spect (50N57); others (98W57) q	γ Coulomb excitation (in Mn^{55}): 0.128 scint spect (27T56a, 27T54a); spect conv (96H56); 0.131 scint spect (141M55); 0.127, 0.59 scint spect (41A56a, 41A56); 0.128 (e_K/γ 0.014) spect conv (116B55)	
Mn^{56}	2.576 h (106B53a); 2.578 h (106B53); 2.574 h (55L53); 2.59 h (12L38, 9B50)	☢ β^- (12A35); A chem, n-capt (12A35); others (56F52, 18R37, 2S47, 9O49, 12P48, 50H51, 22E52, 45R52, 29W52, 32M48, 42B51a, 74M52, 48H50); I 3 atomic beam (127C58)	β^- 2.81 (50%), 1.04 (30%), 0.65 (20%) spect (7S46c); 2.86 (60%), 1.05 (25%), 0.75 (15%) spect (4E43a); 2.88, 1.04 spect (14T41); γ γ_1 0.845, γ_2 1.81, γ_3 2.13 scint spect (144M55); γ_1 0.85 (†100), γ_2 1.81 (†30), γ_3 2.13 (†20) spect, β-γ coinc (4E43a); γ_1 0.822 (†100), γ_2 1.77 (†30), γ_3 2.06 (†20) spect (7S46c); γ_1 (†100), γ_2 1.81 (†29), γ_3 2.13 (†15), γ_4 2.65 (†1.8), γ_5 2.98 (†0.4) scint spect (28C57); γ_2 (pair e/γ 6×10^{-4}), γ_3 (pair e/γ 5×10^{-4}) spect conv (5S52a); γ_1 coinc with γ_2 and γ_3, γ-γ coinc (90G53, 44M53); others (5S51, 9B50, 28E53, 53K42); see also gammas of Fe^{56} and Co^{56}	Q_{β^-} 3.70 (94W55); see Co^{56} 
Mn^{57}	1.7 m (101C54a)	☢ β^- (101C54a); C chem, excit (101C54a)	β^- 2.6 scint spect (101C54a); γ 0.117 (strong), 0.134 (strong), 0.22 (weak), 0.35 (weak), 0.69 (weak), scint spect (101C54a); see also gammas of Fe^{57} and Co^{57}	Q_{β^-} 2.8 (94W55); see Co^{57}
Mn^{57}	7 d (112S51); no activity observed (101C54a, 15N50)	☢ β^- (112S51); F chem, cross bomb (112S51, 101C54a, 15N50)	β^- 1.0 spect (112S51)	
$_{26}Fe^{52}$	8.3 h (23F52b); 7.8 h (32M48)	☢ β^+ ~57%, EC ~43% (59A56); β^+ 40%, EC 60% (23F51); A chem, genet (32M48); parent Mn^{52m} (32M48); not parent Mn^{52} (lim 5%) (23F51); others (42S52, 45R52, 29W52, 51B50, 74M52, 42B51a)	β^+ 0.80 spect (59A56); ~0.55 abs (32M48); ~0.6 abs (23F51); γ 0.163 (~100%) scint spect (225B57); no γ >0.5 scint spect (23F51)	
Fe^{53}	8.9 m (18R37, 12L38a)	☢ β^+ (18R37); A chem (18R37); chem, excit, cross bomb (12L38a); others (34H42, 34H44, 22E52, 42S52, 12P49, 32M48, 42B51a, 74M52)	β^+ 2.5 scint spect (52B51); 2.6 abs (15N50); γ 0.370 (γ/β^+ 0.30) scint spect (34N53); no γ (15N50)	Q_{EC} 3.7 (94W55)
Fe^{54}		% 5.84 (6V41)		

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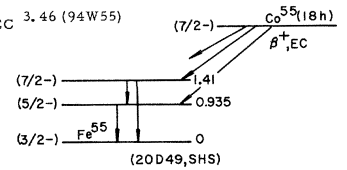
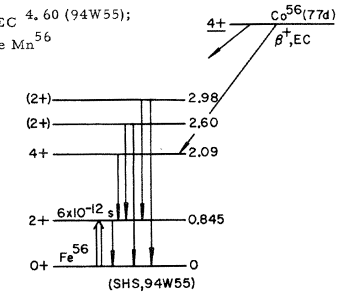
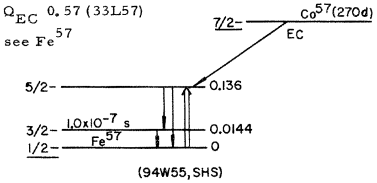
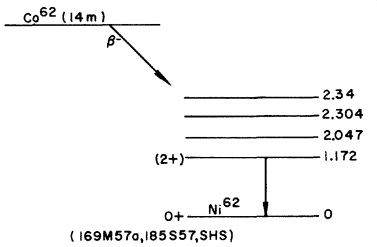
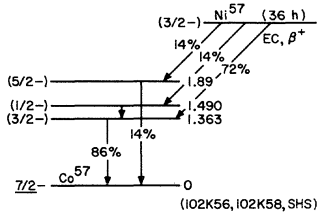
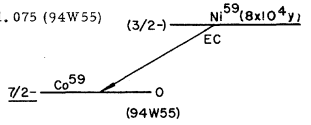
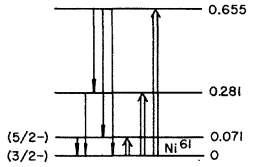
$_{26}Fe^{55}$	2.60 y (53S56); 2.94 y (53B50); others (53S51)	☢ EC, no β^+ (16B46b,94M51,19P53); A chem, excit (12L39a); daughter Co^{55} (12L41); others (93M51,42B51a)	EC internal bremsstrahlung endpoint: 0.22 scint spect (average of 113M54,163S54,132B53,145M53,11B52b, 94M51,94M51a,145M57); Mn K-x (16B46b,19P53); γ no γ (6P46a,19P53); others (165S56,55C53,16B46b,35N56);	Q_{EC} 0.217 (94W55) Fe^{55}(2.6y) (3/2-) EC 5/2- Mn^{55} (94W55)
Fe^{56}		% 91.68 (6V41)	γ Coulomb excitation (in Fe^{56}): 0.85 ($t_{1/2}$ 6 x 10^{-12} s) scint spect (27T56a); others (10I54)	see Mn^{56} and Co^{56}
Fe^{57}		% 2.17 (6V41); I 1/2 paramag res (116G57); μ < 0.05 paramag res (55T53)	γ Coulomb excitation (in Fe^{57}): 0.1220 cryst spect (137C57); 0.122, 0.137 spect conv (96H56); 0.123, 0.137, 0.228 (†10), 0.350 (†130) scint spect (97H57,27T56a,27T54a, 60P57a); others (71L55); 0.014 level of Fe^{57}: $t_{1/2}$ 1.0 x 10^{-7} s delay coinc (147M55,71L55); $t_{1/2}$ 1.1 x 10^{-7} s delay coinc (20D50); see also gammas of Co^{57}	see Co^{57} 5/2- 0.365 5/2- 0.136 3/2- 1.0x10^{-7} s Fe^{57} 0.0144 1/2- 0 (SHS,60P57a,180S56)
Fe^{58}	$t_{\beta\beta}$ >3 x 10^{14} y sp act (59F52)	% 0.31 (6V41)		
Fe^{59}	45.1 d (53S51); 45.0 d (22T53, 22T51); 45.5 d (29G43); 44.3 d (109W57); 47 d (1W53)	☢ β^- (12L38a); A chem, excit, cross bomb (12L38a); others (2S47,2I46,17T48,32M48, 51B50,42B51a,74M52,48H50, 11G49)	β^- 0.271 (46%), 0.462 (54%), 1.560 (0.3%) spect (44M52c); 0.257 (~50%), 0.460 (~50%) spect, β-γ coinc abs (20D42); 0.45, no 0.26 β^- spect (48M51); γ 0.191 (2.8%, e/γ 7 x 10^{-3}, coinc with 1.098 γ), 1.098 (57%, e/γ 1.8 x 10^{-4}), 1.289 (43%, e/γ 1.4 x 10^{-4}) spect, spect conv, scint spect, γ-γ coinc (44M52c); 1.097, 1.295 spect (12H50); 1.10 (not coinc with 1.29 γ), 1.29 spect, γ-γ coinc (48M51); 1.10 (e/γ 1.8 x 10^{-4}), 1.30 (e/γ 1.1 x 10^{-4}) spect conv (144H53); 1.100 (†100), 1.278 (†77) spect (16D56c); others (86S53,20D42,93B52,44M52,130B55)	Q_{β^-} 1.560 (SHS) (3/2-) Fe^{59}(45d) β^- 54% 46% 0.3% (3/2-) 1.289 2.8% (5/2-) 1.098 57% 43% 7/2- Co^{59} 0 (94W55,SHS)
Fe^{60}	~3 x 10^5 y yield (88R57)	☢ [β^-] (88R57); B chem, genet (88R57); parent Co^{60m} (88R57)		
Fe^{61}	5.5 m (72R55)	☢ β^- (72R55); B chem, genet (72R55); parent Co^{61} (72R55)	β^- (72R55); γ (72R55)	
$_{27}Co^{54}$	0.18 s (98M52, 86L57); 0.20 s (39T54)	☢ β^+ (98M52); E excit (98M52)	β^+ >7.4 scint spect (98M52)	Q_{EC} ~8.7 (94W55)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{27}Co^{55}$	18.2 h (19D37)	☢ β^+ ~60%, EC ~40% (calc from 20D49); A chem (19D37); chem, cross bomb, genet (12L41); parent Fe^{55} (12L41); others (12L38b, 42S52, 45R52, 29W52, 32M48, 42B51a, 74M52, 48H50)	β^+ 1.50 (†53), 1.03 (†40), 0.53 (†4.9), 0.26 (†2.3) spect (79C54); 1.51 (†51), 1.04 (†45), 0.79 (†4) spect (49M58); 1.50 spect (24L39, 20D49); γ 0.253 (γ/β^+ 0.02), 0.477 (γ/β^+ 0.38, e/γ 3.9×10^{-4}), 0.935 (γ/β^+ 1.6, e/γ 8×10^{-5}), 1.41 (γ/β^+ 0.26, e/γ 1.4×10^{-4}, coinc with 1.03 β^+), 1.84 (γ/β^+ 0.006), 2.17 (γ/β^+ 0.04) spect, spect conv, scint spect, β-γ coinc (79C54); 0.477 (γ/β^+ 0.3, e/γ 3×10^{-4}), 0.935 (γ/β^+ 1.4, e/γ 4×10^{-4}), 1.41 (γ/β^+ 0.3, e/γ 1×10^{-4}) spect, spect conv, β-γ coinc (20D49); 0.247, 0.476, 0.937, 1.41 spect conv, scint spect, γ-γ coinc (49M58); others (85S51)	Q_{EC} 3.46 (94W55)  (20D49, SHS)
Co^{56}	77.3 d (109W57); 77 d (50B54); 72 d (12L41); 80 d (28C42)	☢ EC 80%, β^+ 20% (28C56a); A chem, excit, cross bomb (12L41); daughter Ni^{56} (44S52, 32W52); others (16J41, 21P42, 29W52, 42S52, 45R52, 42B51a); I 4 paramag res (181B56, 52J56); μ ±3.86 paramag res (52J56); ±3.85 paramag res (181B56); others (182S56, 54P55, 146M56, 91G55)	β^+ β_1^+ 0.44 (†4), β_2^+ 1.50 (†96) spect (181S54); β_2^+ 1.53 (†73), β_3^+ 1.00 (†27) spect (70C52a); others (4E43a, 12L41, 28C42, 47K56, 77A57); γ γ_1 0.845 (†100), γ_2 0.98 (†1.8), γ_3 1.03 (†16), γ_4 1.22 (†70), γ_5 1.35 (†5.7), γ_6 1.76 (†17), γ_7 2.02 (†12), γ_8 2.56 (†16), γ_9 2.98 (†1.9), γ_{10} 3.25 (†12), γ_{11} 3.47 (†1.1) scint spect (28C56a); γ_1 0.845 (†100, coinc with γ_4 and β_2^+), γ_4 1.26 (†50, coinc with β_2^+), γ_6 1.74 (†20), γ_7 2.01 (†10), γ_8 2.55 (†20), γ_{10} 3.25 (†20) spect, β-γ coinc (4E43a); γ_1 0.85 (†100, coinc with γ_4, γ_6, γ_8, and γ_{10}), γ_4 1.24 (†55, coinc with γ_6 and γ_7), γ_6 1.75 (†24), γ_7 2.03, γ_8 2.60 (†14), γ_{10} 3.25 (†24) scint spect, spect conv, γ-γ coinc (181S54, 181S55); others (85S51, 137M54a, 180B57, 63W55a, 145H55, 180B57a); see also gammas of Fe^{56} and Mn^{56}	Q_{EC} 4.60 (94W55); see Mn^{56}  (SHS, 94W55)
Co^{57}	270 d (12L41); 267 d (10C55)	☢ EC, no β^+ (lim 0.08%) (71L55); EC, no β^+ (lim 0.002%) (118C55); EC, (L/K 0.2) (57M56); β^+ (12L41, 70C52a, 10C55); A chem, excit, cross bomb (12L40); daughter Ni^{57} (23F52); I 7/2 paramag res (181B53); μ ±4.65 paramag res (181B56)	β^+ no β^+ (71L55, 118C55, 147M55); 0.32 spect (70C52a); ~0.30 spect (10C55); EC internal bremsstrahlung endpoint: 0.43 scint spect (38J56); γ γ_1 0.01437 (K/L 8.9), γ_2 0.12194 (K/L 6.7), γ_3 0.13631 (K/L 8.2) spect conv (188B57, 188B56, 188B55, 188B57b); γ_2 0.12205, γ_3 0.13640 cryst spect (137C57a); γ_2 0.123 (†15, e_K/γ 0.011), γ_3 0.138 (e_K/γ 0.14) spect conv, ion ch (13A54b); γ_1 (†1.5), γ_2 (†15) scint spect (113M55); γ_1 (e/γ 15) ion ch, scint spect (71L55); γ_1 $t_{1/2}$ 1.0×10^{-7} s delay coinc (147M55, 71L55); γ_1 $t_{1/2}$ 1.1×10^{-7} s delay coinc (20D50); others (4E43a, 21P42, 12L38b, 22P38, 54B39, 7G56, 9B55, 65L57); see also gammas of Fe^{57} and Mn^{57}	Q_{EC} 0.57 (33L57) see Fe^{57}  (94W55, SHS)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{27}Co^{58m}$	9.2 h (25C50); 9.0 h (37A52); 8.8 h (55S50)	☢	IT, no β^+ (55S50);	γ	0.025 (e/γ large, K/L 1.9) spect conv (55S50); 0.023 spect conv (79C54)	Q_{IT} 0.025 (SHS)
		A	chem, excit (55S50); others (74M52)			
Co^{58}	71.3 d (53S56); 71.0 d (10C55); 72 d (12L41, 113H52)	☢	EC 85%, β^+ 15% (21G46, 28C56a); EC 87%, β^+ 13% (7C56);	β^+	0.472 spect (70C52a); 0.49 spect (10C55); 0.47 spect (20D44);	Q_{EC} 2.30 (94W55); Q_{β^-} 0.16 (94W55)
		A	chem, excit, cross bomb (12L41); others (12L38b, 22P38, 54B39, 37A52, 29W52, 7V38, 20D44, 51B50, 42B51a, 74M52, 48H50);		1.3 (6×10^{-4}%) spect (51D58);	
				γ	γ_1 0.81 (†100, coinc with γ_2), γ_2 ~E of γ_1 (†1.6), γ_3 1.62 (†0.5) scint spect, γ-γ coinc (40F56);	
		I μ	1 or 2 paramag res (67D57); ±4.05 (assuming I = 2) paramag res (67D57); others (68D52, 87W55, 92G56)		γ_1 0.805 (†100), γ_3 1.67 (†0.5) scint spect (28C56a); γ_1 (e_K/γ 3×10^{-4}) spect conv (70C52a, 55S50); γ_1 (†100), γ_3 1.64 (†0.5) scint spect (39R56); others (10C55, 9B52, 20D44, 12L41, 7G56, 45R52, 67P57, 56B57c, 77A57)	
Co^{59}		%	100 (45M51);	γ	Coulomb excitation (in Co^{59}): no γ (141M55, 27T54a)	
		I	7/2 atomic spect (87M50); 7/2 paramag res (97B51d);			
		μ	+4.639 nucl induct (67K56, 61W53, 87M50);			
		q	+0.5 atomic spect (88M53)			
Co^{60m}	10.47 m (106B53); 10.7 m (12L41)	☢	IT 99+%, β^- 0.28% (20D51);	β^-	1.56 spect (6P47); 1.35 spect (15N42); 1.28 spect (20D45);	Q_{β^-} 2.876 (SHS)
		A	n- capt (6H37a); chem, excit, cross bomb (12L41); others (12L37, 20D42a, 2S47, 6H37b)	γ	0.0589 (K/L 4.6) spect conv (42C50); 0.056 spect conv (20D45); others (20D51)	
Co^{60}	5.24 y (93G57); 5.20 y (55L56); 5.21 y (51K53); 5.27 y (22T55, 22T51); others (55L53, 12L41, 53B50, 38S51)	☢	β^- (27R37);	β^-	β_1^- 0.312 spect (average of 10Y53, 190B54, 29F52, 31W50a, 43M47); β_2^- 1.478 (0.01%) spect (6W56); β_2^- 1.48 (0.15%) spect (95K54a);	Q_{β^-} 2.817 (SHS); see Cu^{60}
		A	n-capt (37S36); chem, excit, cross bomb (12L41);			
		I μ	5 paramag res (67D56a, 65A57); ±3.80 paramag res (67D56a); + nucl alignment (87W55a); others (97B54b, 54P55a, 68D52, 20D42a, 20D51, 29F52, 12L38b, 54B39, 15N42, 27R37, 2S47, 1Y51)	γ	γ_1 1.1728 (K/L+M ~10), γ_2 1.3325 (K/L+M ~10) spect conv (49L53); γ_1 1.172, γ_2 1.332 cryst spect (29L49); γ_3 2.158 (1.2 $\times 10^{-3}$%) spect (6W55); γ_1 (e/γ 1.72 $\times 10^{-4}$), γ_2 (e/γ 1.24 $\times 10^{-4}$) spect conv (29F52); γ_1 (e/γ 1.73 $\times 10^{-4}$), γ_2 (e/γ 1.29 $\times 10^{-4}$) spect conv (31W50, 31W50a); γ_1 coinc with γ_2, γ-γ coinc (23K53, 36A52, 50C53, 41L53, 71L54, 54W54, 120C55); γ_2 $t_{1/2}$ ~8×10^{-12} s delay coinc (15A55); others (16D51, 7S50, 17B50, 44M50a, 13A49, 37D51, 85B50a, 85S51, 34J56, 33E56, 1H39, 34E56, 16D53, 63F49, 44A56, 28E53, 9B52, 135B53, 95K54, 88W54, 189B55, 66G53a, 90G53, 58K53, 61K52, 61K53, 40F57, 175S57, 60W57, 56R57, 7G57, 84A57, 63D57, 14L57, 16D56h, 65L57c, 65L57d, 233B58); see also gammas of Cu^{60}	
Co^{61}	99.0 m (56S51, 34N56); 105 m (60B53a, 23P49); 110m (48H50)	☢	β^- (23P47);	β^-	1.22 (~95%) scint spect (34N56); 1.42 (~55%), 1.00 (~45%) abs (56S51);	Q_{β^-} 1.29 (SHS): see Cu^{61} and Ni^{61}
		A	chem, excit, cross bomb, sep isotopes, mass spect (23P47); daughter Fe^{61} (72R55); others (29K48, 12P48, 22E52, 49H51, 32M48, 42B51a, 74M52, 48H50, 42B51)	γ	0.072 (~100%) scint spect (35E55); no 0.50 γ (35E55, 34N56); others (22N55, 6F55, 23P49, 56S51, 29K48); see also gammas of Cu^{61} and Ni^{61}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{27}Co^{62}$	1.6 m (23P49)	☢ β^- (23P49);	γ (23P49)	
		E cross bomb, sep isotopes (23P49)		
Co^{62}	13.9 m (23P49, 118G57)	☢ β^- (23P49);	β^- 0.88 (25%), 2.88 (75%) scint spect (118G57); 2.8 abs (34N54a); 2.3 abs (23P49);	
		A chem, sep isotopes (23P49, 118G57)	γ 1.17 (†100, coinc with 1.17 γ), 1.47 (†11), 1.74 (†11), 2.03 (†4), 2.5 (†<1) scint spect, γ-γ coinc (118G57); 1.0 (†40), 1.17 (†100), 1.5 (?, †5), 1.7 (†10), 2.0 (†15), 2.5 (?, †3) scint spect (34N54a)	
Co^{64}	~5 m (23P49)	F cross bomb, sep isotopes (23P49)		
$_{28}Ni^{56}$	6.4 d (44S52); 6.0 d (32W52)	☢ EC ~100%, no β^+ (lim 1%) (44S52);	γ 0.17 (†100), 0.28 (†30), 0.48 (†40), 0.81(†80), 0.96 (†10), 1.33 (†5), 1.58 (†15), 1.75 (†2) scint spect (44S52); 0.14, 0.77, >1.4 scint spect (32W52)	Q_{EC} ~2.7 (94W55)
		A chem (32W52); chem, sep isotopes, genet (44S52); parent Co^{56} (44S52, 32W52)		
Ni^{57}	36 h (46M49, 12L38c)	☢ β^+ 50%, EC 50% (23F50); β^+/EC to 1.363 level of Co^{57}: 1.25 (102K58); β^+/EC to 1.490 level of Co^{57}: 0.75 (102K58); β^+/EC to 1.89 level of Co^{57}: 0.07 (102K58);	β^+ 0.849 (†87), 0.72 (†11), 0.35 (†2) spect, β-γ coinc (102K56, 102K58); 0.84 spect (43C51, 23F50);	Q_{EC} 3.24 (94W55)
		A chem, excit, cross bomb (12L38c); parent Co^{57} (23F52); others (14D41, 15N42a, 46M49, 43C51, 29W52, 80M52, 34H44, 12P48, 12P49, 22E52, 42S52, 32M48, 42B51a, 74M52, 48H50)	γ γ_1 0.1272 (14%, e_K/γ 0.022, K/L+M 9, coinc with β^+ and γ_3), γ_2 0.40 (0.5%), γ_3 1.368 (86%, coinc with β^+), γ_4 1.89 (14%, coinc with β^+), scint spect, spect conv, γ-γ coinc (102K56, 102K58); γ_1 0.128, γ_3 1.38 (†88), γ_4 1.91 (†15) spect, spect conv (43C51); γ_3 1.39 (†88), γ_4 1.90 (†18) scint spect (44S52); others (23F50)	
Ni^{58}		% 67.76 (24W48)		
Ni^{59}	8×10^4 y yield (48B51) 1×10^5 y yield (165S56); 8×10^5 y yield (33W51)	☢ EC (33W51); no β^+ (163S54);	EC Co-K-x (48B51, 33W50, 33W51); internal bremsstrahlung endpoint: 1.07 scint spect (163S54); 1.06 scint spect (165S56);	Q_{EC} 1.075 (94W55) 
		A chem, cross bomb, n-capt (44C45); chem, sep isotopes, n-capt (48B51); others (58T50)	γ no γ (33W50, 33W51)	
Ni^{60}		% 26.16 (24W48)	γ $t_{1/2}$ of 1.33 level of Ni^{60}: $t_{1/2}$ 8×10^{-13} s nucl res fluor (44M56a); $t_{1/2}$ ~8×10^{-12} s delay coinc (15A55)	
Ni^{61}		% 1.25 (24W48);	γ Coulomb excitation (in Ni^{61}): 0.070, 0.282, 0.657 scint spect (52F56); see also gammas of Co^{61} and Cu^{61}	
		μ ~0 atomic spect (87M50)		
Ni^{62}		% 3.66 (24W48)		

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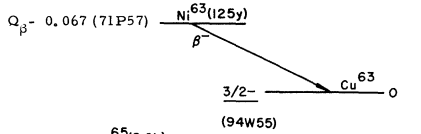
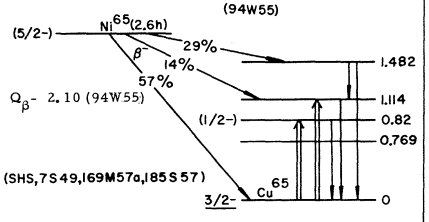
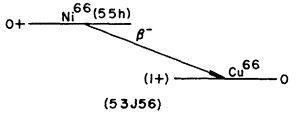
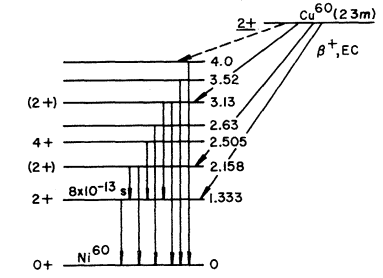
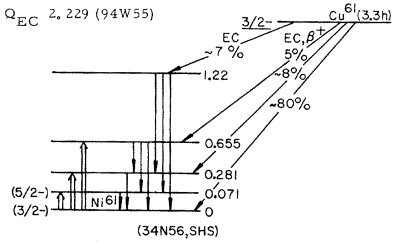
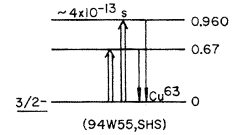
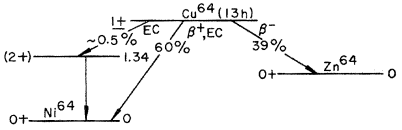
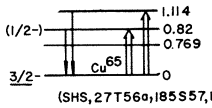
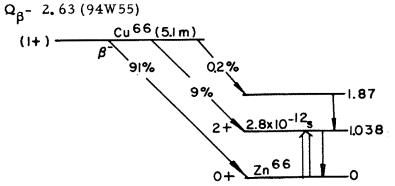
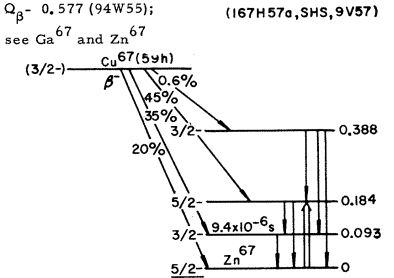
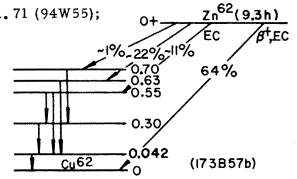
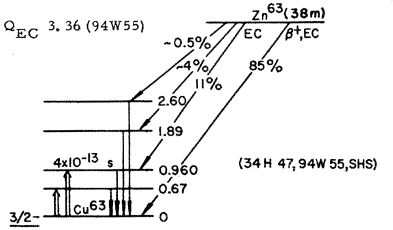
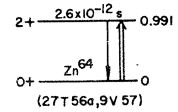
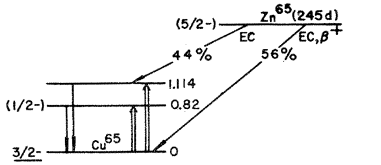
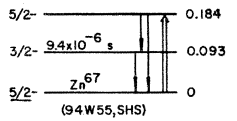
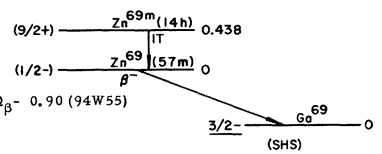
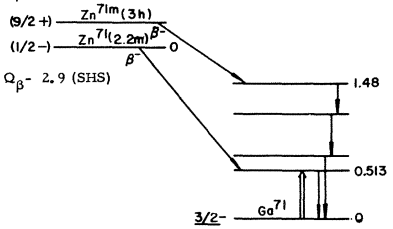
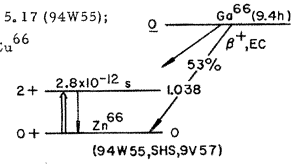
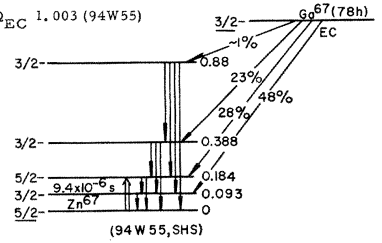
$_{28}Ni^{63}$	125 y sp act (148M56); 85 y yield (48B51); 61 y yield (33W51)	☢ β^- (48B51); A chem, n-capt, sep isotopes (48B51); others (33W50)	β^- 0.067 ion ch (71P57); 0.062 electrostatic analyzer (68K53a); 0.067 ion ch (48B51); 0.063 ion ch (33W49); others (115M53)	Q_{β^-} 0.067 (71P57)  (94W55)
Ni⁶⁴	$t_{\beta\beta}$ >3 x 10^{15} y sp act (59F52)	% 1.16 (24W48)		
Ni^{65}	2.564 h (57S49); 2.6 h (12L38c, 46M49, 56F52)	☢ β^- (6H37b); A n-capt (6R35); chem, sep isotopes, excit (54S46, 45C46); others (15N42a, 14D41, 2S47, 46M49, 29K51, 32M48, 51B50, 74M52, 48H50, 11G49, 6O48)	β^- 2.10 (57%), 1.01 (14%), 0.60 (29%) spect (7S49); γ 1.49, 1.12, 0.37 spect, β-γ, γ-γ coinc (7S49); others (54W51); see also gammas of Cu^{65} and Zn^{65}	 Q_{β^-} 2.10 (94W55) (SHS,7S49,169M57a,185S57)
Ni^{66}	54.8 h (103K56); 55 h (53J56); 56 h (48H50, 11G49)	☢ β^- (11G49); A chem, genet (11G49); parent Cu^{66} (11G49)	β^- 0.20 scint spect (53J56); others (22N55, 103K56); γ no γ (lim 1%) (53J56); no γ (199B54)	Q_{β^-} 0.20 (53J56)  (53J56)
$_{29}Cu^{57}$	0.18 s (39T54); 0.14 s (98M52)	F excit (39T54, 98M52)		
Cu^{58}	9.5 m (4Y55a); 7.9 m (5D39); 10 m (30L47)	☢ β^+ (5D39, 4Y55a); B chem (5D39); chem, excit, sep isotopes (30L47)		
Cu^{58}	3.04 s (98M52); 3 s (39T54)	☢ β^+ (98M52); C excit (39T54, 98M52)	β^+ >7.5 scint spect (98M52)	Q_{EC} ~9.1 (est) (94W55)
Cu^{59}	81.5 s (191B58a); 81 s (56P56, 72L55, 5D39, 30L47); 83 s (4Y55a)	☢ β^+, no EC (lim 5%) (4Y55b); C chem (5D39); excit, sep isotopes (30L47)	β^+ 3.7 spect (56P56); 3.8 spect (161S56a); 1.9 spect (4Y55a); γ 0.343 (†45), 0.42 (?, †15), 0.46 (†40), 0.872 (†80), 1.305 (†100), 1.70 (†10), no 0.19 γ, all γ's coinc with β, no γ-γ coinc observed, scint spect, β-γ coinc, sum scint spect (191B58a); 0.87 (†100), 1.28 (†100), 1.68, 2.06 scint spect (56P56); 0.88, 1.31 scint spect (72L55); others (4Y55a, 4Y55b, 191B56)	
Cu^{60}	23.4 m (34N54b); 24.6 m (30L47)	☢ β^+ 93%, EC 7% (34N54b); A chem, excit, sep isotopes, mass spect (30L47); others (42B51a, 48H48a); daughter Zn^{60} (72L55a); I 2 atomic beam (65R58)	β^+ 2.00 (†69), 3.00 (†18), 3.92 (†6) spect (34N54b); γ γ_1 0.85 (15%, coinc with γ_2), γ_2 1.33 (80%, coinc with γ_3), γ_3 1.76 (52%), γ_4 2.13 (5.7%), γ_5 2.64 (5.5%), 3.13 (3.7%), 3.52 (2.0%), 4.0 (1.1%) scint spect, γ-γ, β-γ coinc (34N54b); see also gammas of Co^{60} and Ni^{60}	 (34N54b,SHS,55P57,185S57) Q_{EC} 6.27 (94W55); see Co^{60}

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{29}Cu^{61}$	3.32 h (200B54); 3.33 h (28C48b); 3.4 h (6T37a, 18R37, 29K50); 3.3 h (48H50)	☢ β^+ 68%, EC 32% (28C51); β^+ 72%, EC 28% (55B50); β^+ 75%, EC 25% (34H49); A chem, excit (18R37a); chem, excit, sep isotopes (30L47, 29K50); daughter Zn^{61} (72L55a, 123C55); others (58S38, 5D39, 12P48, 22E52, 55S51, 42S52, 32M48, 42B51a, 74M52); I 3/2 atomic beam (36N57, 65R58)	β^+ 1.22 (†87), 0.94 (†8), 0.56 (†5) spect, β-γ coinc, scint spect (34N56); 1.21 (†96), 0.55 (†4) spect (13O50); 1.23 spect (16B45b); γ γ_1 0.070 (4%), γ_2 0.280 (12%), γ_3 0.38 (2.5%), γ_4 0.58 (1.5%), γ_5 0.66 (11%), γ_6 0.94 (1.5%), γ_7 1.15 (1%), γ_8 1.22 (5%) scint spect, β-γ, γ-γ coinc (34N56); γ_1 0.076 (γ/β^+ 0.01, e/γ large), γ_2 0.284 (γ/β^+ 0.05, e/γ 0.015), γ_5 0.655 (γ/β^+ 0.25, e/γ ~0) spect, spect conv (13O50); 0.070, 0.278, 0.659, 1.19 scint spect (191B58a); others (28E53, 13O50); see also gammas of Co^{61} and Cu^{61}	Q_{EC} 2.229 (94W55)  (34N56,SHS)
Cu^{62}	9.73 m (200B54); 10.1 m (30L47, 34N54a); 10.0 m (18R37); 9.9 m (12P48, 56F52); 10.5 m (6H37a); others (94G51)	☢ β^+ (6H37a); A excit (6H37a); excit, cross bomb (18R37, 58S38, 37B39); chem, sep isotopes (30L47); daughter Zn^{62} (32M48); others (48G50, 6H37b, 80M52, 30B52, 34H43, 34H43b, 55K52, 25B49, 12P48, 22J50, 55S51, 22E52, 59S48, 9K40a, 9K41a, 42S52, 42B51a, 74M52, 48H50, 78B57)	β^+ 2.91 spect (34N54a); 2.92 spect (61H50); abs (30K50); 2.83 spect (25B49); γ 0.69, 0.88, 1.13, 1.17, no γ >1.17, scint spect (191B58); 0.66 (~2%), 0.85 (~1%), 1.18 (~1%), 1.35 (~1%), 1.46 (~1%), 1.98 (~1%), 2.24 (~1%) scint spect (173B57b); no γ (34N54a, 53R55); see also gammas of 13.9 m Co^{62}	Q_{EC} 3.93 (94W55); see Co^{62}
Cu^{63}		% 69.1 (57B47); I 3/2 atomic spect (87M50); μ +2.221 nucl induct (67K56, 61W53, 87M50); q -0.16 paramag res (97B55); others (61W54, 97B53, 104K52, 104K51, 122C57, 44T57)	γ Coulomb excitation (in Cu^{63}): 0.69, 0.99 scint spect (27T56a); $t_{1/2}$ of 0.960 level of Cu^{63}: $t_{1/2}$ ~4 x 10^{-13} s nucl res fluor (10I54); see also gammas of Zn^{63}	 (94W55,SHS)
Cu^{64}	12.80 h (22T55, 29R50); 12.74 h (53S51); 12.88 h (57S49); 12.87 h (109W57); others (42B51a, 29K51, 34H43b, 34H44, 22J50, 12P49, 55S51, 22E52, 32M48, 2V36, 48H50, 78B57)	☢ EC 42%, β^- 39%, β^+ 19% (SHS, calc from average of K/β^+ and β^+/β^-); K/β^+ 2.2 (24P51); K/β^+ 2.3 (28R50); K/β^+ 1.8 (34H49); K/β^+ 2.7 (55B50); β^-/β^+ 2.0 (55B49, 28C48c); β^-/β^+ 2.1 (16B46a); $\frac{\beta^+ + EC}{\beta^-}$ 1.62 (28R50); A chem, n-capt (12A35); excit (2V36); chem, excit (5D39); others (58S38, 6H37b, 2S47, 74M52, 23R46); I 1 atomic beam (73L54); μ ±0.40 atomic beam (73L54)	β^- 0.571 spect (28C48c, 13O49); 0.570 spect (6P47); 0.58 spect (20T39, 14T41); β^+ 0.657 spect (28C48c, 13O49); 0.644 spect (6P47); 0.65 spect (14T41); 0.66 spect (20T39); γ 1.34 (weak) spect (17K48); 1.35 (γ/β^+ 0.025) spect (20D47); 1.35 (γ/β^+ 0.042) spect (44A56, 16D53a); (γ/β^+ 0.023) abs (10V52); 1.38 (γ/β^+ 0.032) abs (27K50); ~1.34 (e_K/γ ~1.3 x 10^{-4}) spect conv (93B52); others (16B46a, 47M48, 149M51, 227S56, 31V57, 138H57)	Q_{β^-} 0.573, Q_{EC} 1.678 (94W55)  (SHS,94W55)

Isotope Z. A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{29}Cu^{65}$		% 30.9 (57B47); I 3/2 atomic spect (87M50); μ +2.380 nucl induct (67K56, 87M50, 61W53); q -0.15 paramag res (97B55); others (122C57, 97B53, 61W54, 44T57)	γ Coulomb excitation (in Cu^{65}): 0.815, 1.15 scint spect (27T56a); see also gammas of Ni^{65} and Zn^{65}	see Ni^{65}  (SHS, 27T56a, 185S57, 169M57a)
Cu^{66}	5.10 m (3S53); 5.07 m (106B53); 5.12 m (53S51); 5.20 m (60K54); 5.17 m (30R51); others (46C50, 23F51a)	☢ β^- (12A35); A n-capt (12A35); excit (7C37); daughter Ni^{66} (11G49); others (2S47, 9O49, 50H51, 31L40, 6H37b, 78B57)	β^- 2.63 (91%), 1.5 (9%) spect (23F51a); 2.63, 1.64 scint spect (53J56); 2.7 (~94%), 1.65 (~6%) scint spect, β-γ coinc (30R51); γ 1.04 (†100), 0.83 (†2.5) scint spect, γ-γ coinc (167H57a); 1.04 (γ/β^- 0.10, e/γ $<3\times10^{-3}$) spect, spect conv (23F51a); 1.05 scint spect (30R51, 94M51a); 1.03 scint spect (53J56); others (60K54, 28E53); see also gammas of Zn^{66} and Ga^{66}	Q_{β^-} 2.63 (94W55)  (167H57a, SHS, 9V57)
Cu^{67}	58.5 h (29K50); 61 h (48H50, 26E53); 56 h (11G49)	☢ β^- (11G49); A chem (11G49); chem, cross bomb, sep isotopes (29K50); others (29K51, 55S51, 22E52, 48H50)	β^- 0.395 (45%), 0.484 (35%), 0.577 (20%) spect (26E53); 0.37, 0.45, 0.55 abs, β-γ coinc (34N53a); γ 0.092 (complex, e/γ 0.5), 0.182 (e/γ 0.012) spect, spect conv (26E53); 0.092 (complex, †56), 0.182 (†100), 0.296 (†1.4) scint spect (224B57); 0.094 (†28), 0.19 (†100), 0.30 (†~5), 0.39 (†~3) scint spect (34N53a); 0.098 (complex, †22), 0.186 (†78) scint spect (199B54); see also gammas of Zn^{67} and Ga^{67}	Q_{β^-} 0.577 (94W55); see Ga^{67} and Zn^{67}  (224B57, SHS)
Cu^{68}	32 s (9F53)	☢ β^- (9F53); C chem, excit (9F53)	β^- ~3.0 abs (9F53) γ weak (9F53)	Q_{β^-} ~4.5 (est) (94W55)
$_{30}Zn^{60}$	2.1 m (72L55a)	☢ [β^+, EC] (72L55a); B chem, genet (72L55a); parent Cu^{60} (72L55a)	γ (72L55a)	
Zn^{61}	1.48 m (72L55a); 1.5 m (123C55)	☢ β^+ (123C55, 72L55a); A chem, genet (123C55, 72L55a); parent Cu^{61} (123C55, 72L55a)	β^+ 4.8 abs (72L55a); 4.5 abs (123C55, 123C57)	Q_{EC} 5.8 (SHS)
Zn^{62}	9.33 h (61H50); 9.3 h (34N54a); 9.5 h (32M48); 8.4 h (29K53, 1P52a)	☢ EC ~90%, β^+ ~10%, (61H50); A chem, genet (32M48); excit (48G50); parent Cu^{62} (32M48); others (55S51, 22E52, 42S52, 51B50, 42B51a, 48H50)	β^+ 0.66 spect (61H50); γ 0.0418 (K/L >6) spect conv (61H50); 0.0413 (19%, e_K/γ 0.52, K/L+M 8) spect conv, scint spect (34N54a); γ_1 0.042 (†95, e/γ 0.7, coinc with γ_3, γ_4, γ_5, and γ_6, not coinc with β^+), γ_2 0.25 († of $\gamma_2+\gamma_3$: 13, coinc with γ_3 and γ_4), γ_3 0.26, γ_4 0.40 (†5), γ_5 0.51, γ_6 0.59 (†100) scint spect, β-γ, γ-γ coinc (173B57b)	Q_{EC} 1.71 (94W55);  (173B57b)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{30}Zn^{63}$	38.3 m (34H47, 58S38); 38.5 m (5D39)	☢ β^+ 93%, EC 7% (34H47); A chem, excit (37B37, 6H37b, 18R37, others (48G50, 58S38, 47B51b, 31L40, 6H37b, 1P37, 37B39, 12P49, 55S51, 22E52, 42S52, 32M48, 51B50, 42B51a, 48H50)	β^+ 2.36 (↑92), 1.40 (↑7), 0.5(↑~1) spect (34H47); 2.32 spect (14T41); γ 0.960 (~8%, e/γ 2 x 10^{-4}), 1.89 (~4%, e/γ small), 2.60 (~0.5%, e/γ small) spect, spect conv, abs, γ-γ coinc (34H47); see also gammas of Cu^{63}	Q_{EC} 3.36 (94W55) 
Zn^{64}	t (double EC) >8 x 10^{15} y sp act (69B53)	% 48.89 (1B50); μ ~0 atomic spect (87M50)	γ Coulomb excitation (in Zn^{64}): 1.00 ($t_{1/2}$ 2.6 x 10^{-12} s) scint spect (27T56a)	
Zn^{65}	245 d (22T53, 22P38); 244 d (93G57); 246 d (109W57, 32K57)	☢ EC 98.5%, β^+ 1.5% (calc from 57P53, 94M54, 4Y53, 24F51); others (95M52, 4Y52, 4Y52a); A chem (22P38); chem, excit, cross bomb (12L39); daughter Ga^{65} (12L39b); others (58B38, 47B51b, 29K51, 42S39, 2S47, 42B51a, 48H50)	β^+ 0.324 spect (average of 48M49, 181S53, 44A56, 4Y53, 57P53, 8A56, 117B53a); γ 1.119 spect, spect conv, scint spect (average of 48M49, 12H50, 31W50, 25G51a, 36J56, 44A56, 117B53a); γ (e/γ 1.8 x 10^{-4}) spect, spect conv (44A56, 181S53, 117B53a, 55B53); γ (e/γ 2.3 x 10^{-4}) spect conv (31W50); γ (e/γ 2.2 x 10^{-4}) spect, spect conv (172S54); γ (44%) spect, spect conv (57P53); x-γ coinc (24F51); γ (45%) x-e coinc (21G46a); γ (48%) x-γ coinc (152S54) no 0.20 (lim 0.03%) (181S53); 0.21 (coinc with β^+, e/γ ~0.1) β-γ, β-conv coinc (47C50); others (13J49, 30G51, 55B52, 58P53, 94M54, 188B57a, 16D56d, 188B57b) see also gammas of Cu^{65}	Q_{EC} 1.346 (SHS), see Ni^{65} 
Zn^{66}		% 27.81 (1B50); μ ~0 atomic spect (87M50)	γ Coulomb excitation (in Zn^{66}): 1.04 ($t_{1/2}$ 2.8 x 10^{-12} s) scint spect (27T56a); see also gammas of Cu^{66} and Ga^{66}	see Cu^{66}
Zn^{67}		% 4.11 (1B50); I 5/2 atomic spect (87M50); μ +0.8735 nucl induct, atomic spect (87M50, 61W53, 67K56); q +0.18 nucl induct (220B57, 220B57a)	γ Coulomb excitation (in Zn^{67}): 0.090, 0.182 scint spect (27T56a, 27T54a); 0.092 level of Zn^{67}: $t_{1/2}$ 9.4 x 10^{-6} s delay coinc, Zn^{68} (γ,n) (192B57); $t_{1/2}$ 9.3 x 10^{-6} s delay coinc (74R55); others (25F52a, 1P52a, 24K53, 47M53, 74L56, 18V56); see also gammas of Cu^{67} and Ga^{67}	see Ga^{67} 
Zn^{68}		% 18.56 (1B50); μ ~0 atomic spect (87M50)		

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{30}Zn^{69m}$	13.8 h (12L39)	☢	IT (14K39);	γ	0.438 spect, spect conv, scint spect (average of 91S53, 23D53, 2H41, 28G41, 44A56, 67L55, 73D55, 72D53);	Q_{IT} 0.438 (SHS)
		A	chem, excit (6T38); chem, excit, cross bomb (12L39, 14K39); parent Zn^{69} (14K39); others (6V39, 2S47, 6T38, 48H50)		γ (e/γ 0.053) spect conv (91S53); γ (e_K/γ 0.04, K/L+M 8) spect conv (73D55, 44A56, 72D53); γ (e/γ 0.06) spect conv, scint spect (23D53); others (16N44)	
Zn^{69}	57 m (12L39); 51 m (48H48a); 52 m (7H49)	☢	β^- (6H37b);	β^-	0.897 spect (23D53); 0.914 spect (91S53); others (72D53, 67L55, 73D55, 14K39, 12L39, 35B46a);	Q_{β^-} 0.90 (94W55)
		A	chem, n-capt (6H37b); chem, excit, cross bomb (12L39, 14K39); daughter Zn^{69m} (14K39); others (7H49, 6V39, 6H36, 6T38, 2S47, 42S39, 48H48a)	γ	no γ (12L39, 67L55, 70D57a)	
Zn^{70}	$t_{\beta\beta} > 10^{15}$ sp act (59F52)	%	0.62 (1B50)			
Zn^{71m}	3 h (67L55)	☢	β^- (67L55);	β^-	1.5 (coinc with γ_1, γ_2, and γ_3) abs, β-γ coinc (67L55);	Q_{β^-} 3.0 (SHS)
		C	sep isotopes, n-capt (67L55)	γ	γ_1 0.38 (coinc with γ_2 and γ_3), γ_2 0.49 (coinc with γ_1 and γ_3), γ_3 0.61 scint spect, β-γ, γ-γ coinc (67L55)	
Zn^{71}	2.2 m (67L55, 28H46b)	☢	β^- (28H46b);	β^-	2.4 abs, β-γ coinc (67L55); 2.1 abs (28H46b);	Q_{β^-} 2.9 (SHS)
		C	n-capt, cross bomb (28H46b); n-capt, sep isotopes (67L55)	γ	0.12, 0.51 (coinc with 2.4 β^-), 0.90 (weak), 1.09 (weak) scint spect, β-γ, γ-γ coinc (67L55); see also gammas of Ga^{71}	
Zn^{72}	49.0 h (60S51)	☢	β^- (60S51);	β^-	~0.3 (95%), ~1.6 (5%) abs (60S51);	Q_{β^-} ~1.6 (94W55)
		A	chem, genet (60S46, 60S51); parent Ga^{72} (60S51); others (48H50, 11G49, 21T51, 61S51a)	γ	(60S51)	
$_{31}Ga^{64}$	2.6 m (118C53a); 2.5 m (101C53a)	☢	β^+ (118C53a);	β^+	6.09 (†62), 2.81 (†38) spect (59J57); ~5 scint spect (101C53a);	Q_{EC} 7.2 (SHS); see Zn^{64}
		B	chem, cross bomb (118C53a); chem, excit, sep isotopes (101C53a)	γ	0.98, 1.30, 2.25, 3.25, no 3.8 γ scint spect (59J57); 0.97, 2.2 (?), 3.8 scint spect (101C53a); see also gammas of Zn^{64}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{31}Ga^{65}$	15.2 m (51D57); 15 m (6A38, 12L39b, 118C54, 60K54, 1P52a)	☢	EC (6A38); β^+ >50% (25A52);	β^+	2.24 (†13), 2.11 (†49), 1.39 (†19), 0.82 (†19), no 2.5 (lim †0.2) spect (51D57); 2.1 (†90), 2.52 (†10) spect (118C53a); 2.1 abs (1P52a, 60K54); 1.9 abs (25A56, 25A52a, 25A52);	Q_{EC} 3.26 (51D57)
		A	chem, genet (12L39b); parent Zn^{65} (12L39b)	γ	0.053 (K/L+M 3.8) spect conv (51D57); 0.052 (e/γ large), 0.092, 0.114 spect conv (118C54); 0.054, 0.117 spect conv (6V39); 0.118 (γ/β^+ 0.7, coinc with β^+, 0.74 γ and 1.86γ), 0.74 (γ/β^+ 0.14), 0.91 (γ/β^+ 0.01), 1.38 (γ/β^+ 0.06), 1.86 (γ/β^+ <0.01) scint spect, β-γ, γ-γ coinc (107M57); 0.114, 0.154, 0.21, 0.64, 0.75, 0.88, 1.06 scint spect (80F58)	
Ga^{65}	8.0 m (118C54)	☢	β^+, EC (118C54);	γ	no γ (118C54)	
		C	chem, cross bomb, excit (118C54)			
Ga^{66}	9.45 h (10L50a); 9.4 h (18R37, 59B38); 9.2 h (49M50, 50M37); others (40F57b)	☢	β^+ 66%, EC 34% (10L50a);	β^+	4.144 (†87), 1.4 (†4), 0.88 (†7), 0.40 (†2) spect (10L50a); 4.15 (†87), 1.38 (†4), 0.90 (†7), 0.40 (†2) spect (49M52);	Q_{EC} 5.17 (94W55); see Cu^{66} 
		A	chem, excit (50M37, 18R37a); daughter Ge^{66} (48H49); others (42B51a, 29W52, 48H50, 42B51);	γ	γ_1 0.83 (†2), γ_2 1.04 (†30), γ_3 1.37 (†3), γ_4 1.58 (?), γ_5 1.93 (†4), γ_6 2.18 (†6), γ_7 2.40 (†2), γ_8 2.75 (†22), γ_9 3.24 (†2), γ_{10} 3.41 (†3), γ_{11} 3.78 (†2), γ_{12} 4.12 (†2), γ_{13} 4.33 (†5), γ_{14} 4.83 (†2) scint spect, pair scint spect (58M53);	
		I	0 atomic beam (102H57a);			
		μ	<4 x 10^{-5} atomic beam (102H57a, 110W57a)		γ_2 1.05 (γ/β^+ 0.62, coinc with γ_8), γ_5 (γ/β^+ 0.05), γ_6 2.2 (γ/β^+ 0.08), γ_8 2.75 (γ/β^+ 0.50), γ_9 3.3 (γ/β^+ 0.08), γ_{13} (γ/β^+ 0.03), γ_{14} (γ/β^+ 0.03) spect, γ-γ coinc abs (49M52); γ_5 1.89, γ_6 2.14, γ_7 2.38, γ_8 2.73, γ_9 3.23, γ_{10} 3.35, γ_{11} 3.76, γ_{12} 4.14, γ_{13} 4.27, γ_{14} 4.78 scint spect (13A55a); others (55H50, 10L50a, 20D57a, 78F57); see also gammas of Cu^{66} and Zn^{66}	
Ga^{67}	77.9 h (22T55, 22T51); 78.2 h (51M48)	☢	EC (6A38); no β^+ (lim 0.01%) (47M53); no β^+ (49M52);	γ	γ_1 0.09122, γ_2 0.09326, γ_3 0.1845 cryst spect (137C57a); γ_1 0.090 (†7.3, e_K/γ 0.074), γ_2 0.092 (†100, e_K/γ 0.63, K/L+M 7), γ_3 0.182 (†81, e_K/γ 0.011, K/L+M 13), γ_4 0.206 (†2.1, e_K/γ 0.029, K/L+M ~14), γ_5 0.296 (†54, e_K/γ 0.0029, K/L+M 7.6), γ_6 0.388 (†13, e_K/γ 0.0019), γ_7 0.496, γ_8 0.790, γ_9 0.880, γ_4 coinc with γ_1 and γ_3, γ_7 coinc with γ_5 and γ_6, γ-γ coinc, spect conv, scint spect (24K53); γ_2 0.092 (e_K/γ 0.28, K/L+M 6.5), γ_3 0.182 (e_K/γ 0.0091, K/L+M 9), γ_4 0.205 (e_K/γ 0.0055), γ_5 0.298 (e_K/γ 0.0025), γ_6 0.388 (e_K/γ 1.7 x 10^{-3}) spect, spect conv (49M52); γ_1 0.090 (†8), γ_2 0.092 (†100, e/γ 0.54), γ_3 0.182 (†47), γ_4 0.21 (†3), γ_5 0.30 (†30), γ_6 0.39 (†11), γ_7 0.48 (†~0.2), γ_{10} 0.69 (†~0.1), γ_8 ~0.8 (†~0.2), γ_9 ~0.9 (†~0.6), γ_3 coinc with γ_4, γ_7, and γ_{10}; γ_7 coinc with γ_4, γ_5, and γ_6; γ_4 coinc with γ_1, scint spect, γ-γ coinc (47M53); γ_1 (†5), γ_2 (†100), γ_3 (†57), γ_4 (†5.5), γ_5 0.296 (†52), γ_6 0.388 (†16), γ_7 0.485 (†0.5), 0.60 (†~0.2), γ_{10} 0.69 (†~0.2), γ_8 0.78 (†~0.2), γ_9 0.87 (†0.5), γ_7 coinc with γ_5 and γ_6; γ_3 coinc with γ_4 scint spect, γ-γ coinc (74R55); γ_2: $t_{1/2}$ 9.3 x 10^{-6} s delay coinc (74R55); $t_{1/2}$ 9.5 x 10^{-6} s delay coinc (47M53); others (94M54, 25F52a, 1P52a, 2H41, 10C42, 28G41, 7S52); see also gammas of Cu^{67} and Zn^{67}	Q_{EC} 1.003 (94W55) 
		A	chem, excit (50M38a, 50M38); chem, excit, cross bomb (6A38); daughter Ge^{67} (48H49); others (31G38, 6V39, 59B38, 42S52, 42B51a, 48H50, 78B57);			
		I	3/2 atomic beam (102H57a);			
		μ	+1.84 atomic beam (110W57);			
		q	+0.21 atomic beam (110W57)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{31}Ga^{68}$	68 m (18R37, 12P48, 60K54)	☢ β^+ 85%, EC 15% (49M52); A chem, excit (37B37); chem, excit (18R37); daughter Ge^{68} (48H48a); others (2D38, 59B38, 49M50, 31G38, 6V39, 1P37, 37B39, 12P48, 12P49, 42S52, 42S41, 42B51a, 29W52, 48H50)	β^+: 1.88 (↑26, 0.77 (↑1) spect (49M52); 1.94 (↑25), $\beta^+_{1.078}$ (↑1) spect (118C56); β^+_0 (↑~70), $\beta^+_{1.078}$ (↑1) scint spect, β-γ coinc (167H57a); others (60K54, 50M37, 35B46a, 18R37, 51D57); γ: 1.07 (↑100, γ/β^+ ~0.04, coinc with 0.81 γ and 1.24 γ), 0.81 (↑6), 1.24 (↑3), 1.88 (↑4) scint spect, γ-γ coinc (167H57a); 1.10 (γ/β^+ 0.1) spect (49M52); 1.02 (γ/β^+ 0.07) scint spect (118C56)	Q_{EC} 2.90 (94W55) (1+) Ga^{68} (68 m) 0.1% EC, 0.3% EC, β^+, EC 3%, 97% 2.31, 1.88, 1.078 (2+) 0+ Zn^{68} 0 (169H57a, SHS, 9V57)
<u>Ga^{69}</u>		%: 60.2 (3I48); 60.5 (64A53); I 3/2 atomic spect (87M50); μ +2.011 nucl induct, atomic beam, atomic spect (61W53, 87M50); q +0.189 atomic spect, atomic beam (94W55); others (67K56, 75R55, 61W54, 47D53b, 69D54, 79K56, 58J56, 128K52)	γ: Coulomb excitation (in Ga^{69}): 0.322 scint spect (52F56); others (27T54)	
Ga^{70}	21.1 m (2B57a); 20 m (12A35)	☢ β^- (2D38); A chem, n-capt (12A35); chem, excit (2D38); others (50M38, 2S47, 1P37, 37B39, 12P48, 42S41, 85H52, 48H50)	β^-: 1.65 (99+%), 0.61 (0.3%), 0.44 (1.5%) spect, scint spect, β-γ coinc (2B57a); 1.65 spect (56H48); others (42S39a); γ: 0.173, 1.042, 1.215 spect conv (13A57); γ_1 0.174 (0.44%, coinc with 0.44 β^-), γ_2 1.04 (0.76%, coinc with 0.61 β^-), γ_1 coinc with γ_2 scint spect, β-γ, γ-γ coinc (2B57a); 1.215 level of Ge^{70}: 3.0×10^{-9} s delay coinc (13A57)	Q_{EC} 0.67 (94W55); Q_{β^-} 1.65 (94W55) (1+) Ga^{70} (21m) β^- 0.2%, 0.3%, 99+% 0+ 3.0x10⁻⁹ s, 2+ 2.7x10⁻¹² s 1.215, 1.042, 0.003% 0+ Ge^{70} 0 (13A57)
<u>Ga^{71}</u>		%: 39.8 (3I48); 39.5 (64A53); I 3/2 atomic spect (87M50); μ +2.5550 nucl induct (61W53, 87M50); q +0.119 atomic spect, atomic beam (94W55); others (61W54, 67K56, 75R55, 69D54, 47D53b, 79K56, 58J56, 128K52)	γ: Coulomb excitation (in Ga^{71}): 0.513 scint spect (52F56); others (27T54)	see Zn^{71}
Ga^{72}	14.3 h (60S51, 26M43a); 14.1 h (42S39, 9B50)	☢ β^- (42S39); A chem, n-capt, excit (12L38a, 42S39); daughter Zn^{72} (60S51); others (2S47, 42S41, 16C47, 85H52, 42B51, 11G49, 13P47, 21T51); I 3 atomic beam (100G58); μ ±0.12 atomic beam (100G58)	β^-: 0.64 (42%), 0.96 (31%), 1.51 (10%), 2.53 (9%), 3.17 (8%) spect (25J55); 0.6 (40%), 0.9 (32%), 1.5 (11%), 2.52 (8%), 3.15 (9%) spect (56H48); 0.6 (?) (25%), 0.74 (23%), 1.00 (26%), 1.5 (?) (7%), 1.7 (?) (3%), 2.57 (8%), 3.17 (8%) spect (14M48); γ: γ_1 0.601 (↑7), γ_2 0.630 (↑21), γ_3 0.690 (↑~0), γ_4 0.768 (↑3), γ_5 0.810 (↑3), γ_6 0.834 (↑93), γ_7 0.894 (↑10), γ_8 1.050 (↑7), γ_9 1.317 (↑2), γ_{10} 1.463 (↑4), γ_{11} 1.595 (↑6), γ_{12} 1.859 (↑6), γ_{13} 2.203 (↑30), γ_{14} 2.491 (↑10), γ_{15} 2.508 (↑17), γ_{16} 2.827 (↑0.4), γ_{17} 3.086 (↑0.04), γ_{18} 3.350 (↑0.02) spect (25J55); γ_{14} 2.491 (↑10), γ_{15} 2.508 (↑16) spect (12H52); 0.63 (24%), 0.68 (<2%), 0.84 (100%), 1.05 (5%), 1.20 (?) (<2%), 1.59 (5%), 1.87 (8%), 2.21 (33%), 2.51 (26%) spect, spect conv (56H48); 0.115, 0.32, 0.39, 0.44, 0.51 (↑4), γ_1 (↑7), γ_2 (↑22), 0.72 (↑2), γ_6 (↑100), γ_7 (↑7), γ_8 (↑9), 1.24 (↑5), γ_9 (↑<1.3), γ_{10} (↑3), γ_{11} (↑8), γ_{12} (↑8), γ_{13} (↑14), $\gamma_{14} + \gamma_{15}$ (↑30), γ_{16} (↑0.6), γ_6 coinc with γ_2, γ_4, γ_7, γ_8, γ_9, γ_{12}, γ_{13}; γ_2 coinc with γ_8, γ_9, γ_{10}; γ_{10} coinc with γ_{11}, γ_8, and γ_9; γ_3 coinc with γ_2 and γ_{13} scint spect, γ-γ, γ-conv coinc (58K56); γ_3: $t_{1/2}$ 2.9×10^{-7} s delay coinc (52M51); $t_{1/2}$ 5×10^{-7} s delay coinc (28B48); others (9B50, 14M48); see also gammas of Ge^{72}	Q_{β^-} 4.00 (94W55) 3- Ga^{72} (14h) β^- 42%, 31%, 10%, 9%, 8% 3.350, 3.086, 2.508, 1.463 2+ 4.3x10⁻¹² s, 0.834 0+ 2.9x10⁻⁷ s, 0.690 0+ Ge^{72} 0 (94W55, SHS)

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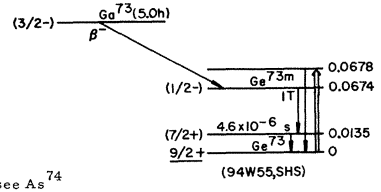
$_{31}Ga^{73}$	5.0 h (60S51)	☢ β^- (60S51); B chem, excit (60S46, 60S51); others (12P49, 85H52, 11G49)	β^- 1.4 abs (60S51); γ with Ge^{73m}: 0.0135, 0.054 spect conv (17J51a); see also gammas of Ge^{73} and As^{73}	Q_{β^-} 1.5 (94W55); see As^{73} and Ge^{73} 
Ga^{74}	7.8 m (45E58); ~8 m (134M56c)	☢ β^- (45E58); B decay charac, excit (134M56c); chem, sep isotopes, excit (45E58)	β^- 2.65, 2.0, 1.1 scint spect (45E58); γ 0.60, 2.3, other weak γ's: 0.30, 0.50, 0.88, 1.1, 1.5, 1.9, 2.8 scint spect (45E58); 0.58, 2.3, 2.6 scint spect (134M56c); see also gammas of Ge^{74} and As^{74}	see As^{74}
$_{32}Ge^{66}$	~150 m (48H50, 56R56)	☢ β^+ (?) (48H50); A chem, genet (48H49); parent Ga^{66} (48H49); others (42B51a)	γ 0.045 (†100), 0.070 (†20), 0.114 (†50), 0.186 scint spect (56R56)	Q_{EC} 3 (est) (94W55)
Ge^{67}	21 m (48H50, 56R56); 19 m (25A53b)	☢ β^+ (48H50); A chem, genet (48H49); parent Ga^{67} (48H49); others (42B51a)	β^+ 2.9 abs (25A56, 25A53b); γ 0.170, 0.68, 0.86, 1.47 (56R56, 56R57a); 0.17 scint spect (25A53b)	Q_{EC} 3.9 (SHS)
Ge^{68}	280 d (118C56); 250 d (48H50)	☢ EC (48H48a); A chem, genet (48H48a); parent Ga^{68} (48H48a, 48H50); others (42B51a)	γ no γ (lim 1%) scint spect (167H57a)	Q_{EC} ~0.7 (est) (94W55)
Ge^{69}	40.4 h (34N57); 39.6 h (51M48); 40 h (48H50); 37 h (50M38)	☢ EC ~67%, β^+ ~33% (51M48); β^+ (50M38); A chem (50M38); chem, excit, cross bomb (51M48); daughter As^{69} (65B55); others (13S41a, 42S41, 34H44, 42S52)	β^+ 1.215 (†88), 0.610 (†10), 0.22 (†2) spect (10H51); 1.22 (†95), 0.62 (†5) scint spect (34N57); γ 0.090, 0.388, 0.576, 0.870, 1.12, 1.34, 1.61 spect, β-γ coinc (10H51); 0.190, 0.20, 0.24, 0.30, 0.32 (†~5), 0.576 (†37), 0.63, 0.80, 0.88 (†34), 0.90, 1.12 (†70), 1.34 (†10), 1.53 (†1), 1.73 (?), 1.89 (†1), 2.00 (†1) scint spect, β-γ, γ-γ coinc (34N57); see also gammas of Ga^{69}	Q_{EC} 2.23 (94W55)
$\underline{Ge^{70}}$		% 20.55 (3I48a); q <0.007 microwave (87M50)	γ Coulomb excitation (in Ge^{70}): 1.02 ($t_{1/2}$ 2.7×10^{-12} s) scint spect (27T56a); see also gammas of Ge^{70} and As^{70}; 1.215 level of Ge^{70}: $t_{1/2}$ 3.0×10^{-9} s delay coinc (13A57)	see Ga^{70}

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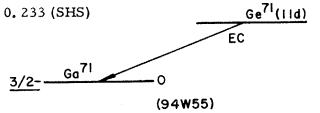
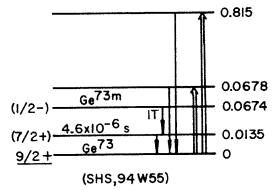
$_{32}Ge^{71}$	11.4 d (51M48); 11 d (26M49, 13S51a)	☢ EC (L/K 0.13) (62D57, 62D57a); EC (L/K 0.30) (64L56); EC, no β^+ (51M48, 26M49); A chem, excit, cross bomb (13S41a); sep isotopes, n-capt (22R50); daughter As^{71} (48H49); others (48H50)	EC Ga K-x (2S47, 51M48, 26M49); internal bremsstrahlung endpoint: 0.220 scint spect (115B55a, 115B56); 0.226 scint spect (64L56, 64L54a); γ no γ (13S41a, 26M49, 51M48); see also gammas of As^{71}; others (165S54a, 165S58, 64L57); 0.175 level of Ge^{71}: $t_{1/2}$ 7×10^{-8} s delay coinc (88G55)	Q_{EC} 0.233 (SHS)  (94W55)
$Ge^{?}$	14 d (64L56, 64L54a)	☢ EC (64L56, 64L54a); E chem (64L56, 64L54a)	EC Ga K-x (64L56, 64L54a); internal bremsstrahlung endpoint: 0.15 scint spect (64L56, 64L54a)	Q_{EC} 0.16 (64L56)
Ge^{72}		% 27.37 (3I48a); q <0.007 microwave (87M50, 35T49)	γ Coulomb excitation (in Ge^{72}): 0.830 ($t_{1/2}$ 4.3×10^{-12} s) scint spect (27T56b); 0.690 level of Ge^{72}: $t_{1/2}$ 2.9×10^{-7} s delay coinc (52M51); 0.834 level of Ge^{72}: $t_{1/2}$ 4.3×10^{-12} s Coul exc (27T56b); $t_{1/2}$ 3.2×10^{-12} s nucl res fluor (44M56b); see also gammas of Ga^{72} and As^{72}	see Ga^{72}
Ge^{73m}	0.53 s (24C57)	☢ IT (24C57); A n-capt, chem, genet (24C57, 24C54); chem, genet (41N54); daughter As^{73} (41N54, 24C57)	γ 0.0135, 0.0539 spect conv (17J51a); 0.06 scint spect (24C57); see gammas of As^{73} and Ga^{73}	Q_{IT} 0.0674 (SHS)  (SHS, 94W55)
Ge^{73}		% 7.67 (3I48a); I 9/2 microwave (87M50, 35T49); μ -0.8768 nucl induct (29J53b, 66A54); q -0.2 microwave (87M50)	γ Coulomb excitation (in Ge^{73}): 0.0678, 0.815 scint spect (27T56a, 27T54a); 0.072 scint spect (41A56, 41A56a); see also gammas of As^{73}; 0.0135 level of Ge^{73}: $t_{1/2}$ 4.6×10^{-6} s delay coinc (57W53)	
Ge^{74}		% 36.74 (3I48a); q <0.007 microwave (87M50, 35T49)	γ Coulomb excitation (in Ge^{74}): 0.593 ($t_{1/2}$ 1.6×10^{-11} s) scint spect (27T56a); 0.596 level of Ge^{74}: $t_{1/2}$ 1.6×10^{-11} s Coul exc (27T56a); $t_{1/2}$ 1.3×10^{-11} s nucl res fluor (44M56b); see also gammas of As^{74}	see As^{74}

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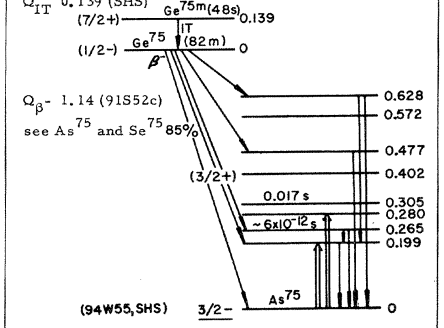
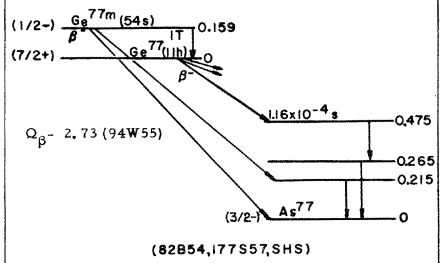
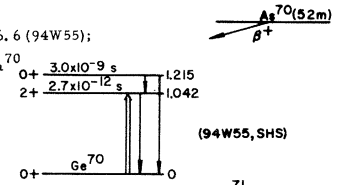
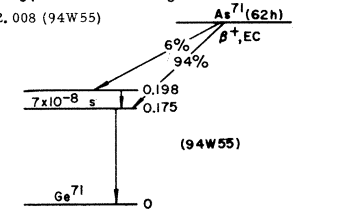
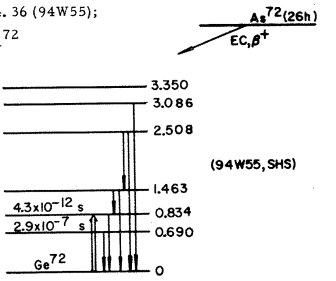
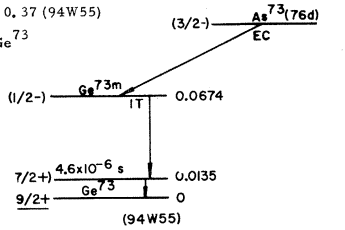
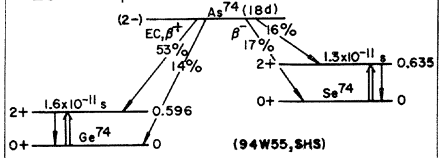
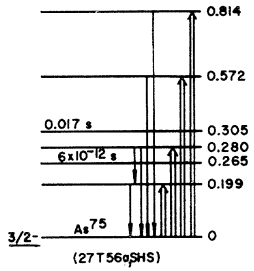
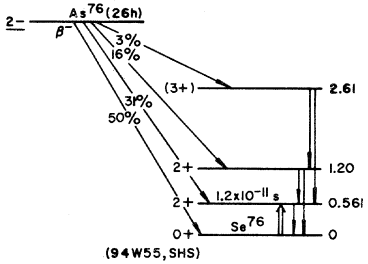
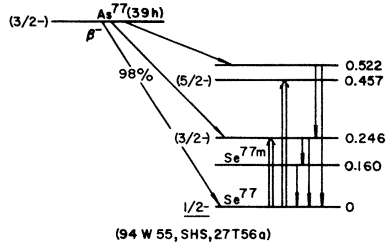
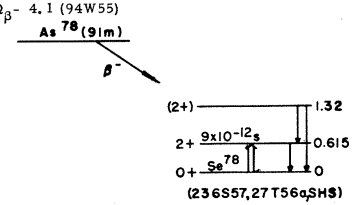
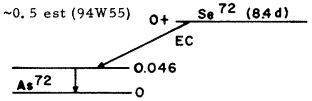
$_{32}Ge^{75m}$	48 s (91S52c); 49 s (82B54); 42 s (9F52)	☢ IT (9F52); A excit (9F52); cross bomb, n-capt, sep isotopes (91S52c)	γ	0.139 (K/L+M 3) spect conv, scint spect (82B54); 0.175 scint spect (91S52c)		Q_{IT} 0.139 (SHS)
Ge^{75}	82 m (51M48); 89 m (13S41a); 79 m (22R50)	☢ β^- (13S41a); A chem, excit, cross bomb (13S41a); n-capt, sep isotopes (22R50); others (42S39, 42S41, 2S47, 34H44, 12P49)	β^-	1.14 (85%, not coinc with γ), 0.614 (15%) spect (91S52c); 1.19, 0.98 (coinc with γ_2), 0.92 (coinc with γ_3), 0.72 (coinc with γ_5) β-γ coinc, scint spect (177S55); others (13S41a, 22R50);		Q_{β^-} 1.14 (91S52c) see As^{75} and Se^{75}
			γ	γ_1 0.066 (†2.2), γ_2 0.199 (†12), γ_3 0.264 (†100), γ_4 0.427 (†2.5), γ_5 0.477 (†2.3), γ_6 0.628 (†1.8), γ_2 coinc with γ_1 and γ_4 scint spect, β-γ, γ-γ coinc (177S55); 0.265, 0.418, 0.572 spect, spect. conv, scint spect (91S52c); others (22R50, 51M48, 135B53); see also gammas of As^{75} and Se^{75}	
Ge^{76}	$t_{\beta\beta}$ >2 x 10^{16} y sp act (59F52)	% 7.67 (3I48a); q <0.007 microwave (35T49, 87M50)	γ	Coulomb excitation (in Ge^{76}): 0.566 ($t_{1/2}$ 2.0 x 10^{-11} s) scint spect (27T56a)		
Ge^{77m}	54 s (35L57); 52 s (82B54); 59 s (23A47); 57 s (22R50)	☢ β^- ~86%, IT ~14% calc (94W55); β^- ~50%, IT ~50% calc (42F52); β^-, IT (14M52); A cross bomb, genet, n-capt (23A47); sep isotopes (22R50); parent As^{77} (23A47, 22R50)	β^-	β_0^- (†100), 2.7 (†10, coinc with 0.215 γ), abs, β-γ coinc (82B54); 2.8 abs (23A47);		Q_{IT} 0.159 (82B54)
			γ	with IT: 0.159 (†100), with β^-: 0.215 (†100, coinc with 2.7 β^-), no 0.38 γ β-γ coinc, scint spect (82B54); 0.38 scint spect (14M52)		
Ge^{77}	11.3 h (35L57); 12 h (13S41a, 61S51, 22R50)	☢ β^- (42S41); A chem, excit, cross bomb (13S41a); parent As^{77} (61S46, 61S51); others (42S39, 42S41, 2S47, 21T51)	β^-	2.196 (42%, coinc with γ), 1.379 (35%), 0.71 (23%) spect (91S52); 2.1, ~1.5, ~1.3 abs, β-γ coinc (82B54); others (14M52, 61S51, 22R50, 26M49);		Q_{β^-} 2.73 (94W55)
			γ	0.042, 0.073 (coinc with 0.213 and 0.264 γ), 0.213, 0.264, 0.368, 0.418, 0.564, 1.105, 1.75 spect, β-γ_2, γ_1-γ coinc (91S52); γ_1 0.210, γ_2 0.215, γ_3 0.265, γ_4 0.365, γ_5 0.410, γ_6 0.56, γ_7 0.63, γ_8 0.71, γ_9 0.79, γ_{10} 0.91, γ_{11} 1.09, γ_{12} 1.19, γ_{13} 1.36, γ_{14} ~1.5 (complex), γ_{15} 1.75, γ_{16} 2.00, γ_{17} 2.30, no 0.30, 0.33, 0.43, 0.47, γ_3 coinc with γ_1, γ_4, γ_6, γ_9, γ_{10}, γ_{12}, and γ_{13}; γ_5 coinc with γ_2, γ_6, γ_9 and γ_{13}; γ_4 coinc with γ_6, γ_9, and γ_{13}; γ_6 coinc with γ_7 and γ_9 scint spect, γ-γ coinc (82B54); 0.153, 0.368 (†2.2), 0.416 (†3.5), 0.56 (†2.5), 0.63 (†1.5), 0.71 (†1.5), 0.80 (†1.0), 0.92 (†0.8, complex), 1.08 (†1.0), 1.19 (†0.5), 1.37 (†0.5), 1.50 (†0.15), 1.74 (†0.06), 1.96, 2.03 (1.96 γ + 2.03 γ: †0.35), 2.32 (†0.09) scint spect, γ-γ coinc (177S57); γ_1 and γ_3: $t_{1/2}$ 1.16 x 10^{-4} s delay coinc (177S57); others (165S53, 135B53, 91S52, 22R50)	
Ge^{78}	86m (63S53); 130 m (61S51)	☢ β^- (61S51); B chem, genet (61S46, 61S51); parent As^{78} (61S51, 63S53)	β^-	~0.9 abs (61S51)		Q_{β^-} ~1.2 est (94W55)





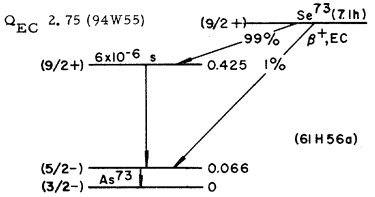
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{33}As^{68}$	~7 m (65B55)	E	chem, excit (65B55)			Q_{EC} ~9 est (94W55)
As^{69}	15 m (65B55)	☢	β^+ (65B55);	β^+	2.9 abs (65B55);	Q_{EC} 3.9 (94W55)
		B	chem, genet (65B55); parent Ge^{69} (65B55)	γ	0.23 scint spect (65B55)	
As^{70}	52 m (48H50, 27V52); 47 m (186S55)	☢	β^+ (48H50); β^+, no EC (lim 20%) (27V52);	β^+	1.35 (†67), 2.45 (†33) spect (186S55); 2.2 abs (25A56, 27V52);	Q_{EC} 6.6 (94W55); see Ga^{70} 
		B	chem (48H49, 48H50); chem, decay charac (186S55); chem, cross bomb (27V52); daughter Se^{70} (48H50); others (37A52, 78B57)	γ	0.18, 1.06, 1.36, 1.74, 2.04 scint spect (65B55); 1.07, 1.5, 2.15, 2.75, 3.25 scint spect (186S55); see also gammas of Ga^{70} and Ge^{70}	
As^{71}	62 h (88G55); 60 h (48H50, 10S53a); 65 h (34A53, 30T54a)	☢	EC (K) ~70%, β^+ ~30% (30T54a); EC, β^+ (51M48a);	β^+	0.81 (†97), 0.25 (?) (†3) spect (30T54a); 0.82 spect (88G55); 0.80 spect (10S53a);	Q_{EC} 2.008 (94W55) 
		A	chem (42S41); chem, genet (48H49); mass spect (104B52); parent Ge^{71} (48H49); others (78B57)	γ	0.0230 (K/L+M ~1), 0.1750 (e_K/γ 0.095, K/L 7.8) spect, spect conv (88G55); γ_1 0.0233 (K/L+M ~5.4), γ_2 0.1745 (e/γ 0.07, K/L+M 8.9, coinc with β^+ and γ_1), spect conv, γ-conv coinc (30T54a); γ_2: $t_{1/2}$ 7 x 10^{-8} s delay coinc (88G55); others (10S53a, 53M50)	
As^{72}	26 h (51M48a); 27 h (48H50)	☢	EC, β^+ (51M48a);	β^+	3.34 (†19), 2.50 (†62), 1.84 (†12), 0.67 (†5), 0.27 (†2) spect (53M50); 2.8 abs (14M47, 51M48a);	Q_{EC} 4.36 (94W55); see Ga^{72} 
		A	chem, excit (14M47); chem, excit, sep isotopes (51M48a); daughter Se^{72} (48H48a); others (78B57)	γ	γ_1 0.63 (†10), γ_2 0.73, γ_3 0.835 (†100), γ_4 0.90, γ_5 1.05 (†3), γ_6 1.25 (†2), γ_7 1.37 (†1), γ_8 1.46 (†4), γ_9 1.68 (†1), γ_{10} 1.75, γ_{11} 1.92 (†1), γ_{12} 2.08 (†3), γ_{13} 2.20 (†4), γ_{14} 2.24, γ_{15} 2.32 (†1), γ_{16} 2.51 (†2), γ_{17} 2.63 (?) (†1), γ_{18} 2.76 (?) (†0.7), γ_{19} 2.91 (†2), γ_{20} 3.0, γ_{21} 3.74 (†0.3), γ_3 coinc with γ_1, γ_2, γ_4, γ_5, γ_6, γ_7, γ_{11}, γ_{12}, γ_{15}, and γ_{16} scint spect, γ-γ coinc (173B56); 0.835, others up to 3.0 (weak) spect (53M50); 0.697 spect conv (10S53a); see also gammas of Ga^{72} and Ge^{72}	
As^{73}	76 d (51M48a); 90 d (42S39b, 53M50)	☢	EC (4E43b); no β^+ (4E43b, 51M48a);	γ	with Ge^{73m}: γ_1 0.0135 (L/M 5.4), γ_2 0.0539 (K/L+M 5.6) spect conv, conv-conv coinc (17J51a, 17J52); γ_1 0.0130, γ_2 0.053 (K/L+M 5.2) spect conv (10S53a); γ_1 (e/γ >1300), γ_2 (e/γ 4.7) scint spect (57W53); γ_2 (e/γ ~8) scint spect, ion ch (122B53); γ_1: $t_{1/2}$ 4.6 x 10^{-6} s delay coinc (57W53); others (4E43b, 53M50); see also gammas of Ge^{73m}, Ge^{73}, Se^{73}, and Ga^{73}; 0.425 level of As^{73}: $t_{1/2}$ 6 x 10^{-6} s delay coinc (61H56a)	Q_{EC} 0.37 (94W55) see Ge^{73} 
		A	chem (42S39b); chem, excit, cross bomb, sep isotopes (51M48a); mass spect (17J51a); parent Ge^{73m} (41N54, 24C57); others (48H50, 25F51)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{33}As^{74}$	17.5 d (51M48a); 19.0 d (48H50); 16 d (42S39b); others (60M48)	☢	β^- 33%, β^+ 29%, EC 38% (17J51); EC (L/K 0.09) 40% (229S57); β^- ~67%, β^+~33% (53M50);	β^-	1.36 (†51), 0.69 (†49) spect (17J51); 1.45 (†47), 0.82 (†53) spect (53M50);
				β^+	1.53 (†11), 0.92 (†89) spect (17J51); 0.96 spect (53M50);
		A	excit (48C38); chem, excit (42S39b); others (42S41, 2I42, 85H52, 11G49)	γ	0.596 (†40), 0.635 (†10) spect, β-γ coinc (17J51); 0.593 spect (53M50); 0.582 spect (20D41); 0.60 (†100), 0.63 (†25), 1.25 (†~1) scint spect (167H57); see also gammas of Ge^{74} and Se^{74}	Q_{EC} 2.56, Q_{β^-} 1.36 (94W55) 
As^{75}		%	100 (6N37);	γ	Coulomb excitation (in As^{75}): 0.200, 0.283, 0.574, 0.814 scint spect (27T56a); 0.265 level of As^{75}: $t_{1/2}$ ~6 x 10^{-12} s nucl res fluor (44M56c); 0.305 level of As^{75}: $t_{1/2}$ 0.017 s delay coinc (177S57); As^{75} (γ, γ') (18V56a, 18V56); $t_{1/2}$ 0.018 s delay coinc (86L57a); others (13J53); see also gammas of Ge^{75} and Se^{75}	see Ge^{75} and Se^{75} 
		I	3/2 atomic spect, microwave (87M50);		
		μ	+1.4349 nucl induct (67K56,61W53);		
		q	+0.3 atomic spect, microwave (87M50, 67K56, 88M52); others (104K52a, 44T53)		
As^{76}	26.4 h (57H53, 57H52); 26.5 h (16D55); 26.3 h (14M40); 26.8 h (34W42, 109W57); 26.1 h (3P48)	☢	β^-, no β^+ (lim 0.03%) (63B47); no β^+ (lim 0.07%) (41M51); no EC (K) (lim 0.02%) (229S57);	β^-	2.97 (51%), 2.41 (31%), 1.76 (16%), 0.36 (3%) spect (47K55); 2.97, 2.42, 1.77 spect (38P56); 2.96 (53%), 2.40 (32%), 1.75 (6%), 1.20 (6%), 0.35 (3%) spect (57H53, 57H52); 3.04 (60%), 2.49 (25%), 1.29 (15%) spect (7S47d); others (54M51, 3P48, 77R52, 52R53, 7T52);
		A	chem, n-capt (12A35); others (6T36, 9O49, 42S39b, 42H47, 85H52, 16W48);	γ	γ_1 0.5605 cryst spect (76R55); γ_1 0.555 (†100), γ_2 0.648 (†9), γ_3 1.210 (†23), γ_4 1.410 (†1.5), γ_5 2.06 (†5) spect (57H53, 57H52, 57H51); γ_1 0.549 (†100, coinc with 2.41 β^-, γ_2 and γ_5), γ_2 0.643 (†20), γ_3 1.200 (†21, coinc with 1.76 β^- and γ_4), γ_4 1.40 (†2), γ_5 2.05 (†4), spect, scint spect, β-γ, γ-γ coinc (47K55); γ_1 coinc with γ_2, γ-γ coinc (44M53a, 58K53); γ_1 0.558 (e_K/γ 0.002) spect conv (7T52); γ_1 (45%) scint spect (10M57); γ_1: $t_{1/2}$ ~2.3 x 10^{-11} s delay coinc (111C55); others (7S47d, 16W48, 43M46, 62B51, 54M49, 54M51, 128B57, 26H53a, 16D56e, 65L57b, 76F57); see also gammas of Se^{76}	Q_{β^-} 2.97, Q_{EC} 1.1 (94W55) 
		I	2 atomic beam (85C57);		
		μ	-0.906 nucl induct (68P57)		

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{33}As^{77}$	38.7 h (2B53, 187S55); 39 h (35E54, 22R53); 38 h (21T51, 63S53); 40 h (61S51)	☢	β^- (61S51);	β^- 0.679 spect (13J51); 0.700 spect (43C51a); others (124C53);	Q_{β^-} 0.684 (94W55); see Se^{77} and Br^{77}  (94W55, SHS, 27T56a)
		A	chem, genet (61S46, 61S51); daughter Ge^{77} (61S51); daughter Ge^{77m} (23A47); not parent Se^{77m} (lim 2%) (56M50a); others (85H52, 11G49, 7N49a)	γ γ_1 0.086 (0.13%), γ_2 0.160 (0.26%), γ_3 0.245 (2.5%), γ_4 0.525 (0.8%), no 0.033 γ scint spect (75L55); 0.032, γ_1 0.087 (†10), γ_2 0.160 (†3), γ_3 0.247 (†66), γ_5 0.270 (†1.2), γ_4 0.520 (†20), γ_3 coinc with γ_5 scint spect, γ-γ coinc (165S53); γ_1 0.086 (†10), γ_2 0.161 (†4.5), γ_3 0.243 (†91), γ_4 0.525 (†27), no 0.28 γ (lim †0.4), no 0.033 γ scint spect (115B55a); γ_1 0.086 (0.2%), γ_2 0.160 (0.1%), γ_3 0.246 (1.5%), γ_4 0.524 (0.5%) scint spect (2B53); others (70D57, 22R53, 7R53a, 70D57a); see also gammas of Se^{77m} and Br^{77}; 0.475 level of As^{77}: $t_{1/2}$ 1.16 x 10^{-4} s delay coinc (177S57)	
As^{78}	91.0 m (63S53); 90 m (61S51, 64B51); 88 m (124C53); 80 m (48C38); others (26S37a, 42S39b)	☢	β^- (26S37a);	β^- 4.1 (~70%), 1.4 (~30%) abs (61S51); 4.1 abs (124C53); 1.4 cl ch (42S39b);	Q_{β^-} 4.1 (94W55)  (236S57, 27T56a, SHS)
		B	chem (26S37a); excit (48C38); daughter Ge^{78} (61S46, 61S51, 63S53); others (85H52)	γ 0.615 (†100), 0.700 (†42), 1.32 (†33), 2.65 (†~4), no 0.26 γ, scint spect (236S57); see also gammas of Se^{78}	
As^{78}	~40 m (64B51); no 40 m activity (124C53, 63S53)	G	chem (64B51, 124C53, 63S53)		
As^{79}	9.0 m (124C53); 9.1 m (11Y54)	☢	β^- (11V52);	β^- 2.3 abs (124C53); ~2.1 abs (11V52)	Q_{β^-} 2.3 (124C53)
		A	chem (65B50); chem, genet (11Y54, 124C53); parent Se^{79m} (11Y54, 124C53)		
As^{80}	~36 s (11Y54)	E	chem, excit (11Y54)		Q_{β^-} 5.5 est (94W55)
As^{85}	0.43 s (91W55)	☢	n (91W55);		
		F	excit (91W55)		
$_{34}Se^{70}$	~44 m (48H50)	☢	β^+ (48H50);		Q_{EC} ~2.5 est (94W55)
		D	chem (48H49, 48H50); parent As^{70} (48H50); others (78B57)		
Se^{71}	4.5 m (25A57); 5 m (78B57a)	☢	β^+ (78B57a);	β^+ 3.4 abs (25A57);	
		B	chem, excit (78B57a, 25A57)	γ 0.16 scint spect (78B57a)	
Se^{72}	8.40 d (53J57, 123C58); 8.64 d (45R56); 9.7 d (48H50)	☢	EC (48H50); no β^+ (lim 0.1%) (123C58);	γ 0.0460 (e_K/γ 0.63, K/L 9.7) scint spect, spect conv (123C58); 0.050 scint spect (78B57)	Q_{EC} ~0.5 est (94W55)  (123C58, SHS)
		A	chem, genet (48H48a); parent As^{72} (48H48a, 48H50)		

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{34}Se^{73}$	7.1 h (49C48, 62S51, 61H56a); 6.7 h (48H50)	☢	β^+, EC (61H56a);	β^+	1.68 (†1), 1.318 (†88), 0.750 (†10), 0.25 (†1) spect (62S51); 1.65 (†1), 1.29 (†100) spect (61H56a);
			β^+, EC, IT (?) (62S51);	γ	γ_1 0.0658 (γ/β^+ 1.3, e_K/γ 0.22, K/L+M 10.2, coinc with β^+ and γ_2), γ_2 0.359 (γ/β^+ 1.6, e_K/γ 0.011, K/L+M 8) no other γ (lim γ/β^+ 0.02) spect conv, scint spect, γ-γ coinc (61H56a); 0.0671 (†10, conv in Se, K/L 7.6), 0.361 (†163, K/L 8.6), 0.860 (†11), 1.310 (†8) spect, spect conv (62S51); γ_1 and γ_2: $t_{1/2}$ 6 x 10^{-6} s delay coinc (61H56a)
		A	chem (48H48a); chem, excit, sep isotopes (49C48); others (78B57)		
Se^{73}	44 m (139H53)	☢	β^+ (139H53);	β^+	1.7 abs (139H53)
		B	chem, excit (139H53); not parent As^{70} (139H53)		
Se^{74}		%	0.87 (24W48);	γ	Coulomb excitation (in Se^{74}): 0.635 ($t_{1/2}$ 1.3 x 10^{-11} s) scint spect (27T56a); 0.635 level of Se^{74}: $t_{1/2}$ 1.3 x 10^{-11} s Coul exc (27T56a); $t_{1/2}$ ~4 x 10^{-12} s nucl res fluor (44M55c); see also gammas of As^{74}
		q	<0.002 microwave (55G50)		
Se^{75}	121 d (32K57); 120 d (109W57); 127 d (49C48); 128 d (10C50); 115 d (26F47); 120 d (48H50)	☢	EC, no β^+ (26F47, 49C48, 10C50);	γ	0.025, 0.066, 0.081, 0.097, 0.121, 0.136, 0.199, 0.265, 0.280, 0.305, 0.402 spect conv (10C50); γ_1 0.024, γ_2 0.066 (†2, e_K/γ ~0.6), γ_3 0.081 (?), γ_4 0.097 (†7, e_K/γ ~1.8), γ_5 0.121 (†28, e_K/γ 0.10), γ_6 0.136 (†94, e_K/γ 0.07), γ_7 0.20 (†~3, e_K/γ ~0.03), γ_8 0.27 (†100, e_K/γ 0.016), γ_9 0.28 (†46, e_K/γ 0.019), γ_{10} 0.31 (†2, e_K/γ ~0.03), γ_{11} 0.40 (†25, e_K/γ 2.4 x 10^{-3}) γ_2 coinc with γ_6 and γ_7; γ_5 coinc with γ_9; γ_6 coinc with γ_8; γ_4 coinc with γ_9 and γ_{10}; no 0.077 γ spect, spect conv, scint spect, γ-γ, conv-conv coinc (177S55, 177S54); 0.067, 0.077 (†20), 0.098 (†~1, e_K/γ ~8, K/L 11), 0.124 (†3, e_K/γ 0.3), 0.138 (†35, e_K/γ 0.12), 0.203, 0.269 (†100, e_K/γ 0.09), 0.281 (†7), 0.308, 0.405 (†20, e_K/γ 0.0015), no 0.025 γ spect, spect conv, γ-γ coinc (13J53); γ_9: $t_{1/2}$ 0.017 s delay coinc (177S57); others (76L55, 11T48, 105K56); see also gammas of Ge^{75} and As^{75}
		A	chem, excit (2D40, 4K42); sep isotopes, n-capt (10C50); others (2S47);		
		I	5/2 microwave (61A55a);		
		q	+1.1 microwave (61A55a)		
Se^{76}		%	9.02 (24W48);	γ	Coulomb excitation (in Se^{76}): 0.567 ($t_{1/2}$ 1.2 x 10^{-11} s) scint spect (27T56a); see also gammas of As^{76}
		μ	~0 atomic spect (87M50);		
		q	<0.002 microwave (55G50)		

Q_{EC} 2.75 (94W55)

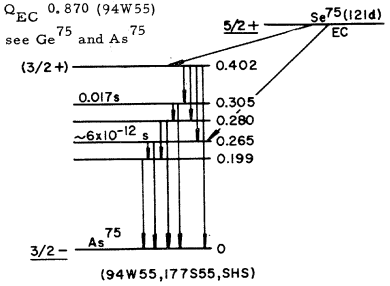


Q_{EC} 2.7 (SHS)

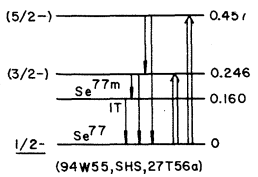
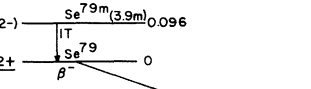
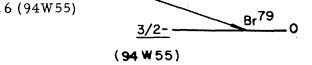
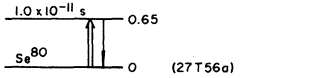
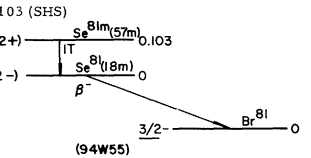
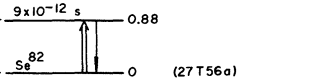
see As^{74}

Q_{EC} 0.870 (94W55)

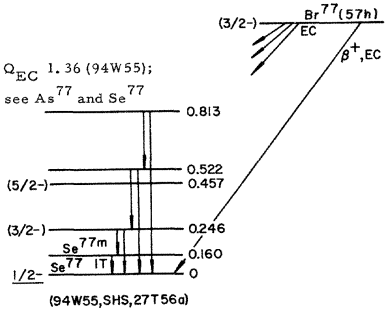
see Ge^{75} and As^{75}



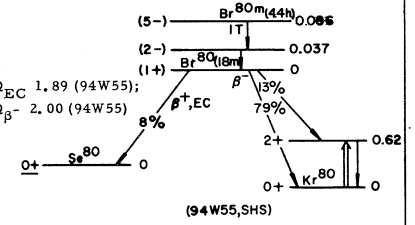
see As^{76}

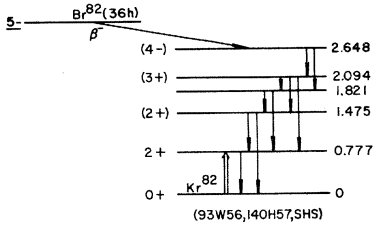
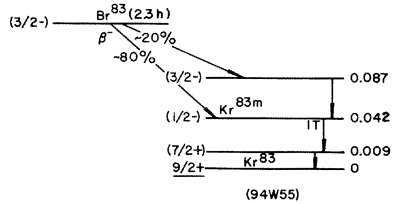
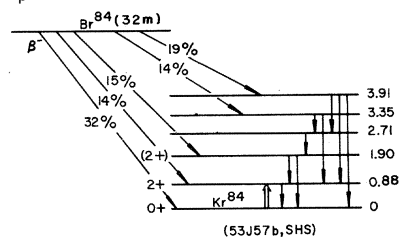
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{34}Se^{77m}$	17.5 s (23A47, 32G49, 43C51b)	☢ IT (23A47); A n-capt (23A47); sep isotopes, n-capt (18G48a); genet (43C51b); daughter Br^{77} (43C51b, 43C51); not daughter As^{77} (lim 2%) (56M50a)	γ 0.162 (K/L 4.6) spect conv (31R52); 0.160 (e/γ large) spect, spect conv (43C51b); 0.165 spect conv (19O52); abs (9F50); others (38M51, 32G49, 23A47); see also gammas of As^{77} and Br^{77}	Q_{IT} 0.160 (SHS); see As^{77} and Br^{77} 
Se^{77}		% 7.58 (24W48); I 1/2 atomic spect (32D54); μ +0.5325 nucl induct (61W53a, 61W53, 61W54); q <0.002 microwave (55G50); others (32D51, 87M50, 67K56)	γ Coulomb excitation (in Se^{77}): γ_1 0.086 (?), γ_2 0.160, γ_3 0.211 (coinc with γ_4), γ_4 0.244, γ_5 0.457 scint spect, γ-γ coinc (27T56a); 0.238, 0.452 scint spect (41A56, 41A56a); see also gammas of As^{77} and Br^{77}	
Se^{78}		% 23.52 (24W48); I 0 atomic spect (32D54); others (55G50, 32D51)	γ Coulomb excitation (in Se^{78}): 0.615 ($t_{1/2}$ 9 x 10^{-12} s) scint spect (27T56a); see also gammas of As^{78}	see As^{78}
Se^{79m}	3.91 m (11Y54); 3.88 m (124C53)	☢ IT (9F50b); A excit, n-capt (9F50, 9F50b); n-capt, sep isotopes (31R52); daughter As^{79} (11Y54, 124C53)	γ 0.096 (K/L 2.9) spect conv (31R52); 0.096 (e_K/γ 10, K/L 3) spect, spect conv (73D55)	Q_{IT} 0.096 (SHS) 
Se^{79}	≤6.5 x 10^4 y sp act (est fission yield) (26P49)	☢ β⁻ (26P49); B chem, spect (?) (26P49); I 7/2 microwave (83H53, 83H52); μ −1.015 microwave (83H53); q +0.9 microwave (165B54); +0.7 microwave (83H53)	β⁻ 0.16 abs (26P49)	Q_{β^-} 0.16 (94W55) 
Se^{80}		% 49.82 (24W48); I 0 atomic spect (32D54); others (87M50)	γ Coulomb excitation (in Se^{80}): 0.654 ($t_{1/2}$ 1.0 x 10^{-11} s) scint spect (27T56a)	
Se^{81m}	56.8 m (11Y54); 56.5 m (25W48); 57 m (26S37a, 20L40); 59 m (33G51); 62 m (85A57)	☢ IT (20L40); A chem, excit, cross bomb (26S37a); sep isotopes, n-capt (32L47); mass spect (67B49); parent Se^{81} (20L40); others (6H37, 2S47)	γ 0.103 (K/L 3.0) spect conv (31R52); 0.104 (e/γ very large, K/L ~3.9) spect conv (67B49); 0.100 (e_K/γ 9, K/L 4.0) spect, spect conv (73D55); others (2H41)	Q_{IT} 0.103 (SHS) 
Se^{81}	18.2 m (11Y54); 18.6 m (85A57); 17 m (33G51); 18 m (9F50); 19 m (20L40); others (25W48)	☢ β⁻ (20L40); A chem, genet (20L40); daughter Se^{81m} (20L40); others (26S37a, 6H37, 2S47, 37B39)	β⁻ 1.38 spect (67B49); 1.5 abs (20L40, 33G51); no conv (31R52); γ no γ (33G51)	Q_{β^-} 1.40 (94W55)
Se^{82}	>10^{17} y genet (112S53)	% 9.19 (24W48); μ ~0 atomic spect (87M50); q <0.002 microwave (55G50)	γ Coulomb excitation (in Se^{82}): 0.88 ($t_{1/2}$ 9 x 10^{-12} s) scint spect (27T56a)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{34}Se^{83}$	70 s (143C58); 67 s (23A47)	☢	β^- (23A47);	β^- 3.4 abs (23A47); 1.5 (coinc with 1.0 γ) scint spect, β-γ coinc (143C58);	Q_{β^-} 3.4 (143C58)
		A	chem, genet (23A47); parent Br^{83} (23A47)	γ 2.02 (†40), 1.01 (†100, complex), 0.650 (†20), 0.350 (†16, coinc with 0.65 γ and 1.0 γ), scint spect, γ-γ coinc (143C58); others (31R52)	
Se^{83}	25 m (33G51a); 26 m (31R52); 30 m (20L40); others (11Y54)	☢	β^- (26S37a);	β^- 1.5 abs (33G51a, 31R52);	Q_{β^-} 2.8 est (94W55)
		A	chem, excit, cross bomb (26S37a); chem, genet (20L40); parent Br^{83} (20L40, 33G51a); others (2S47, 72B51)	γ 0.350 scint spect (143C58); 0.950, 0.176, 0.061 (?), 0.04 (?) spect conv, scint spect (31R52); 1.1, 0.37, 0.17 abs (33G51a)	
Se^{84}	3.3 m genet (188S57)	☢	β^- (33G51b);		Q_{β^-} 1.3 est (94W55)
		B	chem, genet (33G46); parent Br^{84} (33G51b, 20E51)		
Se^{85}	40 s genet (188S57)	☢	[β^-] (188S57);		
		C	chem, genet (188S57); parent Br^{85} (188S57)		
$Se^{86,87}$	17 s (188S57)	☢	[β^-] (188S57);		
		C	chem, genet (188S57); parent 1 m Br (188S57);		
$_{35}Br^{<74}$	4 m (13H53)	E	chem, excit (13H53)		
Br^{74}	36 m (13H53); 42 m (78B57)	☢	β^+, EC (13H53);	γ 0.64 scint spect (78B57); see also gammas of As^{74} and Se^{74}	Q_{EC} 6.3 est (94W55)
		B	chem, excit (13H53); chem, genet energy levels (78B57)		
Br^{75}	1.6 h (13H53, 78B57); 1.7 h (35W48)	☢	β^+, EC (35W48);	β^+ 1.70 (†46), 0.8 (†20), 0.6 (†15), 0.3 (†19) spect (25F52);	Q_{EC} 2.72 (94W55)
		B	chem, cross bomb, sep isotopes (35W48)	γ 0.29 scint spect (78B57)	
Br^{76}	17.2 h (25F52); 17.5 h (30T55); 15.7 h (48H48)	☢	β^+ (48H48);	β^+ 3.57 (†46), 1.7 (†10), 1.1 (†11), 0.8 (†14), 0.6 (†19) spect (25F52);	Q_{EC} 4.59 (94W55); see As^{76}
		A	chem (48H48); chem, sep isotopes (25F52); chem, mass spect (30T55); daughter Kr^{76} (78C54, 30T55); others (78B57)	γ 1.2, 0.96, 0.75, 0.68, 0.42, 0.37, 0.33, 0.25 spect, spect conv (25F52); ~1.2, 0.66, 0.56 scint spect (30T55); see also gammas of As^{76} and Se^{76}	
Br^{77}	57 h (48H48, 13H51); 58 h (35W48)	☢	EC 99%, β^+ 1% (152S54); EC 95%, β^+ 5% (35W48);	β^+ 0.336 spect (43C51); 0.36 spect (48H48); abs, spect (35W48); β^+ (not coinc with γ) β-γ coinc (152S54);	Q_{EC} 1.36 (94W55); see As^{77} and Se^{77}
		A	chem, sep isotopes (35W48); parent Se^{77m} (43C51, 43C51b); others (78B57)	γ 0.160 (†0.6), 0.237 (†20), 0.284 (†0.2), 0.298 (†0.2), 0.520 (†100), 0.641 (†8.6), 0.813 (†25) spect, spect conv (43C51); 0.160, 0.234, 0.299, 0.521 spect conv, x-γ coinc (25F52); 0.023 (?), 0.086, 0.160, 0.246, 0.30, 0.524, 0.58, 0.76, 0.82, 1.00 scint spect (2B53); see also gammas of As^{77} and Se^{77}	
Br^m	1.27×10^{-4} s (18V56a)	☢	IT (18V56a, 18V56b);	γ 0.149 scint spect (18V56a)	
		E	excit (18V56a)		

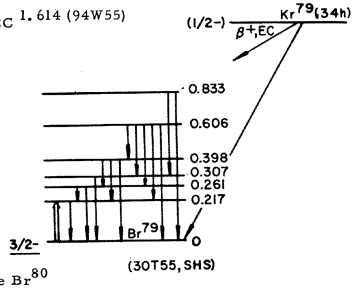
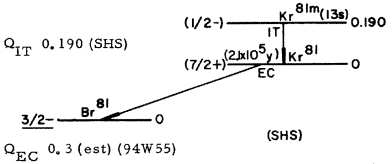
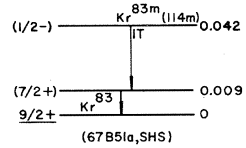


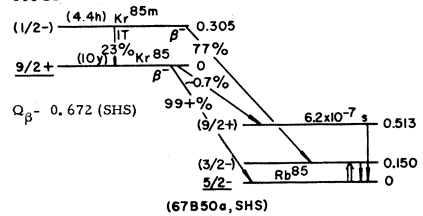
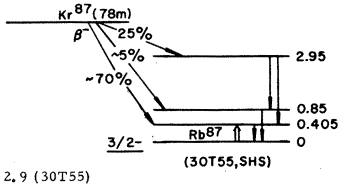
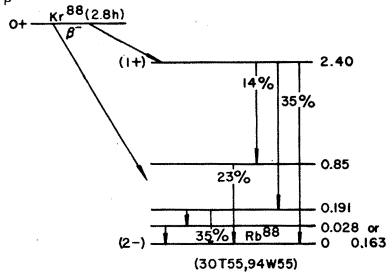
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{35}Br^{78m}$	6.4 m (26S37a); 6.5 m (13H51)	☢ IT (106S53b); A chem, excit (26S37a); others (59B38, 7C37, 37B39, 6H37)	γ	0.108, 0.046 spect conv (6V39); Br K-x cryst spect (106S53b)	Q_{IT} 0.154 (SHS)
Br^{78}	<6 m (94W55, calc from 26S37a)	☢ β^+ (26S37a); [A] [genet] (94W55, 106S53b); [daughter Br^{78m}] (94W55, 106S53b)	β^+	2.4 abs (35B46a, calc from 26S37a); 2.3 abs (26S37a)	Q_{EC} 3.28 est (94W55)
$Br^{79,81m}$	3.7×10^{-5} s (18V56a)	☢ IT (18V56a, 18V56b); E excit (18V56a)	γ	0.268 scint spect (18V56a, 18V56b); see also gammas of Kr^{79}	
$\underline{Br^{79}}$		% 50.52 (9W46); 50.56 (103C55a); I 3/2 atomic spect, microwave (87M50); μ +2.0992 atomic spect, nucl induct, atomic beam (67K56, 61W53, 87M50); q +0.33 atomic beam (106K54); others (60F53, 107K53, 61W54, 94W55)	γ	Coulomb excitation (in Br^{79}): 0.219, no 0.044 scint spect (92W57); 0.266, 0.213, 0.044 scint spect (97H54); see also gammas of Kr^{79}	see Kr^{79}
$Br^{79,80m}$	5.0 s (17S54)	☢ IT (17S54); E n-capt (17S54)	γ	0.21 scint spect (17S54)	
Br^{80m}	4.38 h (127K57); 4.58 h (41M51); 4.5 h (26S37a); 4.4 h (59B38)	☢ IT (24S39); A chem, n-capt (12A35); chem, excit, cross bomb (26S37a); others (35W48, 25F52, 24A36, 24S39, 2S47, 37B39, 1P37, 9P40, 9P41); parent Br^{80} (24S39, 21D40, 64S41)	γ	0.049, 0.037 (e/γ ~1.3) ion ch (32R50); 0.048, 0.036 spect conv (33L50); 0.049, 0.037 spect conv (6V39); 0.049 (L_I/L_{III} 1.0) spect conv (63M52a); 0.048 (e/γ very large), 0.037 (e/γ ~1) abs (35G40); others (52W51, 121B56a, 201S55, 121B54, 146H52)	Q_{IT} 0.086 (SHS)
Br^{80}	17.6 m (127K57, 188S57a); 18 m (26S37a, 24S39)	☢ β^- 92%, β^+ ~3%, EC ~5% (calc from 41M51, 28R50);	β^-	1.99 (†85), 1.38 (†15) spect, β-γ coinc (34L56a, 34L54, 34L54a, 34L53, 34L52, 34L51);	Q_{EC} 1.89 (94W55); Q_{β^-} 2.00 (94W55)
		β^+/β^- 0.037 (41M51);		1.97 (†80), 1.1 (†11), 0.7 (†9) spect (25F52);	
		$\frac{\beta^+ + EC}{\beta^-}$ 0.09 (28R50);		1.99 spect (33L50); others (50C48, 24A36);	
		β^+/β^- 0.028 (34L51);	β^+	0.87 spect (34L56a, 34L54, 34L54a, 34L53, 34L52, 34L51);	
		β^+/β^- 0.03 (63B47);		0.86 spect (33L54); others (16D49, 63B47);	
		β^+/β^- 0.04 (33L54);	γ	0.62 (γ/β^- 0.12) scint spect (33L54);	
		A chem, n-capt (12A35); chem, excit, cross bomb (26S37a); chem, genet (24S39); daughter Br^{80m} (24S39, 21D40, 64S41); others (2S47, 9O49, 37B38, 1P37)		0.62 (γ/β^- 0.09, coinc with β^-) scint spect, β-γ coinc (17S53); 0.62 (coinc with β^-) scint spect, β-γ coinc (34L56a); others (21D40, 26S37a, 59B38, 34L52); see also gammas of Kr^{80}	
$\underline{Br^{81}}$		% 49.48 (9W46); 49.44 (103C55a); I 3/2 atomic spect, microwave (87M50); μ +2.2625 atomic spect, nucl induct, atomic beam (67K56, 61W53, 87M50); q +0.28 atomic beam (106K54); others (60F53, 107K53, 61W54, 94W55)	γ	Coulomb excitation (in Br^{81}): 0.278 scint spect (92W57)	



Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{35}Br^{82}$	35.87 h (31C50); 36.0 h (68B50); 35.1 h (36W51); 35.7 h (38S51)	☢	β^- (33K35); no EC or β^+ (lim 0.03%) (28R50); no β^+ (lim 0.02%) (41M51);	β^-	0.444 spect (93W56); 0.47 spect, β-γ coinc (33R41, 20D42b); 0.46 scint spect, β-γ coinc (70D56); 0.44 spect, no other β^- (lim 0.6%) (193B56);	Q_{β^-} 3.10 (SHS); Q_{EC} 0.11 (94W55)
		A	chem, n-capt (33K35); chem, excit, cross bomb (26S37a); others (59B38, 6R41a, 56M51, 2S47, 63S52, 13P47, 11G49, 6O48, 2F51);	γ	γ_1 0.5541 (†80), γ_2 0.6187 (†50), γ_3 0.6984 (†33), γ_4 0.7769 (†100), γ_5 0.8276 (†30), γ_6 1.044 (†35), γ_7 1.317 (†32), γ_8 1.475 (†21) spect (140H57); γ_1 0.545 (†102, e_K/γ 6.8×10^{-4}), γ_2 0.610 (†50, e_K/γ 1.6×10^{-3}), γ_3 0.688 (†37, e_K/γ 1.1×10^{-3}), γ_4 0.766 (†100, e_K/γ 1.0×10^{-3}), γ_5 0.817 (†30, e_K/γ 3.2×10^{-4}), γ_6 1.029 (†36, e_K/γ 3.6×10^{-4}), γ_7 1.305 (†36, e_K/γ 1.8×10^{-4}), γ_8 1.469 (†18, e_K/γ 1.8×10^{-4}), γ_4 coinc with γ_3 and γ_7; γ_8 coinc with γ_1 and γ_2; γ_1 coinc with γ_2 spect conv, scint spect, γ-γ coinc (93W56); γ_1 0.535 (†104), γ_2 0.602, γ_4 0.750 (†100), γ_6 1.020 (†28), γ_7 1.292 (†24), γ_8 1.445 (†11) spect (16D52); 0.547, 0.615, 0.682, 0.752, 0.822, 1.026, 1.306, 1.453 spect (57H51a); ~0.25, ~0.35, 0.56 (complex), 0.61, 0.69, 0.77 (complex), 0.82, 1.03, 1.29, 1.45, ~1.8 (weak), ~2.0 (weak) scint spect, γ-γ coinc (70D56); 1.03 (26%) scint spect (10M57); others (7S49a, 33M49, 69B44, 193B56, 76L54, 135B53); see also gammas of Kr^{82}	
		I	5 atomic beam (120G57);			
		μ	±1.6 atomic beam (125G57);			
		q	±0.7 atomic beam (125G57)			
Br^{83}	2.30 h (189S53); 2.33 h (20L40, 49H51a); 2.4 h (33G51a, 26S37a)	☢	β^- (26S37a);	β^-	0.940 spect (23D51); 0.94 spect (25F52);	Q_{β^-} 1.00 (94W55)
		A	chem, excit (26S37a); daughter Se^{83}, parent Kr^{83m} (20L40, 65S40, 57M40, 57M41, 33G51a); others (63S52, 13P47, 11G49, 7N49a, 6O48, 6B39, 21T51, 72B51, 32K48, 61S51a)	γ	0.046 spect conv (2H41); 0.051 (K/L+M >8) abs sec (189S53); ~0.046 (?) cl ch (50W52); others (26S37a, 33G51a); with Kr^{83m}: 0.0325, 0.0093 spect conv (67B52, 67B51a); see also Kr^{83m}	
Br^{84}	6.0 m (188S57)	☢	β^- (188S57);	β^-	0.8 (20%), 1.9 (70%), 3.2 (?) (~8%) scint spect (188S57);	
		B	chem, decay charac (188S57); not daughter Se^{84} (188S57)	γ	0.44 (60%), 0.88 (70%), 1.46 (60%), 1.89 (20%) scint spect (188S57)	
Br^{84}	31.8 m (53J57b); 30 m (65S40); 32 m (23D51); 33 m (32K51)	☢	β^- (22D39);	β^-	4.68 (40%), 3.56 (9%), 2.53 (16%), 1.72 (35%) spect (23D51); 4.76 (32%), 3.83, 2.80, 1.81, 1.39, 0.83 scint spect, β-γ coinc (53J57b);	Q_{β^-} 4.7 (23D51, 53J57b)
		A	chem (22D39); chem, excit (70B43); daughter Se^{84} (33G51b); others (70B43, 72B51, 16H39a, 16H39b, 65S40, 57M41)	γ	γ_1 0.27 (†1), γ_2 0.35 (†3), γ_3 0.43 (†5), γ_4 0.47 (†2), γ_5 0.52 (†6), γ_6 0.61 (†5), γ_7 0.74 (†7), γ_8 0.81 (†18), γ_9 0.88 (†100, coinc with 3.83 β^- γ_1, γ_2, γ_3, γ_5, γ_6, γ_7, γ_8, γ_{10}, γ_{11}, γ_{12}, γ_{13}, γ_{14}, γ_{18}, γ_{19}, γ_{20}, and γ_{21}), γ_{10} 1.01 (†20), γ_{11} 1.21 (†8), γ_{12} 1.47 (†4), γ_{13} 1.57 (†2), γ_{14} 1.74 (†4), γ_{15} 1.90 (†36, coinc with 1.81 β^-, 2.84 β^-, γ_1, γ_2, γ_3, γ_4, γ_5, γ_8, γ_{11}, γ_{13}, and γ_{16}), γ_{16} 2.05 (†4), γ_{17} 2.17 (†4), γ_{18} 2.47 (†16, coinc with 0.83 β^- and 1.39 β^-), γ_{19} 2.82 (†4), γ_{20} 3.03 (†8), γ_{21} 3.28 (†6), γ_{22} 3.93 (†25, coinc with γ_1) scint spect, γ-γ, β-γ coinc (53J57b); 0.89 (strong), 1.89 (weak) scint spect (10H52); see also gammas of Kr^{84} and Rb^{84}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{35}Br^{85}$	3.00 m (63S49); 3.0 m (65S40, 70B43)	☢ β^- (65S40); A chem (65S40); chem, genet (66S43); parent Kr^{85m} (66S43, 63S49); daughter Se^{85} (188S57)	β^- 2.5 abs (63S49); γ no γ (63S49)	Q_{β^-} 2.8 (94W55)
Br^{87}	55.6 s (n) (28H48a); 55.0 s (n) (34R47); 56.1 s (β^-) (63S49); others (129K57)	☢ β^-, β^- n (~2% of disintegrations) (19L51a, 67S53); A chem (65S40, 26S47); chem, genet (70B43, 63S49); parent Kr^{87} (70B43, 66S43, 63S49); parent Kr^{86} (2% of disintegrations) (26S47, 63S49); others (63S47a)	β^- 2.6 (†70), 8.0 (†30) abs, β-γ coinc (67S53); n (mean): 0.25 abs paraffin (28H48a); 0.30 p recoil in cl ch (71B46); γ 5.4, ~3 abs, abs sec, γ-γ coinc (67S53)	Q_{β^-} 8.0 (94W55)
Br^{88}	15.5 s (63S49, 59P57); others (129K57)	☢ β^- (63S49); n (weak) (59P57); A chem, genet (63S49); parent Kr^{88} (63S49)		
Br^{89}	4.51 s (n) (28H48a); 4.45 s (n) (34R47); others (129K57)	☢ β^-, β^- n (26S47a, 28H48a); D chem (63S47a); parent Kr^{89} (?), parent Kr^{88} (?) (51C51); others (63S49, 59P57a)	n (mean): 0.43 abs paraffin (28H48a); 0.65 p recoil in cl ch (71B46)	
Br^{90}	1.4 s (59P58); others (129K57)	☢ n (59P58); D chem, decay charac (59P58)		
$_{36}Kr^{76}$	9.7 h (78C54); ~11 h (30T55)	☢ [EC], no EC (K) (78C54); no β^+ (30T55); A chem, genet (78C54); chem, mass spect (30T55); parent Br^{76} (78C54)	γ 0.028, 0.093, 0.267, 0.316, 0.40 scint spect (30T55)	Q_{EC} ~1 (est) (94W55)
Kr^{77}	1.1 h (35W48a); 1.2 h (30T55); others (78B57)	☢ EC (K) ~20%, β^+ ~80% (30T55); EC 70%, β^+ 30% (35W48a); A chem, sep isotopes (35W48a); chem, mass spect (30T55)	β^+ 1.86 (†61), 1.67 (†32), 0.85 (†7) spect (30T55); 1.7 abs (35W48a); γ γ_1 0.0242 (K/L+M 1.3), γ_2 0.1076 (K/L+M 3.6), γ_3 0.131 (K/L+M 8), γ_4 0.149 (K/L+M ~5), γ_5 0.246, γ_6 0.281, γ_7 0.313, γ_8 0.665 (coinc with γ_3 and γ_4), γ_9 0.87 spect conv, scint spect, conv-γ coinc (30T55); others (35W48a, 78B57)	Q_{EC} 2.89 (94W55)
Kr^{78}		% 0.354 (6N50a)	γ Coulomb excitation (in Kr^{78}): 0.45 scint spect (97H57b)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{36}Kr^{79m}$	55 s (29C40b)	☢	IT (?), no β^+ (29C40b);	γ	0.127 spect conv (29C40b)	
		D	chem (29C40b); others (33B40a)			
Kr^{79}	34.5 h (12R52); 34 h (33B40a, 35W48a, 29C40b)	☢	EC 95% (L/K 0.26), β^+ 5% (12R52a, 12R52b, 12R55, 64L54b); EC (K)/β^+ 9 (67B51, 30T54d);	β^+	0.598 (†91), 0.33 (†9) spect, β-γ coinc (30T55, 30T54d); 0.595 spect (67B51); others (58H51);	Q_{EC} 1.614 (94W55) 
		A	chem (29C40b); chem, sep isotopes (35W48a); mass spect (104B52); others (33B40a, 52C41, 30C44, 26S37a)	γ	0.0445 (K/L+M 7.2), 0.0840, 0.1361 (K/L+M 8.6), 0.1805, 0.2086 (K/L+M 6.9), 0.2173 (K/L+M 11), 0.2613 (K/L+M 8), 0.2998 (K/L+M 11), 0.3069 (K/L+M 9.4), 0.3455, 0.3892, 0.3977 (K/L+M 10), 0.5259, 0.6064 (K/L+M 7.8), 0.8334 spect conv, γ-conv, β-γ coinc (30T54d, 30T55); 0.263 (e/γ ~0.02), 0.044 spect conv (67B51, 67B52); see also gammas of Br^{79}	
Kr^{80}		%	2.27 (6N50a);	γ	Coulomb excitation (in Kr^{80}): 0.62 scint spect (97H57b, 27T56a); see also gammas of Br^{80}	see Br^{80}
Kr^{81m}	13 s (29C40b); ~10 s (7K50); others (33B40a)	☢	IT, no β^+ (29C40b);	γ	0.193 spect conv (7K50); 0.187 spect conv (29C40b); see also gammas of Rb^{81}	Q_{IT} 0.190 (SHS) 
		A	chem (29C40b); genet (7K50); daughter Rb^{81} (7K50)			
Kr^{81}	2.1×10^5 y sp act (28R50a)	☢	EC (28R50a);	γ	0.012 abs, Br K-x (28R50a)	Q_{EC} 0.3 (est) (94W55)
		A	chem, mass spect (28R50a);			
Kr^{82}		%	11.56 (6N50a);	γ	Coulomb excitation (in Kr^{82}): 0.78 scint spect (97H57b, 27T56a); see also gammas of Br^{82} and Rb^{82}	see Br^{82} and Rb^{82}
		μ	~0 atomic spect (87M50)			
Kr^{83m}	114 m (67B51a, 21R46); 113 m (20L40, 25V52)	☢	IT (20L40);	γ	0.0325 (e/γ very large, K/L+M 0.35), 0.0093 (e/γ very large, L/M ~3) spect conv (67B52, 67B51a); 0.032 (K/L 0.32), 0.009 (e/γ ~10) ion ch (91B52); 0.046, 0.029 spect conv (2H41)	Q_{IT} 0.042 (SHS) see Br^{83} and Rb^{83} 
		A	chem, genet (20L40); mass spect (67B50); daughter Br^{83} (20L40); daughter Rb^{83} (53C50); others (52C41, 50W52, 37W45)			
Kr^{83}		%	11.55 (6N50a);	γ	Coulomb excitation (in Kr^{83}): no γ (60P57)	
		I	9/2 atomic spect (87M50, 78R55);			
		μ	0.96706 nucl induct (173B54a); -0.967 atomic beam, atomic spect (87M50, 61W53);			
		q	+0.22 atomic spect (78R55); +0.15 atomic spect (87M50)			
Kr^{84}		%	56.90 (6N50a);	γ	Coulomb excitation (in Kr^{84}): 0.88 scint spect (97H57b, 27T56a); see also gammas of Br^{84}, Rb^{84} and Rb^{84m}	see Br^{84} and Rb^{84}
		μ	~0 atomic spect (87M50)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{36}Kr^{85m}$	4.36 h (34K49); 4.4 h (35W48a); 4.5 h (58H51, 26S37a); 4.6 h (21R46, 66S43)	☢ β^- 77%, IT 23% (67B51d); β^- 78%, IT 22% (196B55); A chem (26S37a); chem, mass spect (34K49); daughter Br^{85} (66S43, 63S49); others (52C41, 70B43)	β^- 0.824 spect (30T55); 0.83 spect (67B52, 67B51d); others (70B43a, 58H51, 34K49); γ 0.1495 (†57, e_K/γ 0.040, coinc with β^-), 0.3050 (†10, e_K/γ 0.41, K/L+M 6.2) spect conv, scint spect, β-γ coinc (67B51d, 67B52, 67B54, 30T55, 64B50a); see also gammas of Sr^{85m} and Rb^{85}	Q_{β^-} 0.976, Q_{IT} 0.305 (SHS) see Sr^{85} 
Kr^{85}	10.3 y mass spect (91W53); 9.4 y (13T48a); ~10 y (58H51a)	☢ β^- (58H51a); A chem (58H51a); chem, mass spect (13T47); others (58H51); I 9/2 atomic spect (78R55a); μ -1.001 atomic spect (78R55a); q +0.25 atomic spect (78R55a)	β^- 0.672 spect (30T55); 0.67 spect (67B52); 0.695 (99+%), 0.15 (0.65%) spect, β-γ coinc abs (8Z50); γ γ_1 0.517 scint spect (30T55); γ_1 0.54 (coinc with 0.15 β^-) scint spect, abs, β-γ coinc (8Z50); γ_1: $t_{1/2}$ 6.2 x 10^{-7} s delay coinc (202S57); see also gammas of Sr^{85}; others (21R46)	Q_{β^-} 0.672 (SHS)
$\underline{Kr^{86}}$		% 17.37 (6N50a); daughter Br^{87} (2% of disintegrations) (26S47, 63S49); others (13T47, 13T48a); μ ~0 atomic spect (87M50)		
Kr^{87}	78 m (34K49); 75 m (66S43, 63S49); 74 m (26S37a)	☢ β^- (26S37a); A chem (26S37a); chem, mass spect (34K49); daughter Br^{87} (66S43, 70B43, 63S49); others (21R46, 58H51)	β^- 3.8 (~70%), ~3.3 (~5%), 1.3 (25%) spect, β-γ coinc (30T55, 30T52a); others (34K49, 70B43a); γ γ_1 0.403 (†100), γ_2 0.85 (†19), γ_3 1.75 (?), γ_4 2.05, γ_5 2.57 (†42), γ_1 coinc with γ_5, 1.3 β^- and 3.8 β^-; γ_5 coinc with 1.3 β^-, scint spect, β-γ, γ-γ coinc (30T55); see also gammas of Rb^{87}	Q_{β^-} 4.0 (94W55) 
Kr^{88}	2.77 h (34K49); 2.8 h (36G40, 63S49)	☢ β^- (20L39); A chem (6H39); chem, genet (20L39); chem, mass spect (34K49); parent Rb^{88} (20L39, 25A39, 6H39, 36G40, 16H40a, 16H40b); daughter Br^{88} (63S49)	β^- β_1 2.8 (20%), β_2 0.9 (12%), β_3 0.52 (68%) spect (30T52b); 2.4 (weak), ~0.5 abs (4J48, 34K49); γ γ_1 0.028 (e/γ ~0.1, K/L+M 8, coinc with β_3^-, γ_2 and γ_7), γ_2 0.166 (†20), γ_3 0.191 (†100, coinc with β_1^-, β_3^-, and γ_7), γ_4 0.36 (†14), γ_5 0.85 (†65), γ_6 1.55 (†40), γ_7 2.19, γ_8 2.40 (†100) scint spect, spect conv, γ-γ, γ-conv, β-γ coinc (30T55, 30T52b)	Q_{β^-} 2.9 (30T55) 
Kr^{89}	3.18 m (35K51a); 2.6 m (24D51); 2.5 m (16H43a)	☢ β^- (36G40); A chem, genet (36G40, 66S40); mass spect (35K51a); parent Rb^{89} (36G40, 66S40, 16H40b, 16H43, 17B51, 35K51a); others (11O51, 26A51)	β^- 4.0 abs (35K51a); 3.9 calc from average recoil energy (35K51)	

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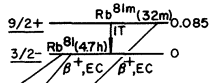
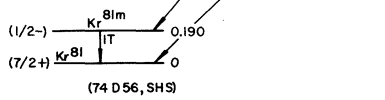
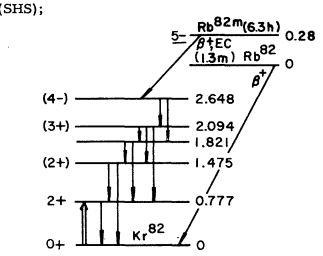
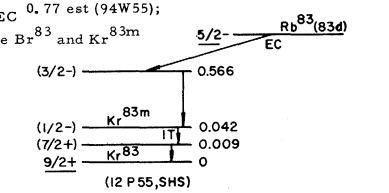
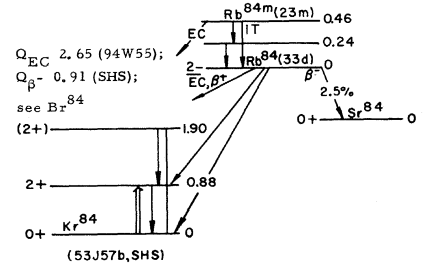
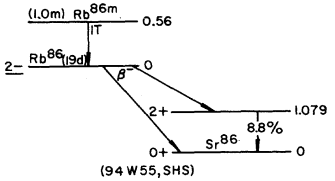
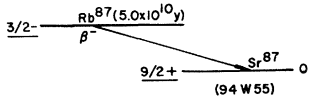
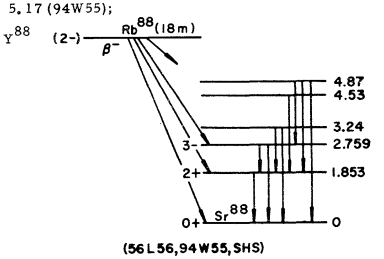
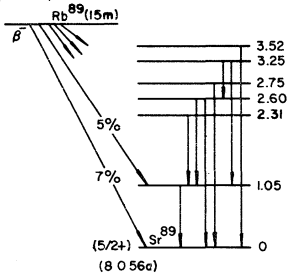
$_{36}Kr^{90}$	33 s (35K51a)	☢ β^- (24D51a); A chem, genet (24D51a); mass spect (35K51a); parent Rb^{90} (35K51a); ancestor Sr^{90} (24D51a, 24D51); others (26A51)	β^- 3.2 abs (35K51a)	
Kr^{91}	9.8 s (24D51); 10 s (35K51a); ~6 s (11O51)	☢ β^- (16H40c); A chem, genet (16H40c); mass spect (35K51a); parent Rb^{91}, parent Rb^{91m} (35K51a); ancestor Y^{91} (16H40c, 17B51, 24D51a, 24D51); others (26A51)	β^- ~3.6 abs (35K51a)	
Kr^{92}	3.0 s (24D51)	☢ β^- (16H40a); B chem, genet (16H40a, 24D51); daughter Kr^{92}, ancestor Y^{92} (24D51); others (16H40, 16H40b, 16H43, 26A51)		
Kr^{93}	2.0 s (24D51)	☢ β^- (16H42); B chem, genet (16H42, 70S51); parent Rb^{93} (17B51, 24D51, 24D51a); ancestor Y^{93} (70S51); others (11O51, 26A51)		
Kr^{94}	1.4 s (24D51)	☢ β^- (16H43a); B chem, genet (16H43a, 24D51); parent Rb^{94} (16H43, 16H43a, 24D51); ancestor Y^{94} (16H43a, 24D51)		
Kr^{95}	short (24D51a)	☢ β^- (24D51a); F chem, genet (24D51a); parent Rb^{95}, ancestor Zr^{95} (24D51a)		
Kr^{97}	~1 s (24D51a)	☢ β^- (26A51); B chem, genet (26A51); parent Rb^{97} (24D51); ancestor Zr^{97} (26A51, 24D51)		
$_{37}Rb^{79}$	24 m (78B57, 126C57)	☢ β^+ (78B57); D chem (78B57, 126C57)	γ 0.15 scint spect (78B57)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{37}Rb^{\leq 80}$	8 d (108K55)	D chem (108K55)		
Rb^{81m}	31.5 m (74D56)	☢ β^+, IT (74D56); B chem, genet (74D56); parent Rb^{81} (74D56); I 9/2 atomic beam (102H56a)	β^+ 1.4 spect (74D56); γ 0.085 (conv in Rb) spect conv (74D56)	Q_{IT} 0.085 (74D56) 
Rb^{81}	4.7 h (7K50, 74D56, 53C52)	☢ EC 87%, β^+ 13% (7K50); A chem, mass spect (10R49); parent Kr^{81m} (7K50); daughter Sr^{81} (53C50, 53C52); I 3/2 atomic beam (141H56, 141H54); μ +2.05 atomic beam (102H57b)	β^+ 0.33 (†10), 0.58 (†16), 1.05 (†74) spect (74D56); 0.99 spect (7K50); γ 0.253 (coinc with 1.10 γ), 0.450, 1.10 spect, spect conv, γ-γ coinc (74D56); with Kr^{81m}: 0.190 (e/γ 0.54, K/L+M 5.2) spect, spect conv (74D56); see also gammas of Kr^{81m}	Q_{EC} 2.26 (SHS) 
Rb^{82m}	6.3 h (7K50)	☢ EC 94%, β^+ 6% (7K50); A chem (59H40); chem, mass spect (10R49); not daughter Sr^{82} (lim 0.1%) (54L53, 53C52); I 5 atomic beam (141H56); μ +1.50 atomic beam (102H57b)	β^+ 0.783 spect (193B56); 0.775 (†76), 0.175 (†24) spect (10H52); γ no 0.188 γ, no 0.248 γ, no 0.322 γ, no 0.39γ, no 0.423 γ, no 0.465 γ, spect conv (193B56); 0.188, 0.248, 0.322, 0.389, 0.423, 0.464, 0.550, 0.610, 0.690, 0.768, 0.818, 1.02, 1.31, 1.46 spect conv, spect (10H52); see also gammas of Kr^{82} and Br^{82}	Q_{EC} 4.45 (SHS); see Br^{82} 
Rb^{82}	1.25 m (54L53); 1.27 m (42K53); 1.1 m (108K55)	☢ β^+ (54L53); A chem, genet (54L53, 42K53); daughter Sr^{82} (54L53, 42K53, 108K55)	β^+ 3.15 spect (53C50); 3.5 spect (108K55); γ no γ (54L53)	Q_{EC} 4.17 (94W55)
Rb^{83}	83 d (53C50); 100 d (108K55); 107 d (7K50)	☢ EC (7K50); no β^+ (12P55); A chem, mass spect (7K50); daughter Sr^{83}, parent Kr^{83m} (53C50); I 5/2 atomic beam (141H56); μ +1.42 atomic beam (102H57b)	γ 0.525 (~100%) scint spect, γ-γ coinc (12P55); others (53C50, 53C52); with Kr^{83m}: 0.0325, 0.0093 spect conv (67B52, 67B51a); see also gammas of Br^{83} and Kr^{83m}	Q_{EC} 0.77 est (94W55); see Br^{83} and Kr^{83m} 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{37}Rb^{84m}$	23 m (9F50a); 21 m (79C53); 20 m (59H40)	☢ IT, EC (weak) (79C53); EC (9F50a) B chem (59H40); chem, excit (9F50a)	γ with IT: γ_1 0.239, γ_2 ~ energy of γ_1 (coinc with γ_1), γ_3 0.463 (not coinc with γ_1); with EC: γ_4 0.89 (γ_1+γ_2/γ_3/γ_4 = 100/40/6) scint spect, γ-γ coinc (79C53); γ_1 0.217 (coinc with γ_2), γ_3 0.466 spect conv, γ-γ coinc (74D56)	Q_{IT} 0.465 (SHS)
Rb^{84}	33.0 d (57W55); 34 d (7K50); 38 d (73B50)	☢ EC 78%, β^+ 19%, β^- 2.5% (57W55); EC/β^+ ~13 (7K50); β^+/β^- ~6.2 (73B50); β^+/β^- 5.6 (74D56); EC to 0.88 level: L/K 0.12 (57W55); A chem, cross bomb (63B47); chem, mass spect (7K50); I 2 atomic beam (141H56); μ -1.32 atomic beam (102H57b)	β^+ 1.629 (†39), 0.82 (†58), 0.37 (?) (†~3) spect (10H52); 1.64 (†44), 0.79 (†56) spect (74D56); 1.70 (†47), 0.81 (†53) scint spect, β-γ coinc (57W55); others (7K50, 73B50); β^- 0.910 spect (57W55); 0.91 (†59), 0.49 (†41) spect (74D56); γ 0.88 (†90, coinc with 1.01 γ), 1.01 (†0.6), 1.90 (†1) scint spect, γ-γ coinc (53J57b); 0.89 (64%), 1.91 (0.9%) scint spect (57W55); 0.890 scint spect, spect conv (10H52); see also gammas of Br^{84} and Kr^{84}	Q_{EC} 2.65 (94W55); Q_{β^-} 0.91 (SHS); see Br^{84} 
$\underline{Rb^{85}}$		% 72.15 (6N50a); I 5/2 atomic spect, atomic beam 87M50); μ +1.3482 nucl induct, atomic beam (87M50, 67K56, 61W53); q +0.30 nucl induct (104K55); +0.27 atomic beam (191S56)	γ Coulomb excitation (in Rb^{85}): 0.148 scint spect (52F56); 0.150 scint spect (27T54); 0.513 level of Rb^{85}: $t_{1/2}$ 6.2 x 10^{-7} s delay coinc (202S57); see also gammas of Kr^{85} and Sr^{85}	see Kr^{85m} and Sr^{85m}
Rb^{86m}	1.02 m (192S53); 1.06 m (9F51)	☢ IT, no EC (192S53); EC (9F51); B chem, excit, n-capt (9F51)	γ 0.56 scint spect (192S53); 0.78 abs (9F51)	Q_{IT} 0.56 (SHS)
Rb^{86}	18.66 d (24E55, 24E55a); 18.64 d (38N55); 18.68 d (109W57); 19.5 d (2H41a)	☢ β^- (2H41a); no β^+ (lim 0.002%) (41M51); no EC (lim 0.1%) (192S53); A chem, n-capt (26S37a); chem, excit (2H41a); others (69S38, 2S47, 34H44, 11G49, 2F51a); I 2 atomic beam (98B53, 98B51); μ -1.69 atomic beam (98B53, 98B51)	β^- β_1^- 1.78 (84%) spect (average of 137M54a, 34L56a, 5Z48, 44A56, 75D54, 96M52, 23M51, 38P54, 79C54, 130B56a); β_2^- 0.71 (15%) spect, β-γ coinc (average of 137M54a, 79C54, 38P54, 75D54, 44A56, 5Z48, 23M51, 55M50, 26M50, 34L56a, 130B56a); β_3^- (?) 0.23 (~1%) spect (44A56, 75D54); others (15J48, 34L55); γ 1.079 spect (average of 38P54, 55M50, 5Z48); 1.08 (8.9%) scint spect, ion ch (35L54a); 1.08 (8.5%) scint spect, ion ch (24E55); 1.081, 0.527 spect conv (75D54, 44A56); others (15J48, 85S51, 137M54a, 26H53a, 130B55, 137M57); see also gammas of Y^{86}	Q_{β^-} 1.776 (94W55); Q_{EC} 0.4 (94W55); see Y^{86} 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{37}Rb^{87}$	5.0 x 10^{10} y Sr^{87}/Rb^{87} ratio (7A56); 5.1 x 10^{10} y sp act (3L57); 6.1 x 10^{10} y sp act (61F54); 6.2 x 10^{10} y sp act (79M54); 4.3 x 10^{10} y sp act (95G55); 4.6 x 10^{10} y Sr^{87}/Rb^{87} ratio (62F56); 6.2 x 10^{10} y sp act (21C51); others (50L52, 95G54, 37H38, 37H48a, 37K49, 79M52, 55C51, 65S38, 10E46, 198B52)	☢ β^- (1T05, 54C06); A chem (1T05, 54C06); chem, genet (16H37a, 8M37); chem, mass spect (40H37); parent Sr^{87} (mass spect) (16H37a, 8M37); % 27.85 (6N50a); I 3/2 atomic spect, atomic beam (87M50); μ +2.7414 nucl induct, atomic beam (67K56, 87M50, 61W53); +0.14 nucl induct (104K55); +0.13 atomic beam (191S56); others (67K56a, 57T54) q	β^- 0.275 spect (79M54, 21C51); scint spect (50L52); 0.25 abs (61F54); others (36K35, 34T52, 3L39, 14O41, 12S46); γ no γ (21C51, 79M52, 50L52); Coulomb excitation (in Rb^{87}): 0.407 scint spect (52F56); see also gammas of Kr^{87}	Q_{β^-} 0.273 (94W55); see Kr^{87} 
Rb^{88}	17.8 m (36G40, 2B51); 17.7 m (30T52b); 17.5 m (34W42); 18 m (16H40b, 26S37a)	☢ β^- (16H39a); A chem (26S37a); chem, genet (20L39, 36G40, 16H39a); daughter Kr^{88} (6H39, 20L39, 36G40, 16H40a, 16H40b); others (1P37, 69S38, 2S47, 25A39, 2G39)	β^- 5.30 (78%), 3.6 (13%), 2.5 (9%) spect (30T52b); 5.13 (66%), 3.29 (19%), 2.0 (15%) spect (2B51); 5.20 (~66%), 3.6 (~17%), 1.8 (~17%) abs (37G51); γ γ_1 0.908 (†63, coinc with γ_4), γ_2 1.39 (†6), γ_3 1.85 (†100, coinc with γ_2, γ_4, and γ_5), γ_4 2.11 (†4.5), γ_5 2.68 (†11), γ_6 3.01 (†1.4), γ_7 3.24 (†1.4), γ_8 3.52 (†1.1), γ_9 3.68 (†0.4), γ_{10} 4.87 (†1.4) scint spect, γ-γ coinc (56L56); γ_1 0.91 (†60), γ_3 1.85 (†100), γ_4 2.18 (†4), γ_5 2.76, 4.2 (†0.2) scint spect (30T55); 0.90, 1.86, 2.8 spect (2B51); others (37G51, 124H56); see also gammas of Y^{88}	Q_{β^-} 5.17 (94W55); see Y^{88} 
Rb^{89}	15.4 m (36G40); 14.9 m (8O56a); 15.5 m (16H40b)	☢ β^- (36G40); A chem, genet (36G40, 66S40); daughter Kr^{89} (36G40, 66S40, 16H40b, 16H43, 17B51); parent Sr^{89} (36G40, 16H40a, 16H43, 16H40b)	β^- 3.92 (7%), 2.8 (5%), other β^- scint spect (8O56a); 4.5 abs (35B46a, calc from 36G40); 3.8 abs (36G40); γ 0.663 (†22), 1.05 (†100), 1.26 (†72), 1.55 (†5), 2.20 (†19), 2.59 (†17), 2.75 (†3.7), 3.52 (†2.9), (0.663 γ coinc with 2.59 γ), (1.05 γ coinc with 1.26 γ) scint spect, sum scint spect, γ-γ coinc (8O56a)	Q_{β^-} 3.9 (8O56a) 
Rb^{90}	2.74 m (35K51a)	☢ β^- (35K51a); A chem, genet (35K51a); daughter Kr^{90}, parent Sr^{90} (24D51a, 24D51, 35K51a)	β^- 5.7 abs (35K51a); γ (35K51a)	

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$_{37}Rb^{91}$	14 m (35K51a)	☢ β^- (35K51a); A chem, genet (35K51a); daughter Kr^{91}, parent Sr^{91} (35K51a)	β^- 3.0 abs (35K51a); γ (35K51a)	
Rb^{91}	1.67 m (35K51a); [short] (17B51, 11O51, 24D51, 16H40c, 24D51a)	☢ β^- (35K51a); A chem, genet (35K51a); daughter Kr^{91}, parent Sr^{91} (35K51a); ancestor Y^{91} (24D51a, 16H40c)	β^- 4.6 abs (35K51a); γ (35K51a)	
Rb^{92}	80 s (16H40a); [short] (17B51, 24D51)	☢ β^- (16H40a); D chem, genet (16H40a); daughter Kr^{92} (24D51); ancestor Y^{92} (16H40a, 16H40c, 16H40, 16H43, 24D51)		
Rb^{93}	[short] (17B51, 24D51, 24D51a, 16H42, 16H43)	☢ [β^-] (16H42); F genet (16H42, 17B51); daughter Kr^{93} (17B51, 24D51, 24D51a); ancestor Y^{93} (16H42, 16H43, 17B51)		
Rb^{94}	[short] (24D51, 16H43, 16H43a)	☢ [β^-] (16H43, 16H43a); F genet (16H43, 16H43a); daughter Kr^{94}, ancestor Y^{94} (16H43, 16H43a, 24D51)		
Rb^{95}	[short] (24D51a)	☢ [β^-] (24D51a); F genet (24D51a); daughter Kr^{95}, ancestor Zr^{95} (24D51a)		
Rb^{97}	[short] (24D51)	☢ [β^-] (24D51); F genet (24D51); daughter Kr^{97}, ancestor Zr^{97} (24D51); others (26A51)		
$_{38}Sr^{81}$	29 m (53C50, 53C52)	☢ EC, β^+ (53C50); B chem, genet (53C50, 53C52); parent Rb^{81} (53C50)	γ conv (53C50)	Q_{EC} ~3.6 est (94W55)
Sr^{82}	25.5 d (42K53); 27 d (97M52, 54L53); 25 d (53C50)	☢ EC, no β^+ (lim 5%) (108K55); A chem, excit (53C50); mass spect (97M52); daughter Y^{82} (78C52); parent Rb^{82}, not parent Rb^{82m} (lim 0.1%) (53C52, 54L53)	β^+ with Rb^{82}: 3.15 spect (53C50); γ 0.95, ~0.40, ~0.15 spect conv, abs (53C50)	Q_{EC} ~0.5 est (94W55)

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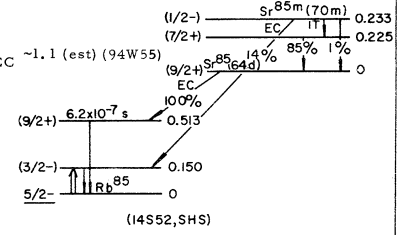
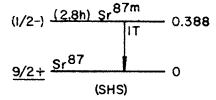
$_{38}Sr^{83}$	33 h (97M52); 34 h (108K55); 38 h (53C50)	☢ EC, β^+ (53C50);	β^+ 1.15 spect (53C50); 1.35 abs (97M52);	Q_{EC} 2.3 (94W55)
		A chem, genet (53C50); mass spect (97M52); parent Rb^{83} (53C50); daughter Y^{83} (78C52)	γ 0.040, 0.074, 0.101, 0.151, 0.165 spect conv (53C50, 53C52)	
Sr^{84}		% 0.56 (6N38b); 0.55 (7A53)		
Sr^{85m}	70 m (2D40a)	☢ IT 86%, EC 14% (14S52);	γ 0.0075 (e/γ very large), 0.150 (with EC), 0.225 (e/γ 0.031, K/L ~5.5), 0.233 (e/γ ~0.04) scint spect, spect conv, x-γ coinc (14S52); 0.233, 0.152 spect conv (11T51); see also gammas of Kr^{85m} and Rb^{85}	Q_{IT} 0.233 (SHS)
		A chem, excit (2D40a)		
Sr^{85}	64.0 d (109W57); 65 d (11T51, 142H56); 66 d (2D40a)	☢ EC (11T51, 115B56a); EC (L/K 0.13) (115B56a); no β^+ (11T51);	γ 0.513 spect, spect conv (11T51); 0.513 (~100%, e/γ 0.008) spect conv, x-γ coinc, scint spect (14S52); 0.514 (~100%, e/γ 0.007, K/L ~12) spect, spect conv, coinc abs (2E52); 0.513 γ: $t_{1/2}$ 9×10^{-7} s delay coinc (14S52); see also gammas of Kr^{85}	Q_{EC} ~1.1 (est) (94W55) 
		A chem, excit (2D40a); daughter Y^{85} (78C52)		
Sr^{86}		% 9.86 (6N38b); 9.87 (7A53);		
		μ ~0 atomic spect (87M50)		
Sr^{87m}	2.80 h (58M51, 8H51b); 2.88 h (59G52); 2.90 h (142H56); 2.75 h (2D40a)	☢ IT (2D40a);	γ 0.388 (K/L+M 5.8) spect conv (59G52); 0.390 (e/γ 0.28, K/L+M 6.9) spect conv, x-conv coinc (58M51); 0.39 (e/γ 0.26) ion ch (115H56, 33E55, 67A54); 0.388 (K/L+M 5.5) spect conv (79B52); others (11T51, 8H51b, 2H41)	Q_{IT} 0.388 (SHS) 
		A chem, excit (71S37); chem, excit, cross bomb, genet (2D40a); daughter Y^{87} (2D39, 2D40a, 58M50, 58M51); others (35R40, 35R40a, 37W45a, 71S37, 2S47, 2S47a, 42S40)		
Sr^{87}		% 7.02 (6N38b, 7A53);		
		I 9/2 atomic spect (87M50);		
		μ -1.0893 nucl induct (29J53a); others (87M50)		
Sr^{88}	$t_{\beta\beta} > 3 \times 10^{16}$ y sp act (59F52)	% 82.56 (6N38b, 7A53);	γ 1.85 level of Sr^{88}: $t_{1/2}$ $\sim 10^{-13}$ s electron scattering (124H56); 2.76 level of Sr^{88}: $t_{1/2}$ $\sim 7 \times 10^{-11}$ s electron scattering (124H56)	
		μ ~0 atomic spect (87M50)		

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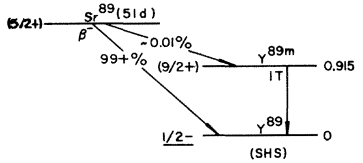
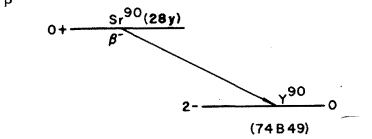
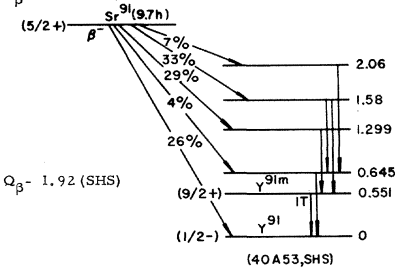
$_{38}Sr^{89m}$	~10 d (142H54, 142H55); others (142H56)	☢ IT (142H54, 142H55); C chem, genet (142H54); parent Sr^{89} (142H54, 142H55)	γ	(142H54, 142H55)	
Sr^{89}	50.5 d (142H54, 142H55); 51 d (103K56); 53 d (1N51); 54 d (36L39); 55 d (71S39, 11G49)	☢ β^- (71S37); A chem, excit (71S37); chem, mass spect (60H48); daughter Rb^{89} (36G40, 16H40a, 16H40b, 16H43, 38G46); parent Y^{89m} (0.02%) (35L55c); parent Y^{89m} (~0.01%) (142H56); not parent Y^{89m} (lim 5×10^{-4} %) 115B55b); others (2S47, 42S38, 42S40, 7N49a, 6O48, 11O51, 72B51, 21T51, 38G48, 28F51)	β^- γ	1.463 spect (10L49); 1.462 spect (115B55b); 1.5 spect (72S49, 11R47); cl ch (71S39); no γ (1N51, 71S39, 71S37); with Y^{89m}: 0.913 (142H56, 35L55c, 73S51); see also gammas of Y^{89m}	Q_{β^-} 1.463 (SHS) 
Sr^{90}	27.7 y sp act + mass spect (95W55); 28.4 y (79R55); 19.9 y (28P50)	☢ β^- (18N51); A chem, genet (16H42); chem, mass spect (60H48); daughter Rb^{90} (24D51a, 24D51, 35K51a); parent Y^{90} (16H42, 16H43, 38G46, 18N51); others (11G49, 7N49a, 21T51, 38G48)	β^- γ	0.545 spect (130B56a); 0.54 spect (39N56, 23L50); 0.61 spect (47M48a); 0.53 spect (74B49); others (38G46, 33G51c, 75L57, 133H57); no γ (33G51c)	Q_{β^-} 0.545 (SHS) 
Sr^{91}	9.67 h (40A53); 9.7 h (142H54, 142H55, 28F51a); 10 h (16H43)	☢ β^- (40G41); A chem, genet (40G41); chem, excit (66S43a); parent Y^{91m}, parent Y^{91} (40G41, 16H43, 28F51a); daughter 1.7 m Rb^{91}, 14 m Rb^{91} (35K51a); others (63S52, 13P47, 7N49a, 72B51, 21T51, 32K48)	β^- γ	2.67 (26%), 2.03 (4%), 1.36 (29%), 1.09 (33%), 0.62 (7%) spect (40A53); 2.7 (25%), 1.4 (25%), 0.8 (50%) abs (142H54, 142H55); 3.2 (~60%), 1.3 (~40%) abs (28F51a); 0.551 (with Y^{91m}, †59, K/L+M 6.0), 0.645 (†15), 0.748 (†27), 0.93 (†3), 1.025 (†30), 1.413 (†5) scint spect, spect conv, spect, γ-γ coinc (40A53); see also gammas of Y^{91m}	Q_{β^-} 2.67 (94W55) 
Sr^{92}	2.60 h (142H56); 2.7 h (40G41)	☢ β^- (40G41); A chem, genet (40G41); parent Y^{92} (40G41, 58H51b); others (7N49a, 72B51, 16H40a, 16H43, 16H43a, 32K51a, 17B51, 32K48)	β^- γ	0.55 (90%, coinc with 1.37 γ) scint spect, β-γ coinc (80H57); 0.55 (90%), 1.5 (10%) abs (142H56); 1.37 (†100), 0.44 (†4.5), 0.23 (†3.9) scint spect (80H57)	Q_{β^-} 1.92 (SHS)
Sr^{93}	8.2 m genet (113H57d); 7 m (36L39)	☢ β^- (36L39); B chem (36L39); chem, genet (16H43); parent Y^{93} (16H43, 16H43a, 113H57d); others (16H42)			
Sr^{94}	1.3 m genet (113H57d)	☢ β^- (16H43, 16H43a); A chem, genet (16H43, 16H43a); parent Y^{94} (16H43, 16H43a, 113H57d); others (24D51);			

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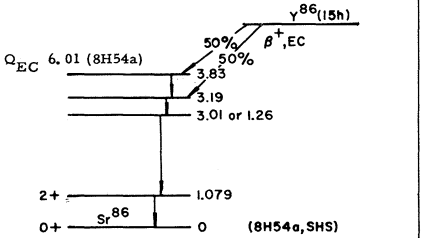
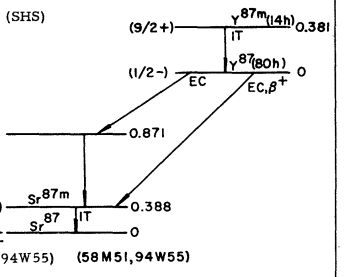
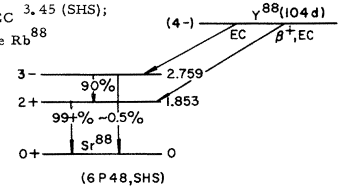
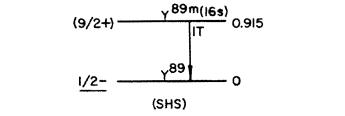
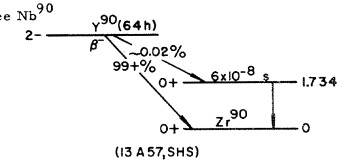
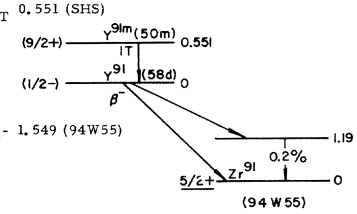
$_{38}Sr^{95}$	~0.7 m genet (113H57d)	☢	β^- (24D51a);			
		B	genet (24D51a, 113H57d); ancestor Zr^{95}, descendent Kr^{95} (24D51a); parent Y^{95} (113H57d)			
Sr^{97}	[short] (24D51)	☢	β^- (24D51);			
		F	genet (24D51); ancestor Zr^{97}, descendent Kr^{97} (24D51, 26A51)			
$_{39}Y^{82}$	70 m (78C52)	B	chem, genet (78C52); parent Sr^{82} (78C52)			
Y^{83}	3.5 h (78C52)	B	chem, genet (78C52); parent Sr^{83} (78C52)			
Y^{84}	3.7 h (36R49)	☢	β^+, EC (36R49);	β^+	2.0 abs (36R49)	Q_{EC} ~8 (est) (94W55)
		B	chem, excit, sep isotopes (36R49)	γ	(36R49)	
Y^{85}	5 h (78C52)	B	chem, genet (78C52); parent Sr^{85} (78C52)			
Y^{86}	14.6 h (53C51, 8H51b)	☢	β^+ (53C51);	β^+	1.80 (~50%), 1.19 (~50%) spect (8H51b);	Q_{EC} 6.01 (8H54a)
		B	chem, excit, sep isotopes (53C51); daughter Zr^{86} (8H51b)	γ	γ_1 0.180 (coinc with γ_2, γ_3, γ_4, and β^+), γ_2 0.635 (coinc with γ_3, γ_4, and β^+), γ_3 1.08 (coinc with γ_4 and β^+), γ_4 1.93 (coinc with β^+) scint spect, γ-γ coinc, sum scint spect (8H54a); others (8H51b, 53C51); see also gammas of Rb^{86}	
Y^m	0.017 s (86L57a)	F	excit (86L57a)	γ	0.41 scint spect (86L57a)	
Y^{87m}	14 h (2D40a, 8H51b, 58M51)	☢	IT (2D40a); no β^+ (8H51b);	γ	0.381 (K/L+M 5.4) spect conv (59G52); 0.384 (e/γ 0.28) spect conv, ion ch, conv-x coinc (58M51); 0.389 spect conv (8H51b)	Q_{IT} 0.381 (SHS)
		A	chem (71S39); chem, excit, cross bomb (2D40a); daughter Zr^{87} (8H51b); parent Y^{87} (58M50, 8H51b, 58M51)			
Y^{87}	80.0 h (58M51); 80 h (2D40a, 8H51b)	☢	EC 99+%, β^+ ~0.3% (58M51); EC, β^+ (weak) (36R50);	β^+	0.7 spect (58M51, 36R50);	Q_{EC} 1.7 (94W55) (58M51, 94W55)
		A	chem (71S39); chem, excit, cross bomb (2D40a); daughter Y^{87m} (58M50, 8H51b, 58M51); parent Sr^{87m} (2D40a, 37L50, 58M50, 8H51b, 58M51)	γ	0.483 (K/L+M ~7) spect conv (59G52); 0.485 (e/γ 0.0035) spect conv, scint spect, γ-x coinc (58M51); 0.388 (with Sr^{87m}); see also gammas of Sr^{87m}	

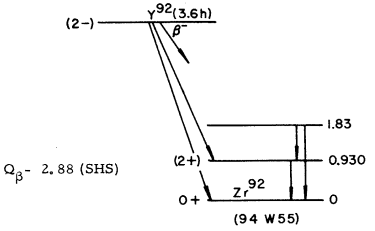
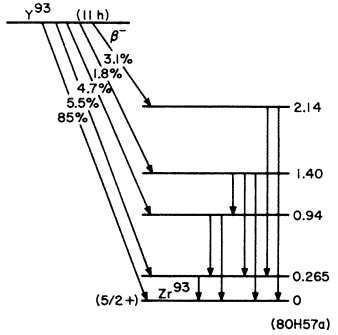
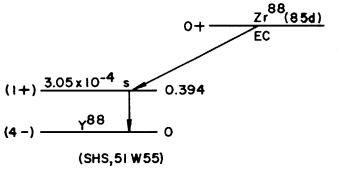
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{39}Y^{88}$	104 d (10O46); 105 d (2D40a); 2.0 h activity not found (36R49, 2D40a, 2D40b, 71S37, 71S39)	☢	EC (2D40a); EC 99+%, β^+ 0.19% (6P48);	β^+	0.58 spect (113S56); 0.83 spect (6P48);
		A	chem (2D40a); chem, excit (2H42); mass spect (60H48); daughter Zr^{88} (8H51b); others (29P40, 17B50)	γ	0.908 (e/γ 0.0003), 1.853 (e/γ 0.0001), 2.76 spect conv, spect (6P48); 0.908 (†92), 1.85 (†100), 2.76 (†0.5) scint spect (56L56, 53T56); 0.908, 1.89 spect, γ-γ coinc (25D41); ~0.9 (e_K/γ 0.00034), ~1.85 (e_K/γ 0.00017) spect conv (44M52b); 2.8 (~1%) D-γ-n reaction (41G44); 0.394 level of Y^{88}: $t_{1/2}$ 3.05×10^{-4} s delay coinc, $Y^{89}(\gamma,n)$ (192B57); $t_{1/2}$ 2.9×10^{-4} s (61P56); $Y^{89}(\gamma,n)$ (18V56); others (17S41, 23K56a, 111C56a, 13A55, 9B55a, 82S53a, 19V53, 8H55, 125K56); see also gammas of Zr^{88} and Rb^{88}
Y^{89m}	16.1 s (124S55); ~14 s (18G51)	☢	IT (18G51);	γ	0.913 spect conv (73S51); 0.917 spect conv (8H51b); ~0.9 (K/L+M 7.0) spect conv (79B52); 0.92 (e/γ 0.01) spect conv, scint spect (74S51, 18G51); see also gammas of Zr^{89}
		A	chem, genet (18G51); daughter Zr^{89} (18G51); daughter Sr^{89} (35L55c, 142H56); not daughter Sr^{89} (115B55b)		
$\underline{Y^{89}}$		%	100 (1D39, 98C57);		
		I	1/2 atomic spect (87M50);		
		μ	-0.13683 nucl induct (173B54)		
Y^{90}	64.2 h (195S55, 28V55); 64.6 h (94C54); 64.8 h (151M55, 142H56); 64.4 h (109W57); 64.0 h (74P57)	☢	β^- (71S37);	β^-	2.26 spect (average of 10L49, 23L50, 74B49, 96M52, 54J55, 39N56, 130B56a, 4Y57a); E (average) 0.90 ion ch (77C52); others (33G51c, 152M53, 145M57, 4Y57, 96G58);
		A	chem, excit, cross bomb (71S37); chem, mass spect (60H48); daughter Sr^{90} (16H42, 16H43, 38G46, 18N51); others (42S38, 2S47, 42S40, 42S38a, 42S40a, 13P47, 11G49, 37B46, 21T51)	γ	1.734 (very weak, e/γ >30) spect conv, scint spect (4Y56a, 4Y57); 1.75 (e/γ very large) spect conv, scint spect (54J55); 1.74 γ: $t_{1/2}$ 6×10^{-8} s delay coinc (13A57); $t_{1/2}$ 6×10^{-9} s delay coinc (20D57); others (165S55, 33G51c, 74B49, 87G56, 4Y56, 18G57, 133H57, 176B58); see also gammas of Zr^{90} and Nb^{90}
Y^{91m}	50.3 m (40A53); 51.0 m (28F51a); 50 m (40G41)	☢	IT, no β^- (lim 1.5%) (40A53);	γ	0.551 (e_K/γ 0.046, K/L+M 6.0) spect conv, scint spect (59G52, 40A53); 0.61 (e/γ ~0.1) abs, abs conv (28F51a); see also gammas of Sr^{91}
		A	chem, genet (40G41); daughter Sr^{91} (40G41, 16H43, 28F51a); others (66S43a)		
Y^{91}	57.5 d (93K55); 58.3 d (142H56); 61 d (38G46, 10L49, 52B53a); 57 d (40G41, 16H40c, 19J44)	☢	β^- (16H40c);	β^-	1.537 spect (10L49); 1.54 spect (15O49); 1.55 spect (16W49c); 1.56 spect (16A50, 96M52); 0.33 scint spect, β-γ coinc (2B54a); 0.36 abs, β-γ coinc (93K55); others (52B53a);
		A	chem, genet (16H40c, 16H43); chem, mass spect (72B51a, 60H48); daughter Sr^{91} (40G41, 16H43, 28F51a); others (66S43a, 40A52, 37L50, 11G49, 11O51, 72B51, 38G48, 28F51, 13E51)	γ	1.19 (0.22%) scint spect, ion ch (93K55); 1.22 (0.3%, coinc with 0.33 β^-) scint spect, β-γ coinc (2B54a); others (132B53, 52B53a, 10L49); see also gammas of Nb^{91m}

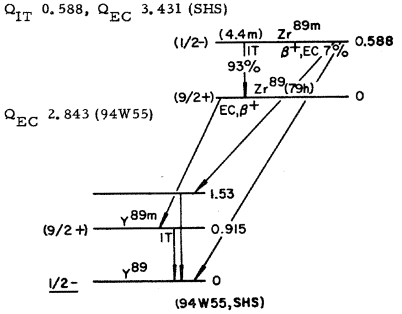
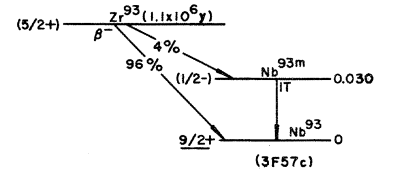


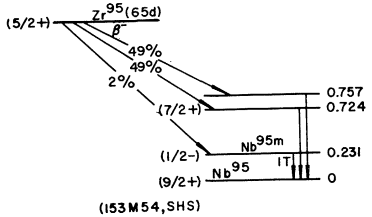
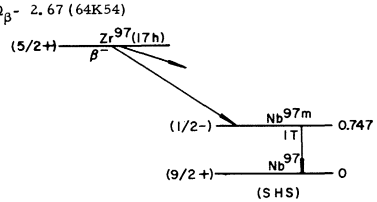
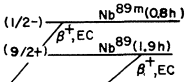
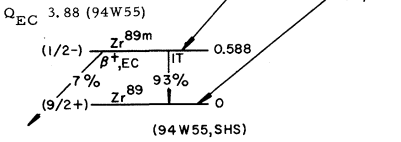




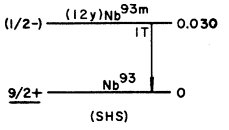
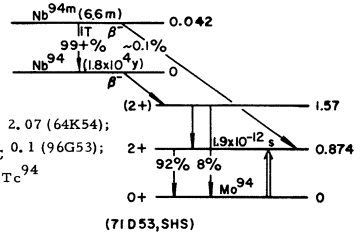
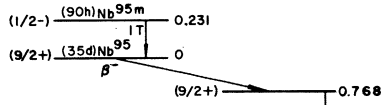
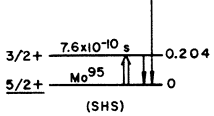
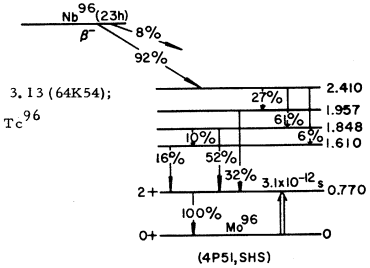


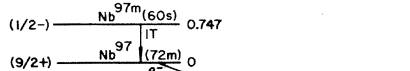
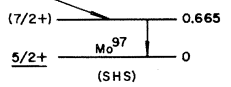
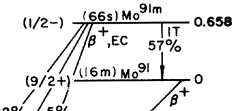
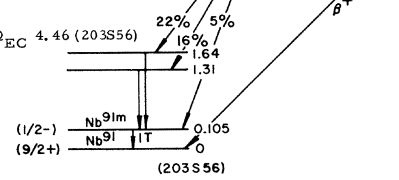
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{39}Y^{92}$	3.60 h (40A52a); 3.5 h (28A43, 16H43a, 36L39)	☢	β^- (36L39);	β^-	3.60, 2.7, 1.3 spect (40A52a); 3.6 spect (125C55); abs (70B43a); others (58H51b, 40G41);	Q_{β^-} 3.60 (94W55)
		A	chem (36L39); fission fragment range (32K48); chem, sep isotopes (196S53); daughter Sr^{92} (40G41, 58H51b); others (42S40, 66S43a, 63S52, 72B51)	γ	γ_1 0.21 (†10), γ_2 0.48 (†11, complex ?), γ_3 0.94 (†19, complex ?), γ_4 1.45 (†~10), γ_5 1.9 (†~1), γ_6 2.4 (†~0.2), γ_1 coinc with γ_2, γ_3, and γ_4; γ_2 coinc with γ_2, γ_3, and γ_4; γ_3 coinc with γ_4 scint spect, β-γ, γ-γ coinc (125C55); others (40G41, 58H51b); see also gammas of Nb^{92}	
Y^{93}	10.4 h (113H57d); 11.0 h (80H57a); 10.0 h (72B51b); 11.5 h (16H43)	☢	β^- (72B51b);	β^-	2.88 spect (113H57d); 3.1 abs (72B51b);	Q_{β^-} 2.88 (SHS)
		B	chem (16H43, 72B46, 72B51b, 70S51); fission fragment range (32K48); daughter Sr^{93} (16H43, 16H43a, 72B51b); others (6O48, 72B51)	γ	0.265 (†100), 0.455 (†3.4), 0.68 (†15), 0.94 (†37), 1.15 (†5), 1.40 (†10), 1.88 (†23), 2.14 (†9) scint spect, γ-γ coinc (80H57a); 0.267 (K/L 4.0) spect conv (113H57d); others (72B51b)	
Y^{94}	16.5 m (75B49); 20 m (24D51b, 16H43)	☢	β^- (16H43, 16H43a);	β^-	5.4 abs (75B49);	
		A	chem, (16H43, 16H43a); fission fragment range (32K48); chem, sep isotopes (196S53); daughter Sr^{94} (16H43, 16H43a); others (66S43a)	γ	1.4 abs (75B49)	
Y^{95}	10.5 m (20K49); <1.5 h (70S51)	☢	β^- (20K49);			
		B	chem, sep isotopes, excit (20K49)			
Y^{97}	[short] (24D51)	☢	β^- (24D51);			
		F	genet (24D51); descendent Kr^{97}, parent Zr^{97} (24D51, 26A51)			
$_{40}Zr^{86}$	17 h genet (8H51b)	☢	EC, no β^+ (lim 10%) (8H54a);	γ	0.241 (K/L 9.3) spect conv (8H54a)	
		B	chem, genet (8H51b); parent Y^{86} (8H51b)			
Zr^{87}	94 m (8H51b); 120 m (36R49)	☢	β^+, EC (36R49);	β^+	2.10 spect (8H51b); 2.0 abs (36R49);	Q_{EC} 3.50 (94W55)
		A	chem, excit, sep isotopes (36R49); chem, genet (8H51b); parent Y^{87m} (8H51b); others (85H52)	γ	0.65, 0.35 abs (36R49)	
Zr^{88}	85 d (8H53a)	☢	EC (8H51b);	γ	0.394 (e/γ ~0.03, K/L+M 8.4) scint spect, spect conv (8H55, 51W55); 0.394 γ: $t_{1/2}$ 2.9 x 10^{-4} s (61P56); see also gammas of Y^{88}	
		B	chem, genet (8H51b); parent Y^{88} (8H51b)			
Zr^{m}	0.013 s (86L57a)	F	excit (86L57a)	γ	0.24 scint spect (86L57a)	

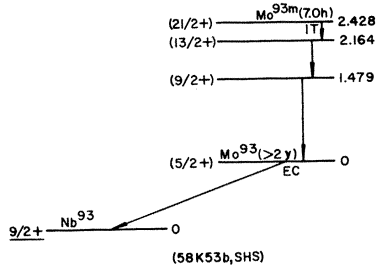
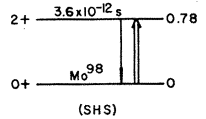
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{40}Zr^{89m}$	4.4 m (73S53, 73S51); 4.3 m (30K53); 4.5 m (2D40a)	☢	IT 93%, EC 5.6%, β^+ 1.8% (73S53);	β^+	2.43, ~0.85 (coinc with 1.53 γ) abs, β-γ coinc (73S53);	Q_{IT} 0.588, Q_{EC} 3.431 (SHS)
		A	chem, excit (2D40a); daughter Nb^{89m} (43D54, 73M55); others (28A43)	γ	0.588 (↑100, γ/β^+ 53, e/γ 0.08, K/L+M 5.4), 1.53 (with EC, ↑8) scint spect, spect conv (73S53, 73S51, 79B52)	
Zr^{89}	79.3 h (74S51); 77 h (8H51b); 78 h (30K53, 2D40a); 79 h (73S53)	☢	EC ~75%, β^+ ~25% (18G51); EC ~80%, β^+ ~20% (73S53);	β^+	0.91 spect (8H51b, 74S51); 0.90 spect (73S53, 73S51);	Q_{EC} 2.843 (94W55)
		A	chem, excit (42S38, 2D40a); parent Y^{89m} (18G51); daughter Nb^{89} (43D54, 73M55); others (42S40)	γ	with Y^{89m}: 0.913 (γ/β^+ 5, K/L+M 7) scint spect, spect conv (73S53); 0.92 (e/γ 0.01) spect conv, scint spect (74S51, 18G51); 0.917 spect conv (8H51b); ~0.9 (K/L+M 7.0) spect conv (79B52); see also Y^{89}	
Zr^{90m}	0.83 s (24C55)	☢	IT (24C55);	γ	2.30 scint spect (24C55)	
		C	excit (24C55)			
Zr^{90}		%	51.46 (24W48)	γ	1.734 level of Zr^{90}: $t_{1/2}$ 6×10^{-8} s delay coinc (13A57); $t_{1/2}$ ~5×10^{-8} s delay coinc, Zr^{90} (n,n') (61K57); 3.59 level of Zr^{90}: $t_{1/2}$ 3×10^{-7} s delay coinc (226B58); see also gammas of Y^{90} and Nb^{90}	see Y^{90} and Nb^{90}
Zr^{91}		%	11.23 (24W48);			
		I	5/2 atomic spect (87M50);			
		μ	-1.29803 nucl induct (calc from 173B57a); others (88M55b, 197S53, 173B57)			
Zr^{92}		%	17.11 (24W48)	γ	Coulomb excitation (in Zr^{92} and/or Zr^{94}): 0.92 scint spect (121S57b, 121S57)	
Zr^{93}	1.1×10^6 y sp act (33G57)	☢	β^- (61S50);	β^-	0.056 (96%) spect (3F57c);	Q_{β^-} 0.056 (3F57c)
		B	chem (61S50); parent Nb^{93m} (3F57c)	γ	with Nb^{93m}: 0.0304 (K/L+M 0.088) spect conv (3F57c)	
Zr^{94}		%	17.40 (24W48)	γ	Coulomb excitation (in Zr^{94} and/or Zr^{92}): 0.92 scint spect (121S57b, 121S57	

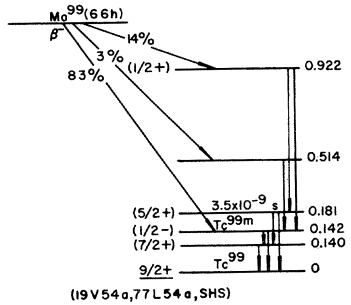
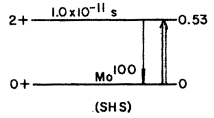
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{40}Zr^{95}$	65 d (17B51a, 38G46, 10C53a); 66 d (2G48); 63 d (42S40)	☢	β^- (42S40);	β^-	0.360 (43%), 0.396 (55%), 0.89 (2%) spect (73D55); 0.364 (54%), 0.396 (43%), 0.88 (3%) spect (153M54); 0.25 (11%), 0.364 (53%), 0.404 (34%), 0.90 (0.9%), 1.13 (0.4%) spect (18Z54, 44A56); ~0.36 (~49%), ~0.41 (~49%), 0.91 (~2%) spect (10C53a); others (5S53a, 5S52, 17N51, 88S51b, 17B51a, 26M48a, 14M51, 84A57);	Q_{β^-} 1.123 (64K54) 
		A	chem (2G40, 42S40); chem, genet (39G51); parent Nb^{95m}, parent Nb^{95} (62H49, 17B51a, 20J51, 61S51b); others (2S47, 20J51, 11G49, 7N49a, 38G48, 28F51)	γ	0.722 (e_K/γ 1.4 x 10^{-3}), 0.754 (e_K/γ 1.1 x 10^{-3}) spect conv (153M54); 0.723, 0.756, 0.235 (with Nb^{95m}) spect conv (18Z54, 44A56); 0.726 (e_K/γ 1.3 x 10^{-3}, K/L 9), 0.760 (e_K/γ 1.8 x 10^{-3}, K/L 6) spect conv (73D55); 0.725 (K/L 5), 0.758 spect, spect conv (10C53a); others (5S53a, 26M53, 5S52, 17N51, 17B51a, 26M48a, 80R55); see also gammas of Nb^{95m}	
$\underline{Zr^{96}}$	t_β >3.6 x 10^{17} y sp act (62A56); $t_{\beta\beta}$ >5 x 10^{17} y sp act (62A56); $t_{\beta\beta}$ 6 x 10^{16} y sp act (72M53)	%	2.80 (24W48)			
Zr^{97}	17.0 h (50B50a, 26M52, 2G40, 32K51b)	☢	β^- (2G40);	β^-	1.91 spect (50B50a); 1.91, 0.46 spect, β-γ coinc (76D57, 76D56a); 1.90 spect (88S56); others (75S49, 32K51b, 26M52);	Q_{β^-} 2.67 (64K54) 
		A	chem (2G40); chem, n-capt, sep isotopes (50B50a, 26M52); parent Nb^{97m} (50B50a); descendent Kr^{97} (24D51); others (42S40, 2S47, 7N49a, 21T51, 16H41a, 32K48)	γ	1.02 (†10), 1.15 (†20), 1.72 (†5) scint spect, β-γ, γ-γ coinc (40N56); 1.35 (~4%), 1.62 (~2%), 2.20 (~1%), 2.58 scint spect, β-γ, γ-γ coinc (76D57, 88S56, 76D56a); with Nb^{97m}: 0.747 (e/γ 0.015) spect, spect conv, β-γ coinc, γ-γ coinc, β-conv coinc (50B50a); 0.750 (e_K/γ 0.014) spect, spect conv (88S56); others (165S55)	
Zr^{99}	30 s (30P58)	☢	β^- (30P58);			
		E	chem, genet (30P58); parent Nb^{99} (30P58)			
$_{41}Nb^{89m}$	0.8 h (43D54); ~2 h (73M55)	☢	β^+ (43D54);			
		A	chem, genet (43D54, 73M55); parent Zr^{89m} (43D54, 73M55)			Q_{EC} 3.88 (94W55) 
Nb^{89}	1.9 h (43D54, 73M55)	☢	β^+ (43D54);	β^+	2.9 scint spect (73M55); abs (43D54);	
		A	chem, genet (43D54, 73M55); parent Zr^{89} (43D54, 73M55)	γ	no γ (73M55)	

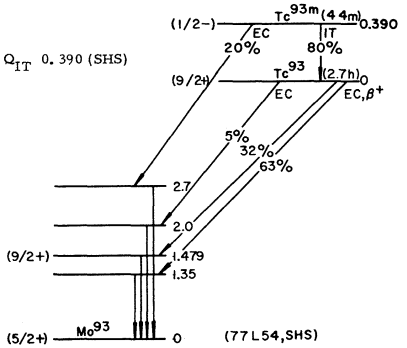
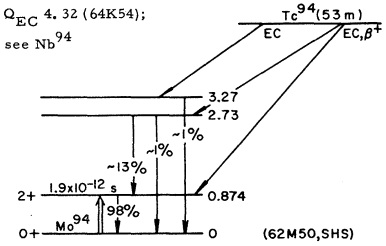
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
41 Nb^{90m}	24 s (73M55a)	☢	IT (73M55a);	γ	0.120 (e_K/γ ~0.5, K/L+M 3.6) scint spect, spect conv (73M55a);	Q_{IT} 0.120 (SHS)
		B	chem, genet (73M55a); daughter Mo^{90} (73M55a)		see also gammas of Mo^{90}	
Nb^{90}	14.60 h (109H54a); 14.7 h (43D53); 15.0 h (29K49); others (20J51)	☢	β^+ (20J51); [EC], β^+ (109H54a);	β^+	1.505 (†97), 0.655 (†2.6) spect, scint spect, β-γ coinc (56L58); 1.49 (†94), 0.65 (†6) spect (226B58); 1.50 (†87), 0.87 (†8.5), 0.55 (†4.5) spect (109H54a); 1.7 scint spect (73M55a); 1.2 abs (29K49, 43D53);	Q_{EC} 6.11 (56L58)
		A	chem, excit, cross bomb (20J51); chem, sep isotopes, cross bomb (29K49); daughter Mo^{90} (43D53); others (22E52)	γ	0.1327 (γ/β^+ 0.12, K/L 2.9, coinc with 2.18 γ), 0.1415 (γ/β^+ 1.8, K/L 5.9, coinc with β^+, 1.138 γ and 1.85 γ), 0.372 (γ/β^+ 0.07, K/L 10, coinc with 0.90 γ), 0.42 (coinc with 1.75 γ), 0.90, 0.996 (?), 1.138 (γ/β^+ 2.4, coinc with β^+, 1.63 γ, and 1.85 γ), 1.63, 1.75, 1.85 (?), 1.98 (?), 2.14 (?), 2.18 (γ/β^+ 0.33), 2.32 (γ/β^+ 2.0, not coinc with γ), no 1.28 γ, scint spect, spect conv, conv-γ, β-γ, γ-γ coinc (226B58);	
					0.133 (e_K/γ large), 0.142 (†135, e_K/γ 0.32, K/L 5.8, coinc with 1.50 β^+), 0.372 (†3.5, e_K/γ 0.009, K/L 7), 1.13 (†130, e_K/γ 2.5 x 10^{-4}, coinc with β^+), 1.27 (†40), 1.77 (†20), 2.20 (†120, e_K/γ 6 x 10^{-5}) scint spect, spect conv, β-conv coinc (109H54a);	
					0.133 (†7, e/γ 2.9, K/L 3.5), 0.142 (†135, e/γ 0.30, K/L 6.5, coinc with β^+, 1.13 γ, 1.85 γ), 0.372 (†3.5, e/γ 0.014, K/L 5.6), 0.43 (†0.03), 0.89 (†3.5), 1.1 (†4.9), 1.13 (†215, e/γ 1.8 x 10^{-4}, coinc with 1.1 γ, 1.60 γ, 1.8 γ, and 1.95 γ), 1.27 (†9), 1.48, 1.60 (†9), 1.76 (K/L ~4.5), 1.85 (†3.5), 2.0 (†2.7), 2.19 (†35), 2.32 (†185) spect conv, scint spect, β-γ, γ-γ coinc (56L58, 56L56a);	
					0.142 γ: $t_{1/2}$ 3 x 10^{-7} s delay coinc (226B58);	
					others (29K49, 73M55a);	
					metastable state in Nb^{90}: γ 0.25 ($t_{1/2}$ 0.010 s) scint spect (86L57a);	
					see also gammas of Y^{90} and Zr^{90}	
Nb^{91m}	64 d (76B49b); 60 d (20J51)	☢	IT (76B49b); IT 90%, EC 10% (calc from 61H55b, 16O51);	γ	0.1045 (e/γ ~50, K/L 2.1) spect conv, scint spect (16O51); 0.105 (K/L+M 2.1) spect conv (4P51); 0.104 (K/L 2.0) spect conv (109H54a); 0.104 (†10), 1.21 (†61, with EC) scint spect, γ-γ coinc, abs (61H55b); others (76B49b, 16O51);	Q_{IT} 0.105 (SHS)
		A	chem, excit (20J51); chem, sep isotopes (16O51)		see also gammas of Y^{91}	
Nb^{91}	long (16O51)	☢	EC (16O51);	γ	Zr K-x (16O51)	Q_{EC} 1.2 (94W55)
		B	genet (16O51); [daughter Nb^{91m}] (16O51)			
Nb^{92m2}	5.9 x 10^{-6} s (18V56a, 18V56b)	☢	IT (18V56a, 18V56b);	γ	0.088 scint spect (18V56a, 18V56b)	
		C	excit (18V56b)			
Nb^{92m1}	13 h (8J54)	☢	EC (8J54);	γ	2.35 scint spect (8J54)	
		B	chem, excit (8J54)			
Nb^{92}	10.1 d (29K47); 9.8 d (60M48); 11 d (42S40a, 42S38a)	☢	EC, no β^- (lim 0.05%) (4P51);	β^-	(?) (42S40a, 29K47, 59M44);	Q_{EC} 2.1 (94W55); Q_{β^-} 0.5 (94W55)
		A	chem, excit (42S38a); others (22E52, 37W46, 42S40)	γ	γ_1 0.90 (†1, coinc with γ_2), γ_2 0.93 (†98), γ_3 1.83 (†2) scint spect (61H55b); γ_2 0.930 (e/γ 8 x 10^{-4}) spect, spect conv (106S53b, 4P51); γ_2 0.933, γ_3 1.84 (weak) scint spect (18T52); others (59M44, 29K47, 1P45, 109H54a)	

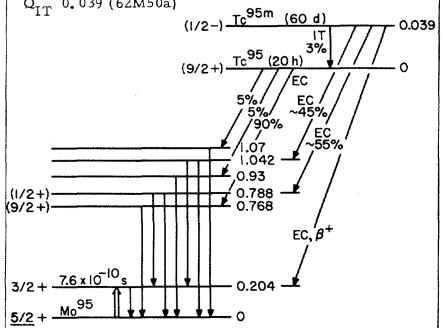
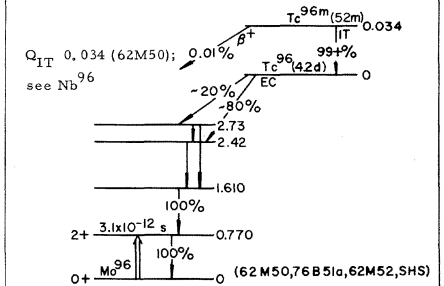
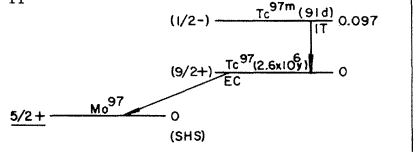
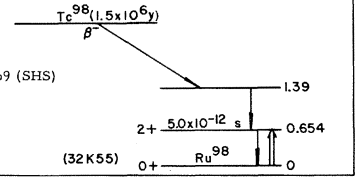
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{41}Nb^{93m}$	12 y (33G57); ~4 y (53S54)	☢	IT (53S54);	γ	0.0304 (K/L+M 0.088) scint spect, spect conv (3F57c) 0.027 ion ch (53S54);	Q_{IT} 0.030 (SHS); see Zr^{93}
		B	genet (33G53); daughter Zr^{93} (33G53)			
$\underline{Nb^{93}}$		%	100 (37S36a, 64W56);	γ	Coulomb excitation (in Nb^{93}) (90R57, 9V55, 141M55)	
		I	9/2 atomic spect (87M50);			
		μ	+6.144 nucl induct (67K56, 61W53, 87M50);			
		q	-0.4 atomic spect (198S55); -0.2 atomic spect (88M55)			
Nb^{94m}	6.6 m (42S40a)	☢	IT 99+%, β^- ~0.1% (18G46b);	β^-	1.3 abs (18G46b);	Q_{IT} 0.042 (SHS)
		A	n-capt, excit (1P37, 42S38a, 18G46b, 29K46); others (42S40a, 18G46a, 2S47, 37W46)	γ	0.0415 (e/γ large, K/L 0.31) spect conv (42C50); 0.056 (e/γ large) abs conv (18G46b); 0.9 (weak) scint spect (38M51a); Nb K-x (18G46a, 18G46b); see also gammas of Mo^{94} and Tc^{94}	
Nb^{94}	1.8×10^4 y sp act (54R55a); 2.2×10^4 y sp act (71D53)	☢	β^-, no EC (71D53);	β^-	0.50 abs (71D53); 0.61 abs (54R54a);	Q_{β^-} 2.07 (64K54); Q_{EC} 0.1 (96G53); see Tc^{94}
		A	n-capt (18G46b); chem, n-capt (63H52); others (18G48a)	γ	0.70 (92%), 0.87 (92%), 1.57 (8%) scint spect (71D53); 0.73, 0.90, 1.63 scint spect (54R55a); see also gammas of Mo^{94} and Tc^{94}	(71D53, SHS)
Nb^{95m}	90 h (61S51b, 62H49, 73D55); 84 h (5S52, 5S53a)	☢	IT (61S51b);	γ	0.231 (e/γ very large) spect conv (5S52, 5S53a); 0.232 (K/L+M ~3.5) spect conv (4P51); 0.235 (K/L+M 4.5) spect conv (10C53a); 0.236 (K/L+M 3.7) spect conv (109H54a); ~0.236 (K/L+M 4.5) spect conv (73D55); Nb K-x (61S51b); others (62H49, 88S52a, 72D53, 44A56)	Q_{IT} 0.231 (SHS)
		A	chem (13E46, 13E51a); chem, genet (61S51b); daughter Zr^{95} (62H49, 17B51a, 20J51, 61S51b); parent Nb^{95} (61S51b, 19L51)			
Nb^{95}	35 d (13E51b, 10C53a); 37 d (20J51)	☢	β^- (39G51);	β^-	0.158 spect (average of 29F52, 5S52, 5S53a, 88S51b, 62H49, 17N51a, 73D55, 18Z54, 44A56, 10C53a, 200S53); 0.93 (~1%) spect (73D55); others (26M48b);	Q_{β^-} 0.923 (SHS); see Tc^{95}
		A	chem (39G46, 39G51); chem, excit, cross bomb (20J51); daughter Zr^{95} (62H49, 17B51a, 61S51b); daughter Nb^{95} (61S51b, 19L51)	γ	γ_1 0.765 scint spect, spect, spect conv (average of 36J56, 73D55, 18Z54, 44A56, 10C53a, 5S52, 5S53a, 62H49, 29F52, 200S53, 154M53, 153M54); γ_1 (e_K/γ 1.9×10^{-3}, K/L 7.4) spect conv (73D55); γ_1 (e/γ 2.1×10^{-3}, K/L+M 2.4) spect, spect conv (172S54); γ_1 (e/γ 1.6×10^{-3}, K/L 4) spect conv (29F52); others (17N51a, 11R47, 26M53, 130B57); see also gammas of Tc^{95}	
Nb^{96}	23.35 h (29K49a); 22.9 h (76B51)	☢	β^- (29K49a);	β^-	0.750 (92%), 0.37 (8%) spect (4P51); 0.686 (92%), 0.37 (8%) spect (31J52);	Q_{β^-} 3.13 (64K54); see Tc^{96}
		A	chem, excit, sep isotopes (29K49a)	γ	0.216 (7%, e/γ <23 x 10^{-3}), 0.238 (10%, e/γ <16 x 10^{-3}), 0.451 (27%, e/γ 4 x 10^{-3}), 0.560 (61%, e/γ 1.7 x 10^{-3}), 0.770 (100%, e/γ 1.2 x 10^{-3}), 0.804 (6%, e/γ 1.3 x 10^{-3}), 0.840 (16%, e/γ 1.2 x 10^{-3}), 1.078 (52%, e/γ 0.5 x 10^{-3}), 1.187 (32%, e/γ 0.3 x 10^{-3}) spect conv, spect (4P51); 0.455, 0.545, 0.745, 0.9, 1.05, 1.1 spect, spect conv (31J52); see also gammas of Tc^{96} and Mo^{96}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{41}Nb^{97m}$	60 s (50B50a)	☢	IT (50B50a);	γ	0.747 (e/γ 0.015, K/L ≥4) spect, spect conv, β-γ coinc, γ-γ coinc, β-conv coinc (50B50a); 0.750 (e_K/γ 0.014) spect, spect conv (88S56); 0.75 scint spect (165S55)	Q_{IT} 0.747 (SHS)
		A	chem, excit, sep isotopes, genet (50B50a); daughter Zr^{97} (50B50a); parent Nb^{97} (165S55)			
Nb^{97}	72.1 m (26M52); 74 m (50B50a); 75 m (2G40)	☢	β⁻ (2G40);	β⁻	1.27 spect (50B50a, 76D57, 76D56a); 1.18 spect (88S56); 1.35 abs (75S49); 1.4 abs (32K51b, 26M52);	Q_{β^-} 1.94 (64K54)
		A	chem, genet (2G40); daughter Nb^{97m} (165S55); others (42S40, 42H47, 12P48, 22E52)	γ	0.665 (e/γ 0.0015) spect, spect conv (50B50a); 0.666 (e_K/γ 0.0025) scint spect, spect, spect conv (88S56); 0.66 (†100), 1.02 (†1) scint spect (40N56); 0.67 (coinc with 1.27 β⁻) β-γ coinc, scint spect (76D57); others (44M53b, 26M52, 165S55)	
Nb^{98}	26 m (30P58); 80 m (76B49b)	☢	β⁻ (76B49b);			
		E	chem, sep isotopes (76B49b)			
Nb^{99}	3.8 m (30P58); 2.5 m (23D50)	☢	β⁻ (23K50);	β⁻	3.2 abs (23D50)	
		B	chem, excit, sep isotopes (23D50); daughter Zr^{99} (30P58)			
$_{42}Mo^{90}$	5.7 h (43D53); 6.4 h genet (108K55)	☢	β⁺, EC (73M55a);	β⁺	1.2 scint spect (73M55a); 1.4 abs (43D53);	Q_{EC} 2.5 (94W55); see Nb^{90}
		A	chem, genet (43D53, 73M55a); parent Nb^{90} (43D53, 73M55a); parent Nb^{90m} (73M55a)	γ	γ_1 0.120 (with Nb^{90m}), γ_2 0.25, γ_1 and γ_2 not coinc with β⁺ or with each other, scint spect, γ-γ coinc (73M55a); γ_2: $t_{1/2}$ ~0.015 s (73M55a); others (43D53); see also gammas of Nb^{90m} and Nb^{90}	
Mo^{91m}	66 s (30K53, 29A55); 64 s (72P57); 73 s (25W48); 75 s (23D49)	☢	IT ~57%, β⁺, EC (203S56); IT ~70%, β⁺, EC (29A55);	β⁺	2.48, 2.78, 3.99 spect (203S56); 2.6 abs (23D49);	Q_{IT} 0.658, Q_{EC} 5.12 (SHS) see Nb^{91}
		B	chem, sep isotopes (23D49); others (22E52, 6H37, 30B52, 30B53)	γ	γ_1 0.658 (with IT, γ/β⁺ 1.4, e/γ 0.055, not coinc with β⁺), γ_2 1.54 (†100, coinc with 2.48 β⁺, not coinc with γ_3), γ_3 1.21 (†68, coinc with 2.78 β⁺), scint spect β-γ, γ-γ coinc, spect conv (203S56); γ_1 0.65 (~70%), γ_2 1.55 (weak), γ_3 1.22 (weak) scint spect (29A55); γ_1 0.65 (†100, not coinc with β⁺), γ_2 1.50 (†39, coinc with β⁺, not coinc with γ_3), γ_3 1.20 (†39, coinc with β⁺) scint spect, β-γ, γ-γ coinc (72P57)	
Mo^{91}	15.5 m (23D49, 25W48, 30K53); 15.7 m (29A55); 17 m (29K49, 37B39, 42S38)	☢	β⁺ (42S38);	β⁺	3.44 spect (203S56); 3.32 abs (30K53); 3.3 scint spect (72P57); others (42S40, 23D49);	Q_{EC} 4.46 (203S56)
		A	excit (37B37a); chem, excit (42S38); chem, sep isotopes, excit (29K49, 23D49); others (22E52, 6H37, 30B52)	γ	no γ (23D49, 29A55, 203S56)	
Mo^{92}	$t_{\beta\beta}$ >4 x 10^{18} y sp act (96W55)	%	15.86 (9W46);			
		μ	~0 atomic spect (87M50)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{42}Mo^{93m}$	6.95 h (76B52b); 6.75 h (29K50a)	☢	IT (29K50a);	γ	γ_1 0.264 (K/L+M 2.8), γ_2 0.685, γ_3 1.479 spect conv (13A53b);	Q_{IT} 2.428 (13A53b)
		A	chem, excit (29K46); chem, excit, cross bomb, sep isotopes (29K50a); chem, excit (76B52b); chem, mass spect (13A53b, 201B53); not daughter Tc^{93} (76B50a); others (37W46, 23D49, 30K53a, 8J54)		γ_1 0.262 (K/L 3.1), γ_2 0.684 (e_K/γ 1.5 x 10^{-3}), γ_3 1.479 (e_K/γ 2.4 x 10^{-4}) spect conv (64F53); γ_1 (↑60), γ_2 (↑100), γ_3 (↑100) scint spect (76B52b); γ_1 (e/γ 9), γ_2 (e/γ 5 x 10^{-3}), γ_3 (e/γ ~0) abs, abs conv, spect conv, conv-γ coinc (29K50a); γ_1 coinc with γ_2 and γ_3, γ_2 coinc with γ_3, γ-γ coinc (58K53b); others (77L54, 19R51, 85S51)	
Mo^{93}	>2 y (76B49)	☢	EC (76B49);	γ	Nb K-x (76B49)	
		B	chem, n-capt (76B49)			
Mo^{94}		%	9.12 (9W46);	γ	Coulomb excitation (in Mo^{94}): 0.87 ($t_{1/2}$ 1.9 x 10^{-12} s) scint spect (27T56a); 0.87 ($t_{1/2}$ 2.0 x 10^{-12} s) scint spect (121S57b); others (9V55); see also gammas of Nb^{94} and Tc^{94}	see Tc^{94} and Nb^{94}
		μ	~0 atomic spect (87M50)			
Mo^{95}		%	15.70 (9W46);	γ	Coulomb excitation (in Mo^{95}): 0.204 scint spect (27T56a); 0.203 ($t_{1/2}$ 7.6 x 10^{-10} s) scint spect (52M58, 121S55a); 0.199 scint spect (141M55); 0.210 scint spect (41A56)	see Nb^{95} and Tc^{95}
		I	5/2 atomic spect (97W54, 87M50); 5/2 paramag res (20O56); 7/2 atomic spect (88M55b);			
		μ	-0.9290 nucl induct (61W53, 67K56)			
Mo^{96}		%	16.50 (9W46);	γ	Coulomb excitation (in Mo^{96}): 0.78 ($t_{1/2}$ 3.1 x 10^{-12} s) scint spect (27T56a); 0.78 ($t_{1/2}$ 3.4 x 10^{-12} s) scint spect (121S57b); see also gammas of Nb^{96} and Tc^{96}	see Nb^{96} and Tc^{96}
		μ	~0 atomic spect (87M50)			
Mo^{97}		%	9.45 (9W46);	γ	Coulomb excitation (in Mo^{97}) (52M58)	
		I	5/2 atomic spect (97W54, 87M50); 5/2 paramag res (20O56); 7/2 atomic spect (88M55b);			
		μ	-0.9485 nucl induct (61W53, 67K56)			
Mo^{98}		%	23.75 (9W46);	γ	Coulomb excitation (in Mo^{98}): 0.79 ($t_{1/2}$ 3.5 x 10^{-12} s) scint spect (27T56a); 0.78 ($t_{1/2}$ 3.6 x 10^{-12} s) scint spect (121S55a, 121S57b)	
		μ	~0 atomic spect (87M50)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{42}Mo^{99}$	66.0 h (117G57); 67.0 h (109W57); 67 h (13S39); 68.3 h (10C49); 63.5 h (25W48); 64 h (42S40)	☢	β^- (42S38);	β^-	1.18 (83%), 0.80 (3%), 0.41 (14%) spect, β-γ coinc (77L54a); 1.23 (~80%), 0.45 (~20%), ~0.08 (weak) (?) spect (2B50a); 1.23 (87%), 0.54 (13%) spect (62M51); 0.87 (~1%) scint spect, β-γ coinc (19V54a); others (54M51, 32K51c);	Q_{β^-} 1.38 (64K54)  (19V54a, 77L54a, SHS)
		A	chem, n-capt, excit (42S38, 42S40); parent Tc^{99m} (13S39, 24S40, 62M49, 33G51e); others (14E46, 61M47, 2S47, 26M48c, 22E52, 37L50, 13P47, 11G49, 66B51, 7N49a, 16H39d, 72B51, 21T51, 16H39e, 32K48, 28F51)	γ	γ_1 0.041 (coinc with γ_2), γ_2 0.140, γ_3 0.181, γ_4 0.372 (coinc with 0.87 β^-), γ_5 0.74 (coinc with γ_1, γ_2, and γ_3) scint spect, β-γ, γ-γ coinc (19V54a); γ_1 0.040, γ_3 0.181 (K/L 5), γ_4 0.367 (†10), γ_5 0.741 (†100), γ_6 0.780 (†14) spect, spect conv (2B50a); 0.745 (†100), 0.780 (†50), 0.850 (†30) spect (54M51); γ_5 and γ_6 coinc with 0.41 β^-, γ_4 coinc with 0.80 β^-, scint spect, β-γ coinc (77L54a); γ_2 (†880), γ_3 (†100), γ_4 (†11), γ_5 (†100), γ_6 (†11) scint spect (112C54a); γ_2 and γ_3: $t_{1/2}$ 3.5 x 10^{-9} s delay coinc (59L55); γ_1 (e/γ ~30), γ_2 (e/γ ~0.6) β-γ, γ-γ coinc, scint spect (77L54a); $\gamma_2 + \gamma_3$ (72%) scint spect (10M57); with Tc^{99m}: 0.0018, 0.140 (62M49, 62M51); metastable state in Mo^{99}: γ 0.098 ($t_{1/2}$ 1.6 x 10^{-5} s) scint spect, Mo^{100} (γ, n) (18V56, 18V56a); see also gammas of Tc^{99m}	
$\underline{Mo^{100}}$	$t_{\beta\beta} \geq 3 \times 10^{17}$ y sp act (96W55); others (59F52)	%	9.62 (9W46);	γ	Coulomb excitation (in Mo^{100}): 0.528 ($t_{1/2}$ 1.0 x 10^{-11} s) scint spect (27T56a); 0.530 ($t_{1/2}$ 1.1 x 10^{-11} s) scint spect (121S55a, 121S57b); others (141M55, 41A56)	 (SHS)
		μ	~0 atomic spect (87M50)			
Mo^{101}	14.61 m (8O57); 14.6 m (3M41, 38W54); 14 m (16H41b)	☢	β^- (42S40);	β^-	2.23 scint spect (8O57); 2.2, 1.6, 1.2, 0.8, 0.7, 0.6 β-γ coinc (140M56a); 2.2 (70%), 1.2 (30%) abs (38W54); others (31R52, 3M41, 42S40);	
		A	chem, n-capt (42S40); others (42S40b, 2S47, 50H51); parent Tc^{101} (42S40b, 37B41, 16H41, 16H41b, 3M41)	γ	0.080, 0.191 (e_K/γ 0.30), 0.510, 0.590, 0.704, 0.890, 1.02, 1.18, 1.56, 2.08, other γ's, scint spect, β-γ, γ-γ coinc (140M56a); 0.191 (K/L ~6), 0.960 (coinc with 1.2 β^-) spect conv, scint spect, β-γ, γ-γ coinc (31R52); 0.083, 0.193, 0.403, 0.515, 0.585, 0.71, 0.90, 1.02, 1.19, 1.54, 1.68, 2.08 scint spect (8O57); others (38M51a); 0.191 γ: $t_{1/2}$ 9.1 x 10^{-4} s delay coinc (140M56a)	
Mo^{102}	11.5 m (65F54); 12 m (16H41); 11 m (76B49a)	☢	β^- (16H41);			
		D	chem (16H41); parent Tc^{102} (16H41, 16H41b)			
Mo^{105}	<2 m (65F55, 65F56); ~5 m (66S47)	☢	β^- (70B43b);			
		D	chem, genet (70B43b); ancestor Ru^{105} (70B43b)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{43}Tc^{92}$	4.3 m (76B52c)	☢ β^+, EC (76B52c); D chem, sep isotopes (61M48)	β^+ 4.1 abs (76B52c); γ 1.3 abs (61M48)	
Tc^{93m}	43.5 m (62M50, 36E53a); 47 m (29K48a)	☢ IT ~80%, EC ~20% (77L54); A chem, excit, sep isotopes (29K48a); mass spect (201B54); chem, mass spect (77L54)	γ with IT: 0.390 (e_K/γ 0.31, K/L+M 5.8) spect, spect conv (36E53a); 0.389 spect, spect conv (62M50); with EC: 2.7 scint spect (77L54); others (29K48a)	Q_{IT} 0.390 (SHS) 
Tc^{93}	2.75 h (29K48a); 2.7 h (61M48, 5D39)	☢ EC 88%, β^+ 12% (152S54); EC 87%, β^+ 13% (77L54); EC 93%, β^+ 7% (29K48a); A chem (13S39); chem, excit, sep isotopes (29K48a); not parent Mo^{93m} (76B50a)	β^+ 0.800 spect (76B51a); 0.82 (†8), 0.64 (†4) spect, β-γ coinc (77L54); γ 1.35 (γ/β^+ 5), 1.50 (γ/β^+ 2.5), 2.0 (γ/β^+ 0.4) scint spect (77L54); others (29K48a, 61M48); see also gammas of Mo^{93m}	Q_{EC} 3.17 (SHS); see Mo^{93}
Tc^{94}	53 m (62M50); 50 m (61M48a)	☢ β^+ ~75%, EC ~25% (62M50); B chem, excit (42G47); chem, excit, sep isotopes (61M48a); daughter Ru^{94} (12V52); others (34H48)	β^+ 2.41 (coinc with γ) spect, β-γ coinc (62M50); 2.5 abs (61M48a); γ 0.874 (e/γ ~10^{-3}), 1.85, 2.73, 3.27 spect, spect conv (62M50); 0.9 abs (61M48a); see also gammas of Nb^{94} and Mo^{94}	Q_{EC} 4.32 (64K54); see Nb^{94} 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{43}Tc^{95m}$	60 d (62M50); 52 d (14E47); 62 d (12C39)	☢	EC 96+%, IT ~3%, β^+ ~0.4% (62M50, 62M50a);	β^+	0.68, 0.46 spect (77L57a); 0.4 cl ch (62M50);	Q_{IT} 0.039 (62M50a)  (62M50, 62M50a, 2U57, SHS)
			β^+/EC 0.013 (2U57);	γ	0.03896 (with IT), 0.2042 (†70, coinc with 0.584 γ and 0.838 γ), 0.584 (†40), 0.768 (with Tc^{95} and/or Tc^{95m}), 0.788, 0.838 (†25), 1.04 (†3) spect conv, scint spect, γ-γ coinc (2U57); γ_1 0.810 (†30, e/γ 0.001), γ_2 0.201 (†70, e/γ 0.036), γ_3 0.570 (†40, e/γ 0.002), γ_4 1.02 (†3) spect, spect conv, γ-γ coinc (62M50); 0.0390 (IT) spect conv (62M50a); 0.80, 0.20, 0.58, 1.03 scint spect (76B51a); others (14E47, 61M48b); see also gammas of Nb^{95} and Mo^{95}	
			β^+ ~0.1% (77L57a);			
		A	chem (12C37, 12C39); chem, sep isotopes (61M48b); others (14E46)			
Tc^{95}	20.0 h (1E48); 20 h (61M48a)	☢	EC (1E48); no β^+ (62M50);	γ	0.762 (~90%), 0.932 (~5%), 1.071 (~5%) spect conv, γ-γ coinc (62M50); 0.76, 1.07, no 0.93 γ scint spect (76B51d); others (1E48); see also gammas of Nb^{95}	Q_{EC} 1.73 (77L57)
		A	chem, sep isotopes (1E48, 61M48a)			
Tc^{96m}	51.5 m (62M50); 52 m (36E53a)	☢	IT (62M50);	γ	0.0344 (K/L 1.2) spect conv (62M50, 36E53a); Tc K-x (62M50)	Q_{IT} 0.034 (62M50); see Nb^{96}  (62M50, 76B51a, 62M52, SHS)
			β^+ ~0.01% spect (36E53a);			
		B	chem, excit (62M50); chem, excit, sep isotopes (62M52)			
Tc^{96}	4.20 d (31C50); 4.35 d (62M50); 4.2 d (61M48b); 4.3 d (14E47)	☢	EC (61M48b); no β^+ (62M50);	γ	1.119 (†17, e/γ 3 x 10^{-4}), 0.842 (†100, e/γ 6 x 10^{-4}), 0.806 (†82, e/γ 6 x 10^{-4}), 0.771 (†100, e/γ 6 x 10^{-4}), 0.312 (†0.5, K/L 6.4) spect, spect conv, γ-γ coinc (62M50); 1.65, 1.89, 2.39 (?) (all weak) scint spect (76B51a); see also gammas of Nb^{96} and Mo^{96}	
		A	chem (15E39); chem, excit, cross bomb (14E47); chem, excit, sep isotopes (61M48b); others (13S39)			
Tc^{97m}	91 d (76B54, 2H41); 90 d (61M48b); 95 d (14E47)	☢	IT (2H41, 14E47);	γ	0.0965, no other γ spect conv (2U57); 0.0958 (K/L+M 1.6) spect conv (62M50); 0.0992 (K/L ~1), 0.0902 (K/L ~1) spect conv, scint spect (10C55a); 0.095 (K/L+M 1.7) spect conv (76B54); others (2H41, 61M48b, 14E47)	Q_{IT} 0.097 (SHS)  (SHS)
		A	chem (22P37, 12C37); chem, genet (61M47b); excit, sep isotopes (61M48b); daughter Ru^{97} (0.04%) (113W58); daughter Ru^{97} (61M47b); others (12C39)			
Tc^{97}	2.6 x 10^6 y yield (113W58); 10^4-10^5 y yield (76B54)	☢	EC (76B54);	γ	Mo K-x (76B54)	
		A	genet (76B51b); [daughter Tc^{97m}] (76B51b); daughter Ru^{97} (99.96%) (113W58)			
Tc^{98}	1.5 x 10^6 y sp act (8O56b); ~10^4 y yield (32K55)	☢	β^- (32K55);	β^-	0.30 scint spect (32K55);	Q_{β^-} 1.69 (SHS) 
		A	chem, mass spect (76B55); others (78L53, 147H54, 68A55, 69A56)	γ	0.65 (†100, coinc with 0.30 β^- and 0.76 γ), 0.74 (†100, coinc with 0.30 β^-) scint spect, β-γ, γ-γ coinc (32K55); 0.66 (coinc with 0.75 γ), 0.75 scint spect (76B56); see also gammas of Rh^{98} and Ru^{98}	

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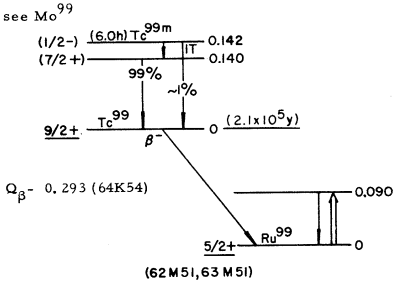
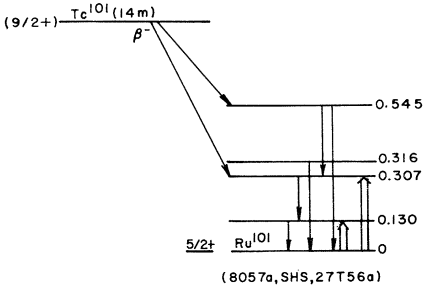
$_{43}Tc^{99m}$	6.04 h (1B53); 5.9 h (33G51e); 6.6 h (13S39)	☢ IT (13S39); A chem, genet (13S39); daughter Mo^{99} (13S39, 24S40, 62M49, 33G51e, 63M51); parent Tc^{99} (13S39, 16H41); others (72B51)	γ 0.1403 (K/L 7.7, L_I/L_{III} >10), 0.1423 (K/L ~2.5) spect conv (63M51, 63M52a); 0.1405 cryst spect (137C57a); 0.1412 (e/γ 0.11, K/L 7.9), 0.0018 (e/γ very large) spect conv (62M49, 62M51); 0.00215 ($M_I/M_{II}+M_{III}/M_{IV}+M_V$ = 3/3/1) spect conv (3F57); 0.140 (K/L ~9) spect, spect conv (2B50a); 0.139 (K/L ~10) spect conv (54M51); others (135B53, 34L56, 34L56b)	Q_{IT} 0.142 (63M51); see Mo^{99} 
Tc^{99}	2.12 x 10^5 y sp act (30F51); 2.2 x 10^5 y sp act (26P51)	☢ β⁻ (25L51, 53S51a); A chem (25L46, 53S46); chem, mass spect (3I47); daughter Tc^{99m} (13S39, 16H41); descendant Mo^{99} (61M47); I 9/2 atomic spect (48K53, 48K51); μ (ground state) + 5.657 nucl induct (67K56, 61W53); μ 0.181 level of Tc^{99}: +4.8 (assuming I = 5/2) ang corr attenuation (81R57); q +0.3 (?) atomic spect (48K53)	β⁻ 0.290 spect (15F52); 0.292 spect (23T51); 0.296 spect (39W52); 0.30 spect (24K50a); γ no γ (61M47, 53S51a, 30F51); $t_{1/2}$ of 0.181 level of Tc^{99}: $t_{1/2}$ 3.5 x 10^{-9} s delay coinc (59L55)	
Tc^{100}	15.8 s (76B52); 17.5 s (64H52)	☢ β⁻ (64H52); A sep isotopes (64H52); sep isotopes, n-capt (76B52)	β⁻ 3.38, 2.88, ~2.2 scint spect, β-γ coinc (8O58); 2.8 abs (76B52); 2.4 abs (64H52); γ 0.542 (strong, coinc with 0.60 γ), 0.60 (strong), 0.71, 0.81, 0.89, 1.01, 1.14, 1.31, 1.49, 1.8 scint spect, γ-γ coinc (8O58); 0.55 scint spect (76B52c); see also gammas of Ru^{100} and Rh^{100}	Q_{β^-} 3.38 (8O58); see Rh^{100}
Tc^{101}	14.0 m (8O57, 3M41, 16H41b); 14.3 m (38W54); 14.5 m (12P48); 16.5 m (60M48)	☢ β⁻ (42S40b); A chem, genet (42S40b); daughter Mo^{101} (37B41, 16H41, 16H41b, 3M41, 42S40b); others (61M48, 12P48, 22E52)	β⁻ 1.32 (coinc with 0.307 γ), 1.07 (coinc with 0.545 γ) scint spect, β-γ coinc (8O57); 1.20 (>95%) abs, β-γ coinc (76B51d); 1.3 abs (average of 38W54, 42S40, 3M41); γ 0.127 (†0.8), 0.130 (†2.6), 0.183 (†0.4), 0.186 (†2.3), 0.235 (†0.8), 0.307 (†100), 0.385 (†1.8), 0.41 (†0.4), 0.545 (†8), 0.64 (†1), 0.72 (†1.2), 0.85 (†0.36), 0.94 (†0.25) scint spect, γ-γ coinc (8O57, 8O57a); 0.307 (coinc with β⁻, K/L ~6), no 0.56 γ spect conv, β-γ coinc, scint spect (31R52); 0.30 (coinc with β⁻), 0.56 (weak) scint spect, β-γ coinc (76B51a); others (38M51a, 38W54); see also gammas of Ru^{101}, Mo^{101}, and Rh^{101}; 0.191 level of Tc^{101}: $t_{1/2}$ 9.1 x 10^{-4} s delay coinc (140M56a)	Q_{β^-} 1.62 (8O57a) 
Tc^{102}	5 s (65F54); others (76B49a, 16H41)	☢ β⁻ (16H41); C chem, genet (16H41, 65F54); daughter Mo^{102} (16H41, 16H41b, 76B49a, 65F54)	β⁻ 4.4 abs (65F55a, 65F56)	
Tc^{102}	4.5 m (65F54, 65F57)	☢ β⁻ (65F56); B chem, genet energy levels (65F56, 65F57)	β⁻ ~2 abs (65F56); γ 0.47 scint spect (65F57); see also gammas of Rh^{102}	
Tc^{103}	1.2 m (65F57)	E excit (65F57)		

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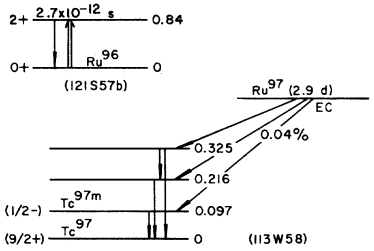
$_{43}Tc^{104}$	18 m (65F56)	☢ β^- (65F56); D chem (65F56)	β^- ~3.0 abs (65F56)	
Tc^{105}	10 m genet (65F55, 65F56)	☢ β^- (70B43b); B chem, genet (70B43b); daughter Mo^{105}, parent Ru^{105} (70B43b, 65F55)		
Tc^{107}	<1.5 m (70B43b)	☢ [β^-] (70B43b); F genet (70B43b); [parent Ru^{107}] (70B43b)		
$_{44}Ru^{93}$	50 s (25A55)	☢ β^+ (?) (25A55); C chem, excit (25A55)		
Ru^{94}	57 m genet (12V52)	☢ EC (12V52); D chem, genet (12V52); parent Tc^{94} (12V52)		
Ru^{95}	1.65 h (204S56, 1E48); 1.7 h (108K55)	☢ EC, β^+ (1E48); A chem, cross bomb, sep isotopes (1E48); others (60M48)	β^+ 1.1 abs (1E48); 1.2 abs (204S56); γ 0.145 (γ/β^+ ~1), 0.340 (γ/β^+ 4), 0.640 (γ/β^+ 0.5), 1.11 (γ/β^+ 1) scint spect (204S56)	
Ru^{96}		% 5.57 (64W56); 5.50 (66F53); 5.7 (16E43)	γ Coulomb excitation (in Ru^{96}): 0.84 ($t_{1/2}$ 2.7 x 10^{-12} s) scint spect (121S57b)	
Ru^{97}	2.88 d (113W58); 2.8 d (25A55a, 23S46, 60M48, 88S56); 2.93 d (76B54a); 2.44 d (10C55a)	☢ EC (23S46); A chem, excit (23S46); chem, cross bomb, sep isotopes (1E48); parent Tc^{97m} (0.04%) (113W58); parent Tc^{97m} (61M47b); parent Tc^{97} (99.96%) (113W58); daughter Rh^{97} (25A55a); others (37L50)	γ γ_1 0.1091 (K/L 3.0, coinc with γ_2), γ_2 0.2161 (K/L 7.3), γ_3 0.3251, γ_4 0.570 spect conv, scint spect, γ-γ coinc (10C55a); 0.220 (†14), 0.325 (†1), 0.565 (weak) scint spect, spect conv (76B54a); 0.219 spect (88S56); others (25A55a, 53M50a, 23S46, 32K57a); see also gammas of Tc^{97m}	
Ru^{98}		% 1.91 (66F53); 1.86 (64W56); 2.2 (16E43)	γ Coulomb excitation (in Ru^{98}): 0.654 ($t_{1/2}$ 5.0 x 10^{-12} s) scint spect (121S57b)	see Tc^{98} and Rh^{98}
Ru^{99}		% 12.7 (64W56, 66F53); 12.8 (16E43); I 5/2 paramag res (97G52); μ -0.6 atomic spect (88M55c, 88M53a)	γ Coulomb excitation (in Ru^{99}): 0.090 scint spect (27T56a); see also gammas of Rh^{99}	see Tc^{99}
Ru^{100}		% 12.7 (66F53, 16E43); 12.6 (64W56)	γ Coulomb excitation (in Ru^{100}): 0.54 ($t_{1/2}$ 2.1 x 10^{-11} s) scint spect (27T56a); 0.54 ($t_{1/2}$ 1.1 x 10^{-11} s), 0.82 (coinc with 0.54 γ) scint spect, γ-γ coinc (121S57a, 121S57b); see also gammas of Rh^{100}	see Rh^{100}

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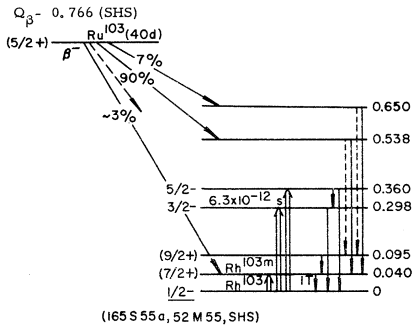
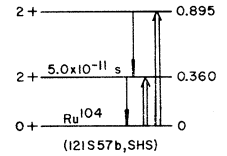
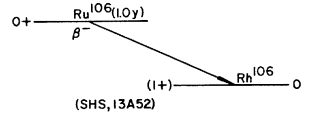
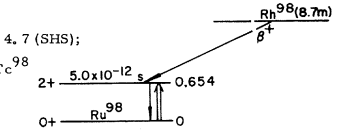
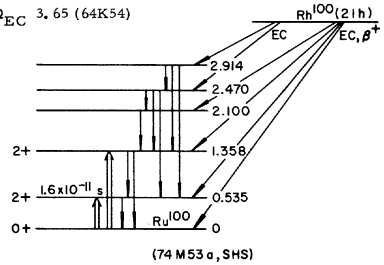
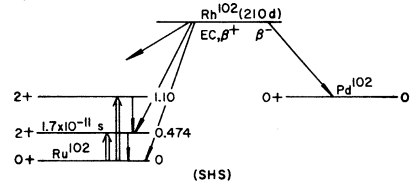
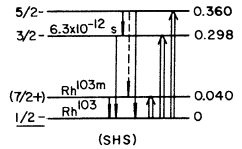
$_{44}Ru^{101}$		%	17.0 (16E43, 66F53); 17.1 (64W56);	γ	Coulomb excitation (in Ru^{101}): 0.127, 0.180, 0.307, 0.52 scint spect (27T56a); see also gammas of Tc^{101}	see Tc^{101}
		I	5/2 paramag res (97G52);			
		μ	-0.7 atomic spect (88M55c, 88M53a)			
Ru^{102}		%	31.5 (66F53); 31.6 (64W56); 31.3 (16E43)	γ	Coulomb excitation (in Ru^{102}): 0.473 ($t_{1/2}$ 1.8×10^{-11} s) scint spect (27T56a); 0.475 ($t_{1/2}$ 1.6×10^{-11} s), 0.625 (coinc with 0.475 γ) scint spect, γ-γ coinc (121S57a, 121S57b); see also gammas of Rh^{102}	see Rh^{102}
Ru^{103}	39.8 d (38K50); 39.5 d (76B54a); 39.7 d (109W57); 42 d (23S51); 41 d (77B45, 15H48)	☢	β^- (5N42);	β^-	0.119 (coinc with 0.61 γ), 0.227 (coinc with 0.495 γ) scint spect, β-γ coinc (89R57); 0.128 (28%), 0.202 (70%), 0.37 (?) (~1%), 0.70 (~1%) spect (51F55); 0.217 (~99%), 0.698 (~1%) spect (38K50, 38K51c); 0.222 (94%), 0.684 (6%) spect (53M50a); 0.205 (strong), 0.670 (weak) spect (79S50); others (15H48, 26M50, 77D54, 38K52, 165S55a, 88S56, 73D55);	Q_{β^-} 0.766 (SHS)  (165S55a, 52M55, SHS)
		A	excit (12L36); chem (5N42, 39G46); chem, excit (23S51, 23S51b); parent Rh^{103m} (23S51b); others (7D38, 37L40, 11G49, 72B51, 21T51, 38G48, 5N41, 39G51a, 28F51, 23S51f, 5N42, 60M48)	γ	0.055, 0.297, 0.323, 0.366, 0.498, 0.610 spect, scint spect (51F55); 0.053 (K/L 1.0), 0.295 (?), 0.499 (K/L 8.5), 0.611 (K/L 4) spect conv (10C52); 0.498 (e_K/γ 0.0054, K/L 6), 0.610 spect conv (73D55); 0.498 (coinc with 0.22 β^-, e/γ ~0.01) spect, spect conv, β-γ coinc (38K50, 38K51c); 0.058 (†4), 0.295 (†~4), 0.357 (†~3), 0.498 (†1000, K/L+M 8), 0.61 (†80, coinc with 0.14 β^-) scint spect, β-γ coinc (77D54); 0.055 (0.5%, coinc with 0.44 γ and 0.56 γ, e_K/γ 1.2), 0.44 (0.5%), 0.495 (90%), 0.56 (0.5%), 0.61 (6%), no 0.30 γ, no 0.365 γ scint spect, β-γ, γ-γ coinc (165S55a); others (28E53, 38K52, 46K52, 53M50a, 26M50, 23E52, 88S56); with Rh^{103m}: 0.040 (38K50, 53M50a, 79S50, 37W45, 10C52, 73D55); see also gammas of Pd^{103}, Rh^{103m}, and Rh^{103}	
Ru^{104}		%	18.5 (64W56); 18.7 (66F53); 18.3 (16E43)	γ	Coulomb excitation (in Ru^{104}): 0.362 ($t_{1/2}$ 4.7×10^{-11} s) scint spect (27T56a); 0.358 ($t_{1/2}$ 5.2×10^{-11} s), 0.535 (coinc with 0.358 γ) scint spect, γ-γ coinc (121S57a, 121S57b); others (52M57)	 (121S57b, SHS)
Ru^{105}	4.5 h (76S51, 23S51d, 23S51a); 4.4 h (77B45); 4.2 h (88S56)	☢	β^- (5N41);	β^-	1.150 spect (23D51); 1.15 spect (90S52, 88S56); others (23S51d, 23S51a, 77B45);	Q_{β^-} 2.005 (64K54)
		A	chem (24S41); chem, excit (23S51c); daughter Tc^{105} (70B43b, 65F55); parent Rh^{105m} (23D51); descendant Mo^{105} (70B43b); ancestor Rh^{105} (5N41, 77B45, 76S51, 23S51c); others (7D38, 12L36, 37L50, 63S52, 13P47, 11G49, 6O48, 72B51)	γ	0.726 (coinc with β^-) spect, β-γ coinc (23D51); 0.728 spect (88S56); 0.265, 0.315, 0.400, 0.48, 0.67, 0.72, 0.87, 0.96 scint spect, γ-γ coinc (80H58b); others (23S51d, 77B45); with Rh^{105m}: 0.130 (e/γ ~3, K/L 1.5) scint spect, spect conv (29A52); see also gammas of Rh^{105m}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{44}Ru^{106}$	1.00 y (53S56); 1.02 y (131M57); 1.0 y (33G51f, 66S46)	☢ β^- (39G51a, 33G51f); A chem (39G46, 33G46a); chem, mass spect (60H48); parent Rh^{106} (33G51f); others (37L50, 11G49, 7N49a, 72B51, 21T51, 38G48, 28F51)	β^- 0.0392 spect (16A50); γ no γ (76S51a, 16A50)	Q_{β^-} 0.039 (SHS) 
Ru^{107}	4 m (33G51g, 70B43b)	☢ β^- (70B43b); D chem (70B43b, 33G51g); parent Rh^{107} (33G51g, 70B43b, 202B55)	β^- ~4 abs (70B43b)	
Ru^{108}	~4 m genet (202B55)	☢ β^- (202B55); E chem, excit (202B55); parent Rh^{108} (202B55)		
$_{45}Rh^{97}$	35 m (25A55a)	☢ β^+ (25A52b); B chem, genet (25A55a); parent Ru^{97} (25A55a)		
Rh^{98}	8.7 m (32K56); 9 m (25A52b)	☢ β^+ (25A52b); B chem, excit (25A52b, 25A53c, 25A55a); daughter Pd^{98} (25A55a, 32K56)	β^+ 2.5 (coinc with 0.65 γ) scint spect, β-γ coinc (32K56); 3.3 abs (25A55a); γ 0.65 scint spect (32K56, 25A55a); see also gammas of Tc^{98} and Ru^{98}	Q_{EC} 4.7 (SHS); see Tc^{98}  see Tc^{99}
Rh^{99}	15.0 d (67F55); 16 d (148H56)	☢ β^+ (67F55); D chem (67F55, 148H56)	γ γ_1 0.086 (K/L 5, coinc with γ_2 and β^+), γ_2 0.353 (coinc with β^+) spect conv, γ-γ coinc (67F55); γ_1 0.088 (coinc with γ_2), γ_2 0.348 scint spect, γ-γ coinc (148H56); see also gammas of Ru^{99}	
Rh^{99}	4.7 h (32K56); 4.5 h (90S52)	☢ EC 90%, β^+ 10% (32K56); B chem (1E49); daughter Pd^{99} (32K56, 25A55a)	β^+ 0.74 spect (90S52); scint spect (32K56); γ γ_1 0.34 (70%, coinc with β^+ and γ_3), γ_2 0.62 (20%), γ_3 0.89, γ_4 1.26, γ_5 1.41 scint spect, γ-γ coinc (32K56); 0.286 spect conv (25F52a)	Q_{EC} 2.10 (32K56)
Rh^{100}	20.8 h (74M53a); 19.4 h (37L48); 21 h (23S51e)	☢ EC ~95%, β^+ ~5% (37L48); B chem (23S51e); chem, genet (37L48); daughter Pd^{100} (37L48)	β^+ 2.62 (†45), 2.07 (†39), 1.26 (†13), 0.54 (†3.6), 0.15 (†0.06) spect (74M53a); 3.0 spect (37L48); γ 0.301, 0.372, 0.442, 0.535, 0.742, 0.823, 1.108, 1.358, 1.557, 1.934, 2.379 spect conv (74M53a); others (37L48, 23S51e); see also gammas of Ru^{100}	Q_{EC} 3.65 (64K54) 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{45}Rh^{101}$	4.7 d (32K56); 4.3 d (67F55, 37L48); 5.9 d (23S51g)	☢ EC (23S51g); B chem, excit (23S51g); daughter Pd^{101} (37L48)	γ 0.144, 0.286 spect conv (25F52a); 0.148, 0.300 spect conv (90S52); 0.31, no 0.148 γ scint spect (32K56); others (67F55, 37L48, 76B54a); see also gammas of Tc^{101} and Ru^{101}	see Tc^{101}
Rh^{101}	5 y (67F55)	☢ D chem (67F55)	γ γ_1 0.125 (coinc with γ_2), γ_2 0.190 scint spect, γ-γ coinc (148H56); γ_1 0.127 (coinc with γ_2), γ_2 0.198 spect conv, γ-γ coinc (67F55); γ_1 (e_K/γ 0.4), γ_2 (e_K/γ 0.7) scint spect, γ-γ coinc (58P56); see also gammas of Tc^{101} and Ru^{101}; others (74M54, 203B55, 8A55, 8A56, 78D55, 98G57)	see Tc^{101}
Rh^{102}	210 d (64M41, 148H56); 215 d (15H47); 220 d (109K54, 67F55)	☢ β^+/β^- 0.84 (74M54); EC, β^+ ~7.5% (8A56, 8A55); A chem, excit (64M41); others (60M48, 22E52, 23S51h)	β^- 1.15 spect (74M54); 1.12 spect (109K54, 67F55); others (15H45, 64M41); β^+ 1.24 (†59), 0.76 (†21), 0.40 (†4) spect (74M54); 1.27 spect (109K54, 67F55); γ γ_1 0.474, γ_2 0.62, γ_3 0.70, γ_4 0.76, γ_5 1.07, γ_6 1.11, γ_7 1.58 scint spect (109K54, 67F55); γ_1 coinc with γ_2 and γ_6, γ_2 coinc with γ_6 scint spect, γ-γ coinc (148H56); γ_1 coinc with γ_2, γ_4, and γ_5; γ_2 coinc with γ_4; γ_3 coinc with γ_6 scint spect, γ-γ coinc (98G57); 0.125 (†50), 0.200 (†60), 0.475 (†80), 0.635 (†30), 0.72 (†10), 0.79 (†10), 1.08 (†60) scint spect (8A56, 8A55); others (78D55, 203B55, 74M54, 58P56); see also gammas of Ru^{102}	Q_{β^-} 1.15, Q_{EC} 2.26 (SHS) 
Rh^{103m}	57 m (33G51f); 58 m (46J56); 56 m (53M50a); 52 m (9F47); 45 m (37W45)	☢ IT (9F44, 37W45); A chem, excit (9F44); chem (33G46a, 33G51f); chem, genet (23S51b); daughter Ru^{103} (23S51b); daughter Pd^{103} (53M50a); others (15H48)	γ 0.0400 (K/L+M 0.2) spect conv, β-γ coinc (38K50, 38K51c, 38K52); 0.0402 (e_K/γ 40, K/L 0.09) spect conv (8A55a); 0.0404 (e/γ very large) spect conv (53M50a); 0.0396 (K/L 0.1) spect conv (10C52); 0.040 (K/L 0.18) spect conv (73D55); others (8A53a, 79S50, 37W45, 9F47, 46J56)	Q_{IT} 0.040 (SHS); see Ru^{103} 
$\underline{Rh^{103}}$		% 100 (57C43); I 1/2 atomic spect (49K50, 87M50); μ −0.0879 nucl induct (162S55)	γ Coulomb excitation (in Rh^{103}): 0.062, 0.298 ($t_{1/2}$ 6.3 x 10^{-12} s), 0.360 scint spect (121S55a, 52M55, 52M58); 0.295, 0.357 scint spect (27T56a); 0.040, 0.325, 0.365 scint spect (46J56); others (41A56, 41A56a); see also gammas of Ru^{103}, Rh^{103m}, and Pd^{103}	

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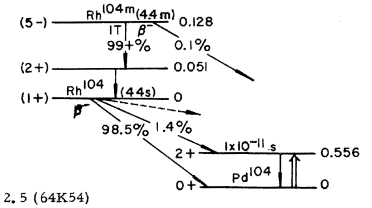
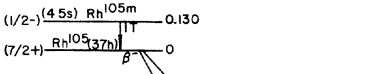
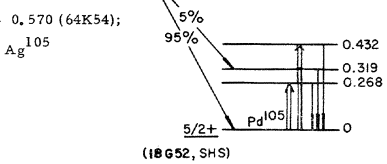
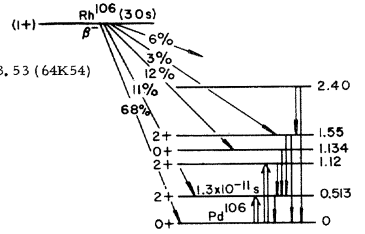
$_{45}Rh^{104m}$	4.4 m (32C39); 4.7 m (38M51); 4.3 m (9F47)	☢	IT 99+%, β^- ~0.1% (2B55a);	γ	0.0511, 0.0772 (K/L ~0.6) spect conv, scint spect, γ-γ coinc (37J53); 0.052 scint spect (38M51); scint spect, ion ch (31K51); 0.051 (e_K/γ 1.9) scint spect (90G53);	Q_{IT} 0.128 (37J53)
		A	n-capt (12A35); parent Rh^{104} (17P38, 9F47); others (1P37, 2S47, 50H51, 42H47, 28A43a)		with β^- and Rh^{104}: 0.556, 0.74, 0.78, ~0.92, ~1.34, 1.53 scint spect, γ-γ coinc (2B55a); others (28A43a, 14O40, 15H47)	 Q_{β^-} 2.5 (64K54) (37 J 53, SHS)
Rh^{104}	44 s (12A35, 17P38)	☢	β^- (17P38);	β^-	2.5 (98.5%), ~1.9 (1.4%), 0.7 (0.08%) spect, β-γ coinc (2B55a); 2.6 spect (15H47); others (18S43, 32C39, 28M40);	
		A	n-capt (12A35); genet (17P38); daughter Rh^{104m} (17P38, 9F47); others (1P37, 2S47, 50H51, 42H47)	γ	γ_1 0.556 (†100, coinc with γ_2), γ_2 1.24 (†5.8) scint spect, γ-γ coinc (2B55a); 0.55, 1.2 (weak) scint spect (37J53); 0.56, 1.1 (weak) scint spect (94M51a); see also gammas of Ag^{104} and Pd^{104}	
Rh^{105m}	45 s (23D51)	☢	IT (23D51);	γ	0.130 (e/γ ~3, K/L 1.5) scint spect, spect conv (29A52); 0.127 spect conv (90S52); 0.133 spect, spect conv (88S56)	Q_{IT} 0.130 (29A52)
		A	chem, genet (23D51); daughter Ru^{105}, parent Rh^{105} (23D51)			
Rh^{105}	36.5 h (23S51c); 37 h (77B45); 34 h (5N41)	☢	β^- (5N41);	β^-	0.570 (~96%), 0.25 (~4%) spect (23D51, 23D51a); 0.560 (~70%), 0.247 (~30%) spect (34L56a, 34L55a); 0.56, 0.26 spect (88S56); others (77L54b, 90S52, 76B52a);	Q_{β^-} 0.570 (64K54); see Ag^{105}
		A	chem, genet (5N41); chem, genet (23S51c); daughter Rh^{105m} (23D51); descendant Ru^{105} (5N41, 77B45, 76S51, 23S51c); others (29K48, 12P48, 72B51, 21T51, 32K48)	γ	0.320, 0.164 (?) spect, spect conv (88S56); 0.322 (~10%, coinc with 0.26 β^-), 0.157 (very weak), 0.080 (?) scint spect β-γ coinc abs (76B52a); 0.310 (e/γ 0.018, ~25%) spect conv, scint spect, β-γ coinc (34L56a, 34L55a); 0.320 (~3%) scint spect (23D51a); others (26M51, 23S51i); see also gammas of Ag^{105} and Pd^{105}	 (18G52, SHS)
Rh^{106}	130 m (172M57); 117 m (202B55a); 138 m (22N55)	☢	β^- (202B55a);	β^-	0.7 abs (202B55a);	
		B	chem, excit (202B55a, 22N55); genet energy levels (172M57)	γ	0.220 (†18), 0.435 (†43), 0.515 (†100), 0.61 (†26), 0.74 (†36), 0.82 (†45), 0.94, 1.07 (†39), 1.23 (†24), 1.38, 1.56 (†39), 2.26 (†1) scint spect (172M57); 0.195, 0.225, 0.51, 0.63, 0.72, 1.06, 1.20, 1.26, 1.50 scint spect (22N55); see also gammas of Pd^{106}, Ag^{106}, and Rh^{106} (30 s)	
Rh^{106}	30 s (33G51f); 40 s (66S46)	☢	β^- (33G51f);	β^-	3.53 (68%), 3.1 (11%), 2.44 (12%), 2.0 (3%), others (6%) spect (13A52); 3.55 (82%), 2.30 (18%) spect (6P47a); 3.5, ~2.3 abs, β-γ coinc (15J49);	
		A	chem, genet (33G46a, 33G51f); daughter Ru^{106} (38G46); others (28F51)	γ	γ_1 0.513 (†100, coinc with γ_2 and γ_4), γ_2 0.624 (†53), γ_3 0.87 (γ_3, coinc with γ_4), γ_4 1.045 (†8), γ_5 1.55 (†2.5), γ_6 1.77 (†1), γ_7 1.96 (†0.6), γ_8 2.10 (†0.5), γ_9 2.37 (†1), γ_{10} 2.66 (†0.2), no 0.22, 0.72, 0.81, 1.21, 1.39, 1.85 γ's scint spect, spect, spect conv, γ-γ coinc (13A52, 13A52e, 13A55); 0.516 (21%), 0.619 (10%), 0.88 (0.3%), 1.04 (1.7%), 1.14 (0.4%), 1.54 (0.2%) 1.76, 2.28, 2.42 scint spect (93K53a); 0.510, 0.622 spect conv (10C52); 0.51 (17%), 0.73 (17%), 1.25 (~1%) spect, β-γ, γ-γ coinc (6P47a); γ_1 (e_K/γ 0.005) spect conv (44M50); others (39A52, 58K53, 88W54, 76L55, 23K53a); see also gammas of Pd^{106}, Ag^{106}, and Rh^{106} (130 m)	Q_{β^-} 3.53 (64K54)  (13A52, SHS)

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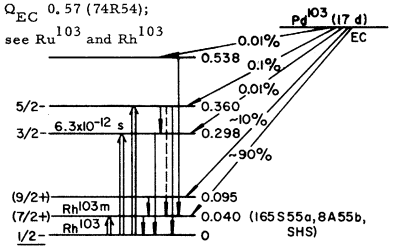
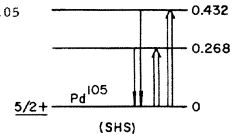
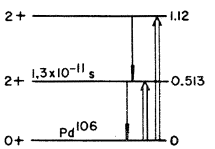
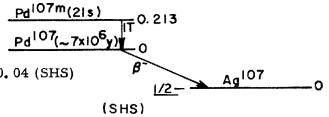
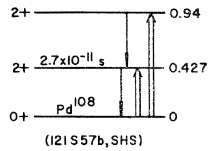
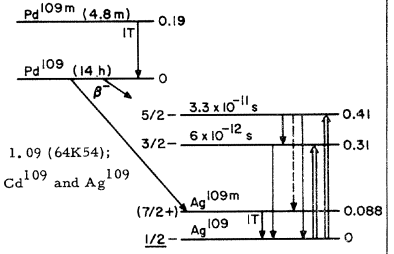
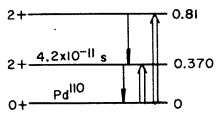
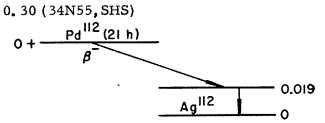
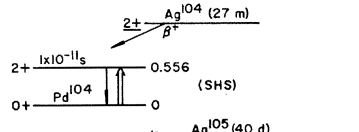
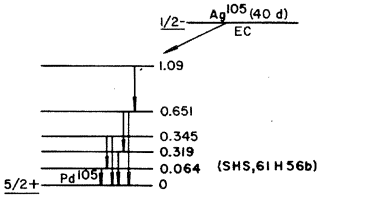
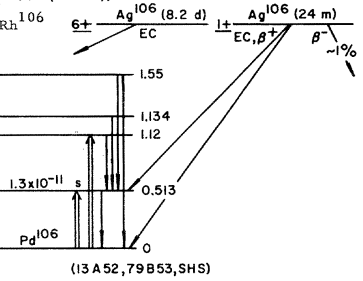
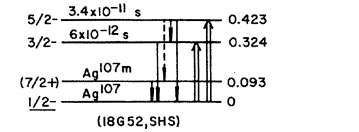
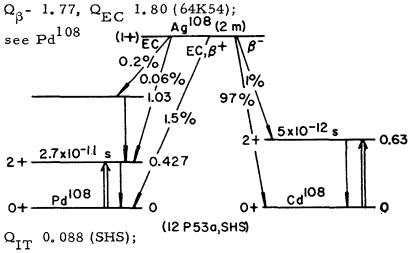
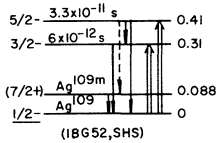
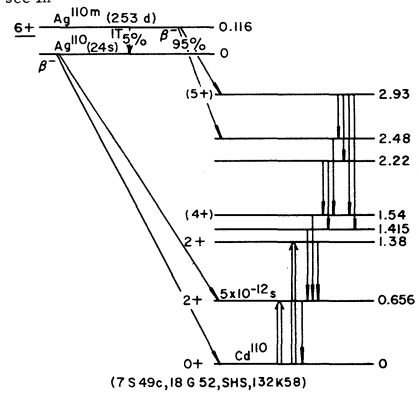
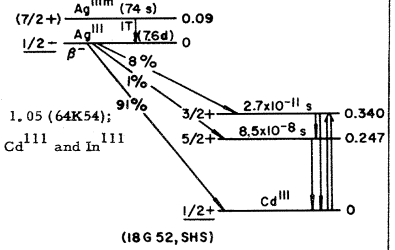
$_{45}Rh^{107}$	24 m (average of 202B55, 22N55, 33G51g, 70B43b)	☢ β^- (70B43b); D chem, genet (70B43b); daughter Ru^{107} (70B43b, 33G51g); others (22E52)	β^- 1.15, ~2 (weak) abs (202B55); 1.2 abs (70B43b); γ 0.305 (†100, coinc with 0.385 γ), 0.385 (†18), 0.570 (†1.6), 0.680 (†3) scint spect, γ-γ coinc (155M56); 0.095, 0.145, 0.305, 0.39, 0.48 scint spect (22N55); 0.32, 0.40, 0.58, 0.68 scint spect (202B55)	
Rh^{108}	18 s (202B55)	☢ β^- (202B55); E chem, genet (202B55); daughter Ru^{108} (?) (202B55)	β^- ~4-5 abs (202B55); γ (202B55)	
Rh^{109}	<1 h (77S51)	☢ [β^-] (77S51); F genet (77S51); [parent Pd^{109}] (77S51)		
$_{46}Pd^{98}$	17.5 m (32K56); 17 m (25A53a)	☢ [EC] (25A53c); B chem, genet (25A53c, 25A55a); parent Rh^{98} (32K56, 25A53c)	γ 0.132 (?) scint spect (25A55a)	
Pd^{99}	21.6 m (32K56); 24 m (25A55a)	☢ β^+ (32K56); B chem, excit (25A55a, 32K56); parent 4.7 h Rh^{99} (32K56, 25A55a)	β^+ 2.0 scint spect, abs (32K56); γ γ_1 0.140 (coinc with γ_2, γ_3, γ_4, and β^+), γ_2 0.275 (coinc with γ_4 and β^+), γ_3 0.420 (coinc with β^+), γ_4 0.67 (coinc with β^+) scint spect, γ-γ coinc (32K56)	Q_{EC} 3.8 (33L57)
Pd^{100}	4.0 d (37L48); 4.1 d (108K55)	☢ EC (37L48); B chem, excit (37L48); parent Rh^{100} (37L48); others (37L50)	γ 0.0807 spect conv (74M53a); 0.09, 1.8 abs (37L48)	
Pd^{101}	8.5 h (32K56); 8 h (37L50); 9 h (1E49)	☢ EC 96%, β^+ 4% (32K56); EC 90%, β^+ 10% (37L48, 1E49); B chem, genet (37L48); parent 4.7 d Rh^{101} (37L48)	β^+ 0.58 scint spect (32K56); 2.3 spect (37L48); 0.5 abs (1E49); γ 0.288 (15%), 0.59 (15%), 0.72, 1.19, 1.28 scint spect, γ-γ coinc (32K56)	Q_{EC} 1.6 (32K56)
Pd^{102}		% 0.96 (205S53); 0.8 (37S36a)		
Pd^{103}	17.0 d (36M47, 48B46a, 11M53)	☢ EC (48B46a); A chem, genet (48B46a); chem, excit (36M47); parent Rh^{103m} (48B46a, 53M50a); daughter Ag^{103} (79H54); others (26O53, 37L48, 78S50, 37L50)	EC internal bremsstrahlung endpoint: 0.51 scint spect (74R54); γ γ_1 0.0402 (†2.1, with Rh^{103m}), γ_2 0.053 (K/L ~1), γ_3 0.065 (†0.04), γ_4 0.298 (†0.3), γ_5 0.324 (†~0.1, e_K/γ ~10, K/L ~10), γ_6 0.362 (†2.1), γ_7 0.498 (†0.5) scint spect, spect conv (8A55a, 8A55b, 8A56); γ_1 (0.1%), γ_3 0.065 (4 x 10^{-3} %, coinc with γ_4), γ_4 0.300 (0.012%), γ_6 0.365 (0.07%), γ_7 0.495 (0.01%) scint spect, γ-γ coinc (165S55a); γ_4 0.305 (0.011%), γ_6 0.367 (0.06%), γ_7 0.503 (0.01%) scint spect (74R54); others (36M47, 53M50a, 145M57); see also gammas of Ru^{103} and Rh^{103}	Q_{EC} 0.57 (74R54); see Ru^{103} and Rh^{103} 

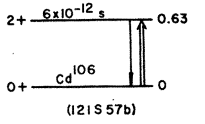
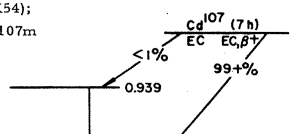
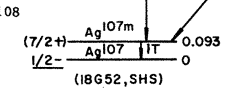
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{46}Pd^{104}$		%	10.97 (205S53); 9.3 (37S36a)	γ	Coulomb excitation (in Pd^{104}): 0.550 ($t_{1/2}$ 1.2 x 10^{-11} s) scint spect (27T56a, 27T55a); 0.555 ($t_{1/2}$ 9.8 x 10^{-12} s) scint spect (121S55a, 121S57b); see also gammas of Rh^{104} and Ag^{104}	see Rh^{104} and Ag^{104}
Pd^{105}		%	22.2 (205S53); 22.6 (37S36a);	γ	Coulomb excitation (in Pd^{105}): 0.266, 0.433 scint spect (27T56a, 27T55a, 27T54); 0.270, 0.430 scint spect (141M55); metastable state in Pd^{105}: γ_1 0.189, γ_2 0.306, γ_1 and γ_2: $t_{1/2}$ 3.7 x 10^{-5} s scint spect, Pd (γ, ?) (18V56, 18V56a); see also gammas of Rh^{105} and Ag^{105}	see Rh^{105} and Ag^{105} 
		I	5/2 atomic spect (99B51, 204B53);			
		μ	-0.57 atomic spect (206S52)			
Pd^{106}		%	27.3 (205S53); 27.2 (37S36a)	γ	Coulomb excitation (in Pd^{106}): 0.510 ($t_{1/2}$ 1.4 x 10^{-11} s) scint spect (27T56a, 27T55a); 0.513 ($t_{1/2}$ 1.2 x 10^{-11} s), 0.607 (coinc with 0.513 γ) scint spect, γ-γ coinc (121S57b, 121S57a, 121S55a, 52M55); 0.50 scint spect (141M55); see also gammas of Rh^{106} and Ag^{106}	see Rh^{106} and Ag^{106} 
Pd^{107m}	21.3 s (156S57a); 23 s (207S58, 9F52a)	☢	IT (9F52a);	γ	0.210 scint spect (207S58); 0.216 (e_K/γ 0.30) scint spect (156S57a)	
		B	excit (9F52a); n-excit, sep isotopes (207S58)			
Pd^{107}	~7 x 10^6 y sp act (26P49a)	☢	β^- (26P49a);	β^-	~0.04 abs (26P49a)	Q_{β^-} ~0.04 (SHS)
		B	chem (26P49a)			
Pd^{108}		%	26.7 (205S53); 26.8 (37S36a)	γ	Coulomb excitation (in Pd^{108}): 0.424 ($t_{1/2}$ 2.8 x 10^{-11} s) scint spect (27T56a, 27T55a); 0.433 ($t_{1/2}$ 2.5 x 10^{-11} s) scint spect (121S55a, 52M55, 52M57, 121S57b); 0.425 scint spect (141M55); 0.508 (coinc with 0.433 γ) scint spect, γ-γ coinc (121S57b, 121S57a); see also gammas of Ag^{108}	see Ag^{108} 
Pd^{109m}	4.75 m (156S57a); 4.7 m (235S57); 4.8 m (9F52a)	☢	IT (31K51, 9F52a);	γ	0.188 (e_K/γ 0.6) scint spect (156S57a); 0.188 scint spect (235S57); 0.170 scint spect (207S58); 0.173 scint spect (31K51); 0.160 (e/γ ~0.6) (9F52a)	
		B	n-capt (31K51); excit, cross bomb, n-capt (9F52a); n-excit, sep isotopes (207S58)			
Pd^{109}	13.5 h (235S57); 13.6 h (11M53); 13.1 h (25W48); 13 h (39K37, 77S51, 38K52); 14.1 h (60M48); 14 h (92D57)	☢	β^- (39K37);	β^-	1.02 spect (96M54); 1.03 spect (235S57); 0.95 spect (7S49b, 38K51c, 38K52); others (2H46, 39K37, 77S51);	Q_{β^-} 1.09 (64K54); see Cd^{109} and Ag^{109}
		A	n-capt (12A35); chem, excit (39K37); chem, mass spect (37R46, 67B49a); others (12P48, 60M48, 25W48, 22E52, 2S47, 9O49, 50H51, 4F38b, 29K47a, 37L50, 11G49, 21T51, 61S48, 32K48); [daughter Rh^{109}] (77S51); parent Ag^{109m} (24S41, 7S49b, 77S51)	γ	0.307, 0.320, 0.325, 0.412, 0.425, 0.448, 0.55, 0.64, 0.77 (all gammas weak) scint spect, γ-γ coinc (235S57); 0.314 (0.02%), 0.412 (0.02%), 0.64 (0.02%), 0.77 (0.02%) (20K57a); 0.305 (0.07%), no 0.410 γ scint spect (47W57); with Ag^{109m}: 0.087 (e/γ >11, K/L+M 1.3) spect conv (7S49b); others (77S51, 70D57a); see also gammas of Ag^{109m} and Cd^{109}	

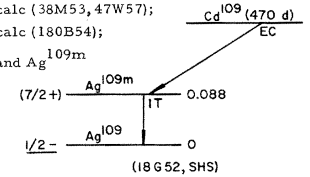
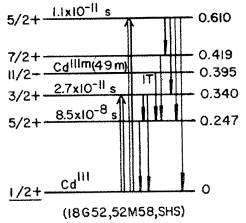
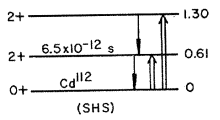
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{46}Pd^{110}$		% 11.8 (205S53); 13.5 (37S36a)	γ Coulomb excitation (in Pd^{110}): 0.370 ($t_{1/2}$ 3.9 x 10^{-11} s) scint spect (27T56a, 27T55a); 0.374 ($t_{1/2}$ 4.5 x 10^{-11} s) scint spect (121S55a, 52M55, 52M57, 121S57b); 0.365 scint spect (141M55); 0.438 (coinc with 0.374 γ) scint spect, γ-γ coinc (121S57b, 121S57a)	 (121S57b, SHS)
Pd^{111m}	5.5 h (66M52, 92D57)	☢ IT 75%, β^- 25% (66M52); A chem, genet (66M52, 92D57); parent Ag^{111} (66M52, 92D57)	γ 0.17 scint spect (66M52, 66M57)	
Pd^{111}	22 m (66M52); 26 m (24S41)	☢ β^- (39K37); A n-capt (12A35); chem, genet (24S41); parent Ag^{111} (39K37, 24S41); parent Ag^{111m} (207S57); others (2S47, 37L50, 5N40a, 92D57)	β^- 2.15 spect (66M52); 3.5 abs (70B43b)	
Pd^{112}	21 h (77S51)	☢ β^- (5N40a); A chem, genet (5N40a, 24S41); parent Ag^{112} (5N40a, 5N40b, 24S41, 77S51); others (37L50, 11G49, 7N49a, 21T51, 32K48)	β^- 0.28 abs, β-γ coinc (34N55); 0.2 abs (77S51); γ 0.0185 scint spect, critical abs (34N55, 34N53b); no γ (77S51)	Q_{β^-} 0.30 (34N55, SHS)  (34 N55, SHS)
Pd^{113}	1.4 m (70A57); 1.5 m (149H54)	☢ [β^-] (149H54); A chem, genet (149H54, 70A57); parent 5.3 h Ag^{113} (149H54, 70A57); parent 1.2 m Ag^{113} (70A57)		
Pd^{114}	2.4 m (70A57)	☢ [β^-] (70A57); D chem, genet (70A57); parent 5 s Ag^{114} (70A57)	γ no γ (70A57)	
Pd^{115}	45 s genet (70A57)	☢ [β^-] (70A57); B chem, genet (70A57); parent 21 m Ag^{115}, parent 20 s Ag^{115} (70A57)		
$_{47}Ag^{102}$	16 m (17E39)	E excit (17E39)		
Ag^{103}	66 m (79H54, 79B53); 59 m (32J55)	☢ β^+, EC (79H54); B chem (79B53); chem, genet (79H54); parent Pd^{103} (79H54)	β^+ 1.3 abs (79H54); γ 0.554 (K/L+M ~5), 0.764 spect conv (79B53)	

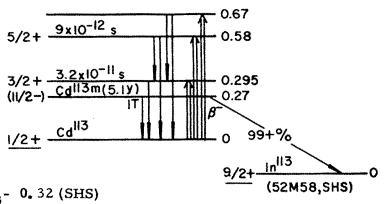
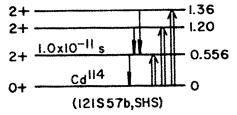
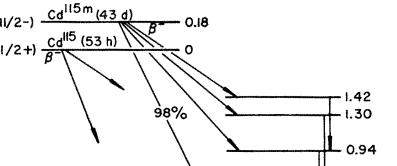
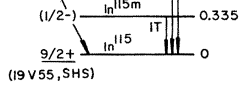
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{47}Ag^{104}$	1.2 h (17E39, 11M52a)	☢ β^+, EC (37L50); B excit (17E39); chem, excit, sep isotopes (11M52a); I 2 (?) atomic beam (65R58)		
Ag^{104}	27 m (32J55)	☢ β^+ (32J55); B chem, genet (32J55); chem, excit, sep isotopes (11M52a); daughter Cd^{104} (32J55); I 2 atomic beam (65R58)	β^+ 2.70 spect (32J55); γ 0.1184, 0.5562 (K/L ~7) spect conv (32J55); see also gammas of Rh^{104} and Pd^{104}	
Ag^{105}	40 d (44G50); 45 d (17E39)	☢ EC (44G50); A excit (17E39); chem, excit (16B47a); others (37L50); I 1/2 atomic beam (208S56)	γ 0.0640, 0.2808, 0.3194, 0.3315, 0.345, 0.393, 0.443 spect conv (32J53); 0.064 (†40, coinc with 0.281 γ), 0.157 (weak), 0.184 (weak), 0.281 (†60), 0.319 (weak), 0.331 (weak, coinc with 0.319 γ), 0.345 (†100), 0.393 (weak), 0.443 (†20, coinc with 0.654 γ), 0.654 (†36) spect conv, scint spect, γ-γ coinc (61H56b); 0.065, 0.117 (?, K/L 1.7), 0.158, 0.185 (K/L 4.2), 0.287 (K/L 5.5), 0.328, 0.351, 0.395, 0.446 (K/L 7.2) spect conv (13A56a); others (53M50b, 17E39, 20D42c, 95R58); see also gammas of Rh^{105} and Pd^{105}	
Ag^{106}	24.0 m (79B51, 79B53); 24.5 m (1P38, 56F52); 24.4 m (2D38); 24.3 m (60M48)	☢ β^+ (39K37); β^+, EC, β^- (?) ~1% (79B53); A excit (37B37a, 6H37); chem, excit (37B37a, 6H37); chem, excit, cross bomb (39K37, 1P38); others (19K39, 16B47a, 17E39, 29K47, 37B39, 60M48, 55S51, 22E52, 59S48, 9K40b); I 1 atomic beam (65R58)	β^+ 1.95 (†89), 1.45 (†11) spect (79B53); 2.0 abs (4F38b); 1.9 cl ch (1P38); β^- 0.36 spect (79B53); γ 0.512 (17%, e_K/γ ~3 x 10^{-3}) spect conv, scint spect (79B53); others (4F38, 1P38); see also gammas of Ag^{106} (8 d)	Q_{EC} 2.98 (64K54); see Rh^{106} 
Ag^{106}	8.2 d (1P38); 8.3 d (44G49); 7.5 d (39K37)	☢ EC (65H44); no β^+ (lim 0.1%) (79B53); A chem, excit, cross bomb (39K37, 1P38); others (16B47a, 2D39, 17E39, 36S51, 37L50); I 6 atomic beam (43E57)	γ 0.22 (K/L 3.2), 0.408, 0.513 (†100, K/L 7.7), 0.624 (†20), 0.72 (†20), 0.805, 1.045 (†30), 1.131 (†10), 1.205, 1.225, 1.388 (†10), 1.53 (†30), 1.72 (†6), 1.85 (†5), 2.10 (†1), 2.63 (†0.3), no 0.87, no 1.96, no 2.41 spect conv, scint spect (13A56a); 0.220, 0.409, 0.511 (K/L 8), 0.620, 0.717, 0.815, 1.04, 1.24, 1.55 spect conv (61H52); others (53M50b, 20D42c); see also gammas of Rh^{106} and Pd^{106}	
Ag^{107m}	44.3 s (16B47, 16B45a); 44 s (40W51)	☢ IT (6A40); A chem, genet (6A40, 2H41b); daughter Cd^{107} (6A40, 2H41b, 16B45c, 2H46, 16B47); others (37W45b, 9F44, 31F41, 24T45)	γ 0.0930 ($L_I/L_{II}/L_{III}$ = 0.2/1/1) spect conv (32J53); 0.094 (e/γ ~16, K/L 0.92) spect conv (16B47); ~0.093 (e_K/γ 10, K/L 0.88) spect conv, scint spect (114B53); others (6V39, 2H41, 96H54)	Q_{IT} 0.093 (32J53); see Cd^{107} 
Ag^{107}		% 51.35 (24W48); I 1/2 atomic spect (87M50); μ -0.11301 nucl induct (173B54); -0.11304 nucl induct (162S54); others (59W53b, 61W53, 87M50)	γ Coulomb excitation (in Ag^{107}): 0.099, 0.324 ($t_{1/2}$ 6 x 10^{-12} s), 0.423 ($t_{1/2}$ 3.4 x 10^{-11} s) scint spect (52M58); 0.318, 0.413 scint spect (27T56a, 97H54a); 0.319, 0.419 scint spect (52F55); ~0.090, 0.323 spect conv, scint spect (94H56, 94H54); others (116B55a, 41A56a, 141M55, 121S55, 52M55)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{47}Ag^{108}$	2.3 m (12A35, 12P48, 60M48, 37B39); 2.4 m (9F44)	☢	β^- 98%, EC 1.6%, β^+ 0.1% (12P53a);	β^-	1.77 (97%) scint spect (12P53a); 1.5 scint spect (45G52);	Q_{β^-} 1.77, Q_{EC} 1.80 (64K54); see Pd^{108}
		A	chem, n-capt (12A35); excit, cross bomb (1P38); others (2D38, 17E39, 2S47, 9O49, 50H51, 36S51, 59S48, 9F44a, 37B39, 22E52, 9K39, 9K40b)	γ	with EC: 0.43 (↑100, coinc with 0.60 γ), 0.60 (↑79) scint spect, γ-γ coinc (12P53a); 0.43 scint spect (45G52); 0.41 scint spect (39J56); with β^-: 0.62 scint spect (12P53a); 0.64 scint spect (39J56); with β^- and EC: 0.61 (2.3%) scint spect (10M57); see also gammas of Pd^{108} and In^{108}	
Ag^{109m}	39.2 s (16B46c, 16B47); 40 s (40W51, 2H41b, 37W45b, 207S57)	☢	IT (2H41b);	γ	0.0875 spect conv (10C50b); 0.0879 spect conv (32J53); 0.0875 (e_{K}/γ 10.3, K/L+M 0.80) scint spect, spect conv (47W54b, 47W57); 0.0877 (e/γ 14, K/L+M 0.84) spect conv (96M54); ~0.087 (e_{K}/γ 12, K/L+M 0.85) spect conv, scint spect (114B53); others (96H54, 8A53b, 34N53b, 38K52, 34H52, 7S49b, 2H46, 16B47, 32K57); see also gammas of Pd^{109} and Cd^{109}	Q_{IT} 0.088 (SHS); see Pd^{109} and Cd^{109}
		A	chem, genet (2H41b); daughter Pd^{109} (24S41); daughter Cd^{109} (2H41b, 16B45c, 2H46); others (9F44, 31F41, 24T45)			
Ag^{109}		%	48.65 (24W48);	γ	Coulomb excitation (in Ag^{109}): 0.107, 0.309 ($t_{1/2}$ 6 x 10^{-12} s), 0.416 ($t_{1/2}$ 3.3 x 10^{-11} s) scint spect (52M58); 0.305, 0.400 scint spect (27T56a, 97H54a); 0.306, 0.412 scint spect (52F55); ~0.090, 0.308 spect conv, scint spect (96H54, 96H56); others (116B55a, 141M55, 41A56a, 121S55, 52M55)	
		I	1/2 atomic spect (87M50);			
		μ	-0.12992 nucl induct (173B54); -0.12996 nucl induct (162S54); others (59W53b, 61W53, 87M50)			
Ag^{110m}	253 d (93G57, 64T57, 32K57); 270 d (44G50, 10C50a); 225 d (12L38d)	☢	β^-, IT (7S49c, 56M50, 10C50a); IT 5%, no EC (K) (lim 0.5%) (26J54); no β^+ (lim 0.002%) (2E49); others (20D47a, 41M51);	β^-	with Ag^{110m} and Ag^{110}: 0.087 (↑58), 0.530 (↑35), 2.12 (↑3), 2.86 (↑3), others (?), spect (7S49c); 0.086, 0.536, 2.87 (not coinc with γ) spect, β-γ coinc (59T56); 0.088 (↑65), 0.520 (↑33), 2.89 (↑2) spect (31A51); 0.080 (↑58), 0.314 (↑16), 0.530 (↑77) spect (71A55, 71A54); others (88S51a, 46M49, 2E49, 11R47);	Q_{β^-} 3.00, Q_{IT} 0.12 (SHS); see In^{110}
		A	chem, n-capt (35R38); resonance neutron activation (18G46c); chem, sep isotopes, n-capt (18G46d); chem, mass spect (67B49a); parent Ag^{110} (56M50); others (35R38, 30A38, 14M38, 2S47, 9K39, 9K40b, 37L50, 65H44a);	γ	0.116 (e/γ very large, K/L 1.3), 0.656 (e/γ 0.0025), 0.676, 0.706, 0.759, 0.814, 0.885, 0.935, 1.389, 1.516 spect conv, spect, β-γ coinc, γ-γ coinc (7S49c); γ_1 0.116 (conv in Ag), γ_2 0.438, γ_3 0.446, γ_4 0.471, γ_5 0.499, γ_6 0.542, γ_7 0.575, γ_8 0.619, γ_9 0.657, γ_{10} 0.677, γ_{11} 0.705, γ_{12} 0.723, γ_{13} 0.764, γ_{14} 0.817, γ_{15} 0.884, γ_{16} 0.937, γ_{17} 1.384, γ_{18} 1.504 spect, spect conv (10C50a); γ_9 coinc with γ_{15}, γ_{16}, and γ_{17}; γ_{15} coinc with γ_{16} and γ_{17}; γ_{18} coinc with γ_9 and γ_{13}, γ-γ coinc (17J52b); 0.116 (K/L 2.1), 0.447, 0.618, 0.655 (K/L+M 4.3), 0.687, 0.706 (K/L+M 6.6), 0.740, 0.759 (K/L+M 6.5), 0.815 (K/L+M 4.1), 0.883 (K/L+M 4.2), 0.932 (K/L+M 6.5), 1.386 (K/L+M 6.5), 1.480, 1.506 (K/L+M 4.5) spect conv (31A51, 117B56); γ_3 (↑7), $\gamma_7 + \gamma_8$ (↑~10), γ_9 (↑100), γ_{10} (↑~12), γ_{11} (↑~18), γ_{12} (↑~2), γ_{13} (↑24), γ_{14} (↑~6), γ_{15} (↑75), γ_{16} (↑25), γ_{17} (↑20), γ_{18} (↑13) scint spect, γ-γ coinc (132K58); >1.67 Be-γ-n, D-γ-n (16D56h); others (40K52, 11R47, 5Y49, 52M51, 59T56, 80R55, 71A55, 52B54, 16D56, 181S57); see also gammas of Cd^{110}, In^{110m}, and In^{110}	
		I	6 atomic beam (43E57)			
Ag^{110}	24.2 s (42H46a); 24 s (52B54); 22 s (12A35, 1P38); others (46G36, 9F44, 2S47, 42H47)	☢	β^- (1P38); no EC (K) (lim 10%) (26J54);	β^-	2.16, 2.84 scint spect (52B54); 2.24 (~60%), 2.82 (~40%) scint spect (45G51a); others (39J56); see betas of Ag^{110m};	Q_{β^-} 2.88 (64K54)
		A	n-capt (12A35); sep isotopes, n-capt (9F44a); chem, genet (56M50); daughter Ag^{110m} (56M50)	γ	0.66, 0.72 (weak), 0.81 (weak), 0.88 (weak), 0.94 scint spect (52B54); 0.66, ~0.9 (weak) scint spect (45G51a)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{47}Ag^{111m}$	74 s (207S57); others (80S52)	☢ IT, no β^- (lim 1%) (207S57); B chem, genet (207S57); daughter Pd^{111} (207S57)	γ	~0.087 abs conv (207S57)		
Ag^{111}	7.6 d (61S51c); 7.4 d (68F57); 7.5 d (17J50, 39K37, 1P38); others (29K47a, 42H47, 23D49a, 37L50, 11G49, 7N49a, 6O48, 61S51c, 5N40a, 21T51, 28F51)	☢ A β^- (39K37); chem, excit (39K37); chem, excit, cross bomb (1P38); daughter Pd^{111} (39K37, 24S41, 17J50); daughter Pd^{111m} (66M52, 92D57); I 1/2 atomic beam (98W56, 73L54); μ −0.145 atomic beam (98W56, 98W55); 0.144 atomic beam (73L54); see also μ of Cd^{111}	β^-	1.04, 0.79 (coinc with γ_1), 0.69 (coinc with γ_2) (89R58); 1.04 (91%), 0.80 (1%), 0.70 (8%) spect (17J50); 1.06 spect (66M51, 53M50b); 1.1 (94%), 0.7 (6.5%) abs (78S50); average energy of β^- 0.38 ion ch (195B53);	Q_{β^-} 1.05 (64K54); see Cd^{111} and In^{111}
			γ	γ_1 0.243 (e/γ <0.08), γ_2 0.340 (e/γ ~0.015) (γ_2/γ_1 ~8) spect, spect conv, β-γ coinc, γ-γ coinc (17J50); γ_1: $t_{1/2}$ 1.0×10^{-7} s delay coinc (13E51c); others (66M51a, 78S50); see also gammas of Cd^{111m} and In^{111}	
Ag^{112}	3.20 h (74S51a); 3.2 h (1P38)	☢ A β^- (1P38); chem, excit, cross bomb (1P38); daughter Pd^{112} (5N40a, 5N40b, 24S41, 77S51); others (42H47, 37L50, 21T51)	β^-	4.1 (~25%, not coinc with γ), 3.5 (~40%), 2.7 (~20%), ~1 (~15%) abs, β-γ coinc (34N53b); 4.2 scint spect (27P51a); others (77S51, 74S51a);	Q_{β^-} 4.0 (64K54); see Cd^{112}
			γ	0.618 (†100), 1.10 (†8), 1.39 (†20), 1.62 (†9), 1.83 (†6), 2.11 (†9), 2.51 (†4), 2.79 (†2) scint spect (34N55); others (40A52b, 77S51, 74S51a); see also gammas of Cd^{112}	
Ag^{113m}	1.2 m (70A57)	☢ B β^- (70A57); chem, genet (70A57); daughter Pd^{113} (70A57)	β^-	<2.0 scint spect (70A57);	see Cd^{113}
			γ	0.14, 0.30, 0.39, 0.56, 0.70 scint spect (70A57); see also gammas of Cd^{113}	
Ag^{113}	5.3 h (70A57, 21T47, 23D49a)	☢ A β^- (21T47); chem (21T47); chem, sep isotopes, excit (23D49a)	β^-	2.0 scint spect (27P51a); 2.2 abs (70A57, 21T47); 2.1 abs (23D49a);	Q_{β^-} 2.1 (SHS)
			γ	0.31 (weak) scint spect (70A57); no γ (21T47, 23D49a)	
Ag^{114}	5 s (70A57)	☢ C β^- (70A57); chem, genet (70A57); daughter Pd^{114} (70A57)	β^-	4.6 scint spect (70A57);	see Cd^{114}
			γ	0.57 scint spect (70A57)	
Ag^{114}	2 m (23D49a); 3 m (66S47)	☢ B β^- (23D49a); chem (21T47, 66S47); chem, excit, sep isotopes (23D49a)	β^-	hard β^- (23D49a)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{47}Ag^{115m}$	~20 s (70A57)	☢ [β^-] (70A57); B chem, genet (70A57); daughter Pd^{115}, parent Cd^{115} (70A57)		
Ag^{115}	21.1 m (70A57); 20 m (23D49a, 66S47); 21 m genet (1W52)	☢ β^- (21T47); A chem (21T47, 66S47); chem, excit, sep isotopes (23D49a); parent Cd^{115} (91%), parent Cd^{115m} (9%) (1W52); parent Cd^{115} (92%), parent Cd^{115m} (8%) (149H55)	β^- 2.9 abs (70A57); 3 abs (21T47, 23D49a); γ 0.138 (weak), 0.227 (weak) scint spect (70A57); no γ (23D49a)	Q_{β^-} 2.9 (SHS)
Ag^{116}	2.5 m (70A57)	☢ β^- (70A57); D chem (70A57)	β^- 5.0 scint spect (70A57); γ 0.70, 0.52 scint spect (70A57)	see Cd^{116}
Ag^{117}	1.1 m (70A57)	☢ [β^-] (70A57); B chem, genet (70A57); parent Cd^{117m}, parent Cd^{117} (70A57)		
$_{48}Cd^{104}$	59 m (32J55); ~54 m (108K55)	☢ EC, no β^+ (32J55); B chem, excit (32J55); parent (27 m) Ag^{104} (32J55)	γ 0.0667 (K/L_I 10), 0.0836 (K/L_I/L_{II}/L_{III} = 480/60/2/1), 0.1236, 0.1342 spect conv (32J55)	
Cd^{105}	55 m (32J53); 57 m (44G50)	☢ EC, β^+ (44G50); B cross bomb (44G50); chem, excit (32J53)	β^+ 1.69, ~0.80 (?) spect (32J53); 1.5 abs (32J53); γ 0.0255, 0.0277, 0.2630, 0.2925, 0.3080, 0.312, 0.317, 0.321, 0.325, 0.336, 0.341, 0.347 (K/L ~4), 0.433 (K/L ~4), 0.607, 1.91, 1.96, 2.00, 2.05, 2.28, 2.32 spect conv (32J53)	
Cd^{106}	$t_{\beta\beta} \geq 6 \times 10^{16}$ y sp act (96W55)	% 1.22 (28L48)	γ Coulomb excitation (in Cd^{106}): 0.63 ($t_{1/2}$ 6 x 10^{-12} s) scint spect (121S57b)	
Cd^{107}	6.7 h (5D39)	☢ EC 99+%, β^+ 0.3% (16B45d, 55B50); A chem (5D39); chem, n-capt, sep isotopes (2H46); parent Ag^{107m} (6A40, 2H41b, 16B45c, 2H46, 16B47); others (9K39, 9K40b, 37L50)	β^+ 0.32 spect (16B45d, 16B45e); γ 0.846 (0.4%, e/γ ~10^{-3}) spect, spect conv (16B45d, 16B45e); 0.85 (β^+/γ 0.66) scint spect (94M54); others (2H41); with Ag^{107m}: 0.093 (32J53)	Q_{EC} 1.44 (64K54); see Ag^{107}, Ag^{107m} 
Cd	0.04 s (86L57)	E excit (86L57)		
Cd^{108}		% 0.88 (28L48)	γ Coulomb excitation (in Cd^{108}): 0.63 ($t_{1/2}$ 5 x 10^{-12} s) scint spect (121S57b); see also gammas of Ag^{108} and In^{108}	see Ag^{108} 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{48}Cd^{109}$	470 d (44G50); 330 d (16B46c)	☢	EC (L/K 0.28) (38M53); EC (K) 81% (47W57); EC (L/K 0.32) (180B54); no β^+ (26D51);	γ	with Ag^{109m}: 0.0875 spect conv (10C50b); see also gammas of Pd^{109} and Ag^{109m}	Q_{EC} 0.16 calc (38M53, 47W57); Q_{EC} 0.15 calc (180B54); see Pd^{109} and Ag^{109m}
		A	chem (9K40b); chem, n-capt, sep isotopes (2H46); parent Ag^{109m} (2H41b, 16B45c, 2H46, 16B46c); others (10C50b, 59C51, 37L50, 26O53, 180B55)		0.058 level of Cd^{109}: $t_{1/2}$ 1.2 x 10^{-5} s delay coinc (61P56a); see also gammas of In^{109}	
Cd^{110}		%	12.39 (28L48);	γ	Coulomb excitation (in Cd^{110}): 0.656 ($t_{1/2}$ 4.6 x 10^{-12} s), 0.82 (coinc with 0.66 γ) scint spect, γ-γ coinc (121S57b); 0.654 ($t_{1/2}$ 5.5 x 10^{-12} s) scint spect (27T56a, 27T55a); others (52M57); see also gammas of Ag^{110m} and In^{110}	see Ag^{110} and In^{110}
		μ	~0 atomic spect (87M50)			
Cd^{111m}	48.6 m (66M51); 48.7 m (37W45b)	☢	IT (31F41, 37W45b);	γ	γ_1 0.150 (e/γ ~3, K/L 2.0), γ_2 0.246 (e/γ 0.064, K/L 5.1) spect conv (66M51, 66M51a); γ_1 (e/γ 2.3) (calc from 14S51, 66M51); 0.149, 0.247 scint spect (14S51); others (15H48a, 59L55a, 58K53c, 72A54, 72A53, 72A54, 159H55b, 72A54a, 25A52); γ_2: $t_{1/2}$ 8 x 10^{-8} s delay coinc (20D50, 63B50); see also gammas of Ag^{111} and In^{111}	Q_{IT} 0.395 (SHS); see Ag^{111} and In^{111}
		A	chem (27D38); chem, sep isotopes, n-capt (18G48a); daughter (0.01%) In^{111} (66M51a); others (2H48, 31F41, 37W45b, 24T45, 17J50, 18G48a, 5N40a, 5N40b)			
Cd^{111}		%	12.75 (28L48);	γ	Coulomb excitation (in Cd^{111}): 0.342 ($t_{1/2}$ 2.7 x 10^{-11} s), 0.610 ($t_{1/2}$ 1.1 x 10^{-11} s), 0.250 (coinc with 0.095 γ, 0.172 γ, 0.191 γ, and 0.363 γ), 0.268 (coinc with 0.342 γ) scint spect, γ-γ coinc (52M58, 121S56a, 52M56); 0.340 scint spect (27T55a, 27T56a); 0.33 scint spect (141M55, 41A56); 0.247 level of Cd^{111}: $t_{1/2}$ 8.48 x 10^{-8} s delay coinc (209S57); $t_{1/2}$ 8.41 x 10^{-8} s delay coinc (176M57); see also gammas of Ag^{111}, Cd^{111m}, and In^{111}	
		I	1/2 atomic spect (87M50);			
		μ	(ground state) -0.5922 nucl induct (67K56, 61W53);			
		μ	(0.245 level of Cd^{111}, assuming I = 5/2): -0.78 ang corr attenuation (82S56, 82S55); -0.73 ang corr attenuation (72A53, 72A54, 159H55b, 72A54a, 36A52a); others (49N57)			
Cd^{112}		%	24.07 (28L48);	γ	Coulomb excitation (in Cd^{112}): 0.61 ($t_{1/2}$ 6.2 x 10^{-12} s), 0.69 (coinc with 0.61 γ) γ-γ coinc, scint spect (121S57b); 0.62 ($t_{1/2}$ 6.7 x 10^{-12} s) scint spect (27T56a, 27T55a); 0.61 scint spect (141M55); others (121S57a, 52M57); see also gammas of Ag^{112}	
		μ	~0 atomic spect (87M50)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{48}Cd^{113m}$	5.1 y (60C50)	☢	β^- (60C50); IT weak (38M56);	β^-	0.59 scint spect (59C51); 0.58 scint spect (38M54); others (60C50);	Q_{β^-} 0.59 (SHS); Q_{IT} 0.27 (38M56)
		A	chem, excit, sep isotopes (60C50, 59C51); others (1W52)	γ	0.265 (~0.1%) scint spect (38M56)	
Cd^{113}		☢	12.26 (28L48);	γ	Coulomb excitation (in Cd^{113}): 0.300 ($t_{1/2}$ 3.2 x 10^{-11} s), 0.582 ($t_{1/2}$ 9 x 10^{-12} s), 0.675, 0.282 (coinc with 0.300 γ), 0.375 (coinc with 0.300 γ) scint spect, γ-γ coinc (52M58, 52M56, 121S56a); 0.290 scint spect (27T55a, 27T56a, 141M55); 0.297 scint spect (41A56)	Q_{β^-} 0.32 (SHS)
		I	1/2 atomic spect (87M50);			
		μ	-0.6195 nucl induct (67K56, 61W53)			
Cd^{114}		☢	28.86 (28L48);	γ	Coulomb excitation (in Cd^{114}): 0.555 ($t_{1/2}$ 9 x 10^{-12} s), 0.645 (coinc with 0.555 γ), 0.81 (coinc with 0.555 γ) scint spect, γ-γ coinc (121S57b, 121S57a); 0.55 ($t_{1/2}$ 1.0 x 10^{-11} s) scint spect (27T56a, 27T55a); 0.55 scint spect (141M55); 0.54 scint spect (41A56); others (52M57); see also gammas of In^{114m}	see In^{114} 
		μ	~0 atomic spect (87M50)			
Cd^{115m}	43 d (2S47b, 10C50b); 44 d (33G51h)	☢	β^- (10C39);	β^-	1.61 (~98%), 0.7 (~2%), ~0.3 (weak) spect (61H52a); 1.5 abs (2S47b, 10C50b, 1W52); 1.4 abs; 0.4 (1%, coinc with γ) β-γ coinc abs (47G50); 1.7 abs (33G51h);	Q_{β^-} 1.63 (61H52a)
		A	chem, excit (2S47b); chem, sep isotopes, n-capt (10C50b);	γ	γ_1 0.49 (†10, coinc with γ_2), γ_2 0.94 (†74), γ_3 1.30 (†31, not coinc with γ_1 or γ_2), no 0.12, no 0.45, no 0.50 scint spect, γ-γ coinc (19V55);	
			daughter Ag^{115} (9%) (1W52); daughter Ag^{115} (8%) (149H55); others (2S47, 37L50, 11G49, 7N49a, 6O48, 21T51, 67M51, 28F51)		γ_1 0.48 (†10), γ_2 0.94 (†74, coinc with γ_1), γ_3 1.30 (†32, not coinc with γ_1 or γ_2) scint spect, γ-γ coinc (13E52); 0.46, 0.50, 0.96, 1.28 scint spect, γ-γ coinc (61H52a); others (56G49)	
Cd^{115}	53 h (1W52); 54 h (10C50b); 56 h (24L40, 67M51a)	☢	β^- (10C37);	β^-	1.11 (58%), 0.58 (42%) spect (10L52); 1.11 (~60%), 0.59 (~40%) spect (61H52a); ~1 (~85%), ~0.5 (~15%) β-γ coinc, abs (1W52); others (26M49a, 10C50b, 67M51a, 19V55, 25A52);	Q_{β^-} 1.45 (64K54)
		A	chem (10C37); chem, genet (18G38); chem, sep isotopes, n-capt (10C50b);	γ	γ_1 0.230 (†10), γ_2 0.260 (†30, coinc with γ_1 and γ_3), γ_3 0.263 (†3), γ_4 0.49 (†220), γ_5 0.52 (†430) no 0.86 scint spect, γ-γ coinc (19V55);	
			parent In^{115m} (18G38, 10C39, 5N40b, 67M51a, 1W52, 10L52); daughter Ag^{115} (91%) (1W52); daughter Ag^{115} (92%) (149H55); others (14M37, 2S47, 60M48, 2S47b, 37L50, 7N49a, 6O48, 21T51, 5N40a)		0.360, 0.50, 0.53 scint spect, γ-γ coinc (61H52a); 0.522 spect (28D50); 0.344, 0.349, 0.363 (?), 0.369, 0.424, 0.452, 0.525, 0.559, 0.713 spect conv (10C50b); with In^{115m}: 0.335 (10L52, 24L40, 61H49, 61H52a, 28D50); see also gammas of In^{115}	

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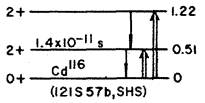
$_{48}Cd^{116}$	$t_{\beta\beta} > 10^{17}$ y sp act (96W55); others (79D55, 59F52)	☢	7.58 (28L48);	γ	Coulomb excitation (in Cd^{116}): 0.517 ($t_{1/2}$ 1.3×10^{-11} s). 0.70 (coinc with 0.517 γ) scint spect, γ-γ coinc (121S57b, 121S57a, 52M57); 0.508 ($t_{1/2}$ 1.4×10^{-11} s) scint spect (27T56a, 27T55a)	
		μ	~0 atomic spect (87M50)			
Cd^{117m}	3.0 h (51C53); 2.9 h (25A52); 2.8 h (24L40); 2.7 h (67M51b)	☢	IT (51C53);	γ	with Cd^{117} and Cd^{117m}: 0.267, 0.281, 0.43, 0.84, 1.27, 1.55, 2.00 spect conv, scint spect (67L54a); others (25A52)	
		A	chem, excit (10C39); ancestor In^{117m} (18G38, 24L40, 67M51b); not parent In^{117m} (lim 10%) (66M55); daughter Ag^{117} (70A57); others (14M37, 2S47, 5N40a, 5N40b)			
Cd^{117}	~50 m (51C53)	☢	β^- (51C53);	γ	see gammas of Cd^{117m}	
		B	chem, genet (51C53); parent In^{117m}, parent In^{117} (51C53); daughter Ag^{117} (70A57)			
Cd^{118}	50 m (119G57); 49 m (20K57)	☢	β^- (51C53);			
		D	chem, excit (51C53); parent 5.5 s In^{118} (119G57); not parent 4.5 m In^{118} (51C53)			
Cd^{119}	10 m (48N57); 9 m (119G57)	☢	β^- (48N57);			
		B	chem, genet (48N57); parent 18 m In^{119} (48N57)			
Cd^{119}	2.9 m (119G57)	☢	β^- (119G57);			
		B	chem, genet (119G57); parent 18 m In^{119} (119G57)			
Cd	3.5 m (48N57)	☢	[β^-] (48N57);			
		E	chem, excit (48N57); parent 11.5 m In, parent 32 m In (48N57)			
$_{49}In^{107}$	30 m (97M52); 33 m (68M49)	☢	β^+ (68M49);	β^+	~2 spect (68M49); scint spect (125C55a);	
		A	chem, sep isotopes (68M49); mass spect (97M52)	γ	0.22 (coinc with β^+) scint spect, β-γ coinc (125C55a)	

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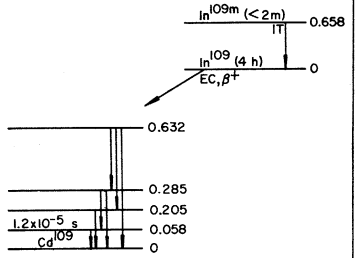
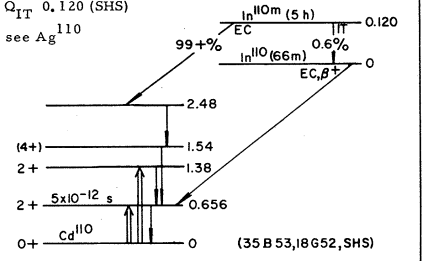
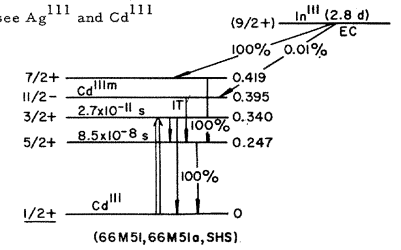
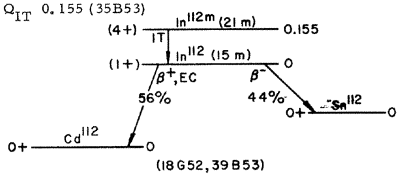
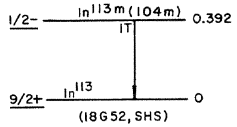
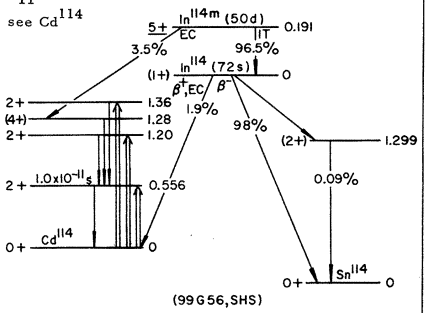
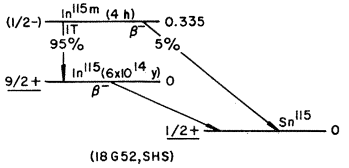
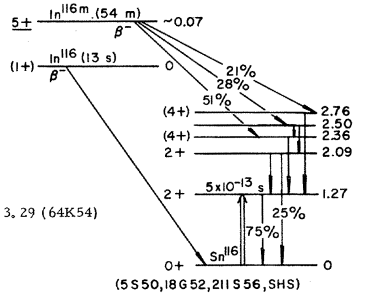
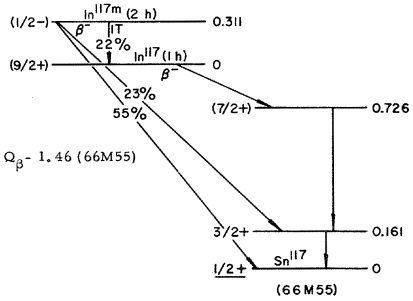
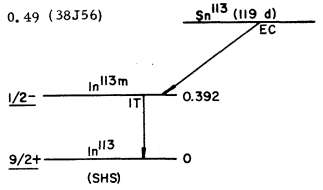
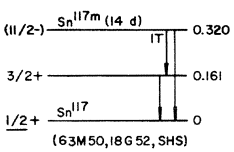
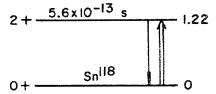
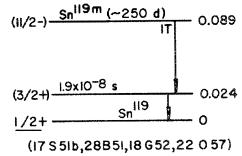
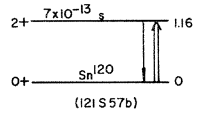
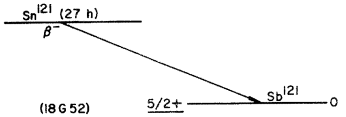
$_{49}In^{108m}$	55 m (156M55, 68M49); 50 m (97M52, 66M51)	☢ β^+, IT (156M55);	β^+ 2.31 spect (66M51); 1.4 spect (156M55); 2.2 abs (37L50);	see Ag^{108}
		A chem, sep isotopes (68M49); mass spect (97M52); daughter Sn^{108} (156M55)	γ 0.246 (conv in In, K/L 3.7), 0.330 (K/L 4), 0.637, 0.88, 1.05, no 0.285 γ spect conv, scint spect (156M55); 0.285 (<5%, K/L >3) spect conv (66M51)	
In^{108}	40 m (156M55)	☢ β^+ (156M55);	β^+ 3.5 spect (156M55);	
		D chem, excit (156M55)	γ 0.637 spect conv (156M55)	
In^{109m}	<2 m (61P56a)	☢ IT (61P56a);	γ 0.658 (e/γ 0.07) spect conv, scint spect (61P56a)	
		C genet (61P56a); daughter Sn^{109} (61P56a)		
In^{109}	4.3 h (68M49); 4.2 h (66M51); 6.5 h (25T47); 5.2 h (48G48)	☢ EC 94%, β^+ 6% (61P56a); β^+, EC (25T47, 68M49);	β^+ 0.80 (6%), ~0.3 (?) spect (61P56a); 0.75 abs (68M49); ~2 (weak) (25T47);	Q_{EC} 2.0 (61P56a) (61P56a)
		A chem, excit (25T47); chem, mass spect (48G48); chem, excit, sep isotopes (68M49); descendant Sn^{109} (61P56a)	γ 0.058 (K/L 0.9), 0.205 (K/L 3), 0.347, 0.427 spect conv (66M51); 0.058 (e/γ >5, K/L+M 0.9), 0.205 (†100, e/γ 0.07, K/L+M 7.6), 0.227 (†4, e/γ 0.04), 0.285, 0.325, 0.347 (†4, e/γ 0.02, K/L+M 5.1), 0.427 (†9, e/γ 0.014, K/L+M 8), 0.632 (†40, e/γ 3 x 10^{-3}) spect conv, scint spect (61P56a); 0.058 γ: $t_{1/2}$ 1.2 x 10^{-5} s delay coinc (61P56a)	
In^{110m}	5.0 h (66M51); 4.9 h (35B51); ~5 h (48G48)	☢ EC 99+%, IT 0.6% (35B53); EC 99+%, IT ~0.3% (66M51);	γ 0.119 (with IT, K/L 4.5), 0.935, 0.885, 0.661 spect conv (66M51); 0.121 (with IT, K/L+M 4.5), 0.937, 0.884, 0.657 spect conv (35B53, 35B51); see also gammas of Ag^{110} and Cd^{110}	Q_{IT} 0.120 (SHS) see Ag^{110} 
		A chem (48G48); chem, genet energy levels (66M51a, 35B51); not daughter Sn^{110} (156M55)		
In^{110}	66 m (58B39, 35B51); 65 m (48G48)	☢ β^+, EC (35B53);	β^+ 2.25 (coinc with γ), no 2.9 β^+ spect, β-γ coinc (35B53);	Q_{EC} 3.93 (35B53)
		A chem (58B39); chem, excit, mass spect (48G48); daughter Sn^{110} (156M55); others (19K39a, 25T47a, 24L40)	γ 0.656 spect conv (35B53, 35B51); see also gammas of Ag^{110} and Cd^{110}	

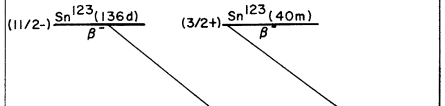
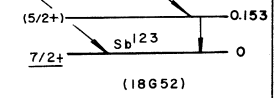
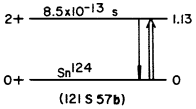
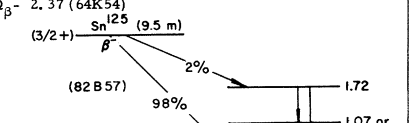
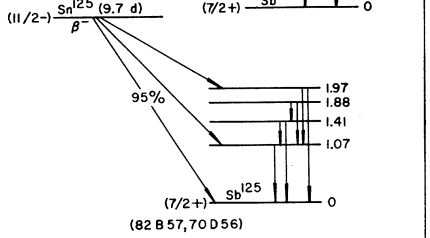
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{49}In^{111}$	2.81 d (176M57); 2.84 d (66M51); 2.7 d (58B39, 10C39)	☢	EC (24L40); no β^+ (lim 0.06%) (66M51); no β^+ (48G48);	γ	0.172 (~100%, e/γ 0.12, K/L 6.6), 0.247 (~100%, e/γ 0.064, K/L 5.2) spect, spect conv, conv-conv coinc abs (66M51, 66M57); 0.173 (e/γ 0.09, K/L ~8), 0.247 (e/γ 0.04, K/L ~5) γ-conv, conv-conv, γ-γ coinc (56B49); 0.171 (K/L+M 7.0), 0.246 (K/L+M 4.8) spect conv (59G52); 0.173 (K/L+M 6.6), 0.247 (K/L+M 5.3) spect conv (34H52); 0.173 (K/L 6.6), 0.247 (K/L 5.4) spect conv (24L40); 0.25 (coinc with 0.17 γ) scint spect, γ-γ coinc (69M51, 90K52, 59L56b); 0.25 γ: $t_{1/2}$ 8.48 x 10^{-8} s delay coinc (209S57); $t_{1/2}$ 8.41 x 10^{-8} s delay coinc (176M57); others (36A51, 36A51a, 20D49a, 63B50, 63G56, 63G54, 82S56a, 74R55a); see also gammas of Ag^{111} and Cd^{111}	see Ag^{111} and Cd^{111}  (66M51, 66M51a, SHS)
		A	chem (10C39); chem, excit (25T47a, 48G48); mass spect (48G48); parent (0.01%) Cd^{111m} (66M51a); others (37L50); see also Cd^{111}			
In^{112m}	20.7 m (35B53); 20 m (58B39); 23 m (25T47a)	☢	IT (81S42, 25T47a);	γ	0.155 (e/γ large, K/L+M 3.7) spect conv (35B53); 0.16 spect conv (58B39); 0.16 (e/γ large) abs (25T47a)	Q_{IT} 0.155 (35B53)  (18G52, 39B53)
		A	chem (58B39); chem, cross bomb, excit (81S42); chem, excit (25T47a); parent In^{112} (81S42, 25T47a, 49G50); others (24L40)			
In^{112}	15 m (35B53)	☢	β^- 44%, β^+ 24%, EC 32% (calc) (35B53); β^-, β^+, EC (25T47a);	β^- β^+	0.656 spect (35B53); 1.52 spect (35B53); 1.7 spect (24L40)	Q_{β^-} 0.656, Q_{EC} 2.54 (64K54)
		A	chem, cross bomb, excit (81S42); chem, excit (25T47a); daughter In^{112m} (81S42, 25T47a, 49G50)			
In^{113m}	104 m (24L40); 105 m (58B39)	☢	IT (58B39);	γ	0.392 (K/L+M 4.2) spect conv (59G52); 0.393 spect conv (10C51a); 0.39 (e/γ 0.44, K/L 4.0) spect conv (67A56a, 67A55, 67A54, 115H56a, 33E55); 0.39 (K/L 5.4) spect conv (24L40); 0.39 (e/γ 0.55) scint spect (62C52); 0.39 (e/γ 0.35, K/L 5.4) spect conv, ion ch (26T51); 0.39 (e/γ 0.52) (8A56)	Q_{IT} 0.392 (59G52)  (18G52, SHS)
		A	chem, excit, genet (58B39); daughter Sn^{113} (58B39); others (63C48, 11D47);			
		I μ	1/2 atomic beam (127C56); ±0.217 atomic beam (127C56)			
$\underline{In^{113}}$	t (EC) >10^{14} y sp act (133H55)	%	4.23 (24W48); 4.33 (64W56);			
		I	9/2 atomic spect, atomic beam (87M50);			
		μ q	+5.496 nucl induct (67K56); +0.75 atomic beam (67K56); 1.14 atomic beam (87M50); others (61W53, 44T53, 75R57, 37E57, 128K52)			
In^m	2.5 s (31K52)	☢	IT (31K52);	γ	0.153 scint spect (31K52)	
		E	(31K52)			

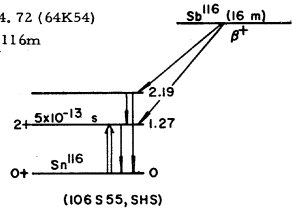
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{49}In^{114m}$	50.0 d (109W57); 49 d (150H57, 58B39); others (46M49)	☢	IT 96.5%, EC 3.5% (99G56);	γ	γ_1, γ_2, γ_3 with In^{114m}, γ_4 with In^{114} (99G56); γ_2 0.556 (3.6%), γ_3 0.723 (3.5%), γ_4 1.299 (0.2%), γ_2 coinc with γ_3 spect, spect conv, scint spect, γ-γ coinc (25J56, 25J53, 25J54, 25J52); γ_1 0.190 (†100), γ_2 0.552 (†19), γ_3 0.722 (†19), γ_4 1.27 (†1.2) spect (53M49); γ_1 0.192 (e/γ 4.2, K/L 1.10) spect conv, scint spect (82S51); γ_1 0.192 ($L_I/L_{II}/L_{III}$ = 0.2/1.3/1) spect conv (70K56); γ_1 (e/γ 4.3, K/L 2.0) spect conv, scint spect (150H57); γ_1 0.190 (K/L+M 1.0) spect conv (59G52); γ_1 0.191 spect conv (10C48); γ_1 0.192 (e/γ 4, K/L 1.1) spect conv (56B49a); γ_2 (†19), γ_3 (†19), γ_2 coinc with γ_3; γ_2 not coinc with γ_4, no 0.576, no 1.278 scint spect, γ-γ coinc (99G56); >1.67 Be-γ-n, D-γ-n (16D56h); others (40K52, 10L49a, 88S51a, 23K52, 80D55, 205B56, 76L54a, 94M54, 80D55, 44A56, 41A53); see also gammas of Cd^{114}	Q_{IT} 0.191 (SHS) 
		A	chem, n-capt, excit (24L37, 14M38); parent In^{114} (49G50); others (37L50, 22E52, 25W48, 24L40);			
		I	5 atomic beam (100G57);			
		μ	+4.7 atomic beam (100G57)			
In^{114}	72 s (24L37, 58B39)	☢	β^- 98%, EC 1.9%, β^+ 4 x 10^{-3}% (99G56); β^- 99+%, β^+ 4 x 10^{-3}% (32J54, 32J52); β^- 99+%, β^+ ~0.01% (56B49a);	β^-	1.984, 0.71 (0.2%, coinc with 1.299 γ) spect, scint spect, β-γ coinc (25J52, 25J56); 1.98 spect (24L40); 2.01 spect (88S51a); 0.68 scint spect, β-γ coinc (99G56); others (34N53c, 46M49);	Q_{β^-} 1.98, Q_{EC} 1.42 (99G56)
		A	excit (7C37, 37B37a, 24L37); n-capt, sep isotopes (18G48a); daughter In^{114m} (49G50); others (1P37, 25W48, 22E52)	β^+	0.40 (4 x 10^{-3} %) scint spect, β-γ coinc (99G56); 0.65 spect (56B49a); 1.2 (4 x 10^{-3}%) abs (25J54);	
				γ	1.30 (0.09%, coinc with 0.68 β^-) scint spect, β-γ coinc (99G56); metastable state in In^{114}: γ 0.311 ($t_{1/2}$ 0.042 s) scint spect, In^{115} (γ,n) (18V56, 18V56a); $t_{1/2}$ 0.047 s scint spect, Cd (p) (86L57a, 86L57)	
In^{115m}	4.50 h (11D47); 4.53 h (24L40)	☢	IT 95%, β^- 5% (10L52); IT (24L39); β^- (11B49);	β^-	0.83 spect (11B49);	Q_{IT} 0.335, Q_{β^-} 0.83 (SHS) 
		A	chem, excit (18G38); daughter Cd^{115} (18G38, 10C39, 5N40b, 67M51a, 1W52, 10L52); others (58B39, 63C48, 58B39a, 38L39, 64C40, 41W43, 41W49, 17P38a, 64C39, 70M49, 83S51, 11B49, 21T51, 5N40a)	γ	γ_1 0.335 (e/γ 0.98, K/L+M 3.8) spect conv (10L52, 59G52); 0.335 (e_K/γ 0.83, K/L+M 3.9) spect conv, scint spect (19V55); γ_1 (e/γ 0.8, K/L 4.4) spect conv (67A56a, 67A55, 115H56, 33E55); 0.338 (e/γ ~1, K/L 5.0, K/L+M 4.0) spect conv (24L40); γ_1 (K/L+M 3.8) spect conv (34L56, 34L56c, 34L56b); others (61H49, 28D50)	
In^{115}	6 x 10^{14} y sp act (71M50); ~10^{14} y sp act (63C51)	☢	β^- (71M50, 63C51);	β^-	0.63 abs (71M50);	Q_{β^-} 0.50 (64K54)
		A	chem, sep isotopes (71M50);	γ	Coulomb excitation (in In^{115}): 0.50 scint spect (141M55, 27T54); 0.56 scint spect (41A56, 41A56a); 0.51 from p,n reaction (51D56); others (135B53)	
		%	95.77 (24W48); 95.67 (64W56);			
		I	9/2 atomic spect (87M50);			
		μ	+5.508 nucl induct (67K56);			
		q	+0.76 atomic beam (67K56); 1.16 atomic beam, atomic spect (87M50); others (61W53, 44T53, 75R57, 37E57, 210S55, 78K54, 128K52)			

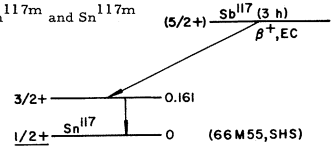
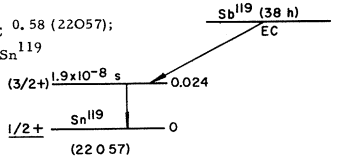
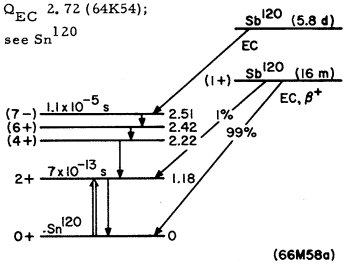
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{49}In^{116m}$	53.99 m (55L53); 53.93 m (57S49); 54.05 m (50G47)	☢ β^- (24L37); A chem, n-capt (12A35); chem, excit, n-capt (24L37); others (58B39, 14M38a, 2S47, 50H51); I 5 atomic beam (100G57, 42N56); μ +4.21 atomic beam (42N56); +4.4 atomic beam (100G57)	β^- 1.00 (51%), 0.87 (28%), 0.60 (21%) spect, β-γ coinc (5S50); 0.85 spect (10C39); cl ch (48C40); 0.7 β-γ coinc abs (26M48d); γ γ_1 0.137 (3%), γ_2 0.406 (25%), γ_3 1.085 (54%, e/γ 8.4 x 10^{-4}), γ_4 1.274 (75%, e/γ 5.7 x 10^{-4}), γ_5 1.487 (21%), γ_6 2.090 (25%) spect conv (5S50); γ_1 0.137, γ_2 0.40 (coinc with γ_6), γ_3 1.09, γ_4 1.27 (coinc with γ_3, γ_5, and γ_7), γ_5 1.48, γ_6 2.09, γ_7 0.80 scint spect, γ-γ coinc (21lS56); others (20D42c, 48C40, 24L40, 42W47); see also gammas of Sn^{116} and Sb^{116}	Q_{β^-} 3.36 (5S50) 
In^{116}	13 s (12A35, 10C39, 99W53)	☢ β^- (24L37); A n-capt (12A35); excit, n-capt (24L37); others (2S47, 42H47)	β^- 3.29 scint spect (52B54); 2.95 abs (35B46a, calc from 24L40); 2.8 cl ch (10C39); abs (99W53); γ no γ (14M38a, 52B54)	Q_{β^-} 3.29 (64K54)
In^{117m}	1.90 h (66M55, 67M51b); 1.95 h (24L40); ~2.5 h (51C53)	☢ β^- 78%, IT 22% (66M55); A chem, excit (10C39); descendant Cd^{117m} (18G38, 24L40, 67M51b); daughter Cd^{117}, parent In^{117}, not daughter Cd^{117m} (lim 10%) (66M55); others (42H47, 5N40a, 5N40b, 32K48)	β^- 1.77 (55%), 1.62 (23%) spect, β-γ coinc (66M55); 1.73 spect (10C39); 1.95 abs (67M51b); γ γ_1 0.161 (e_K/γ 0.13, K/L+M 8.3), γ_2 0.311 (with IT, e_K/γ 1.3), γ_1 coinc with β^-, γ_2 not coinc with β^- spect conv, scint spect, β-γ, γ-γ coinc (66M55); 0.160, 0.312 (with IT), 0.55, 0.72 spect conv, scint spect, β-γ coinc (67L54a); others (25A52, 51C53); see also gammas of Sb^{117} and Sn^{117m}	Q_{β^-} 1.77, Q_{IT} 0.311 (66M55); see Sn^{117} 
In^{117}	1.1 h (66M55); 1.2 h (51C53)	☢ β^- (66M55); A chem, genet (51C53); daughter Cd^{117} (51C53, 66M55); not parent Sn^{117m} (lim 1%) (66M55)	β^- 0.74 spect (66M55); γ 0.161, 0.565 (e/γ ~5 x 10^{-3}, coinc with 0.161 γ and β^-), no 0.726 spect conv, scint spect, β-γ, γ-γ coinc (66M55); see also gammas of In^{117m}, Sb^{117}, and Sn^{117m}	Q_{β^-} 1.46 (66M55)
In^{118}	4.5 m (99W53, 23D49b)	☢ β^- (23D49b); B excit, sep isotopes (23D49b); not daughter Cd^{118} (51C53)	β^- 1.5 abs (23D49b); γ (23D49b)	
In^{118}	5.5 s (20K57); 5 s (119G57)	☢ β^- (51C53); D genet (51C53); daughter Cd^{118} (119G57)	β^- 4.4 abs (51C53, 119G57); ~3.9 scint spect (20K57)	
In^{119}	~2 m (119G57)	E chem, excit (119G57)		
In^{119}	17.5 m (23D49b)	☢ β^- (23D49b); B chem, excit, sep isotopes (23D49b); daughter 10 m Cd^{119} (48N57); daughter 2.9 m Cd^{119} (119G57)	β^- 2.7 abs (23D49b); 2.6 abs (119G57); γ 0.4 abs (119G57); no γ (23D49b)	
In^{120}	~55 s (66M58a)	☢ [β^-] (66M58a); E excit (66M58a)	γ ~1 scint spect (66M58a)	

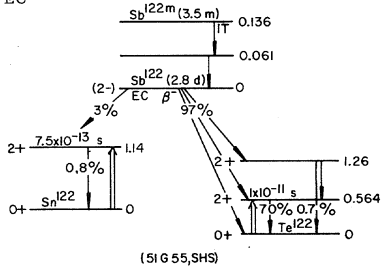
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{49}In$	11.5 m (48N57)	☢ β^- (48N57); E chem, genet (48N57); daughter 3.5 m Cd (48N57)	γ 0.85 (48N57)	
In	32 m (48N57)	☢ β^- (48N57); E chem, genet (48N57); daughter 3.5 m Cd (48N57)	γ 0.52 (48N57)	
$_{50}Sn$	19 m (61P56a)	D chem (61P56a)	γ 0.078 spect conv (61P56a)	
Sn^{108}	9 m genet (156M55)	☢ [EC] (156M55); E genet (156M55); parent In^{108} (156M55)		
Sn^{109}	18.1 m (61P56a)	☢ EC, β^+ (61P56a); B chem, genet (61P56a); ancestor In^{109}, parent In^{109m} (61P56a)	β^+ ~1.6 spect (61P56a); γ 0.335, 0.521, 0.658 (with In^{109m}, e/γ ~0.07), 0.89, 1.12 spect conv, scint spect (61P56a)	
Sn^{110}	4.0 h (156M55, 66M51); 4.5 h (68M49)	☢ EC (68M49); B chem, sep isotopes (68M49); chem, genet (156M55); parent In^{110}, not parent In^{110m} (156M55); parent In^{108} (55 m) (68M49, 37L50, 66M51)	γ 0.283 (e/γ 0.06, K/L+M 8) spect conv, scint spect (156M55)	
Sn^{111}	35.0 m (66H49); 35 m (66M51)	☢ EC ~71%, β^+ ~29% (66M51); B chem, sep isotopes (66H49)	β^+ 1.51 spect (66M51); 1.5 abs (66H49)	Q_{EC} 2.52 (64K54)
Sn^{112}		% 0.95 (1B50)		
Sn^{113}	119 d (8A56); 118 d (10C51a); 120 d (82D53); 130 d (101G56); 105 d (58B39)	☢ EC, no β^+ (58B39); EC (L/K 0.2) (8A56); EC (L/K ~0.8) (26T51); A chem, excit (58B39, 12L39c); parent In^{113m} (58B39); others (60M48, 2S47, 28B51, 37L50)	EC internal bremsstrahlung endpoint: 0.10 scint spect, x-γ coinc (38J56); γ with In^{113m}: 0.392 (59G52, 10C51a, 58B39, 24L40, 62C52, 26T51); 0.260 (†3), 0.393 (†100, with In^{113m}) scint spect (124G57); 0.255 (weak) spect conv (73A57); no 0.255 γ, no 0.401 γ (82D53); 0.401 (weak), 0.255 (weak) spect conv (10C51a); no 0.09 γ (65C47, 26T51, 10C51a, 28B51); others (101G56, 38J56, 118B53, 112K56)	Q_{EC} 0.49 (38J56) 
Sn^{114}		% 0.65 (1B50)	γ Coulomb excitation (in Sn^{114}) (121S57)	
Sn^{115}		% 0.34 (1B50); I 1/2 atomic spect (87M50); μ -0.91320 nucl induct (67K56); others (61W53, 87M50)	γ Coulomb excitation (in Sn^{115}) (52F56)	

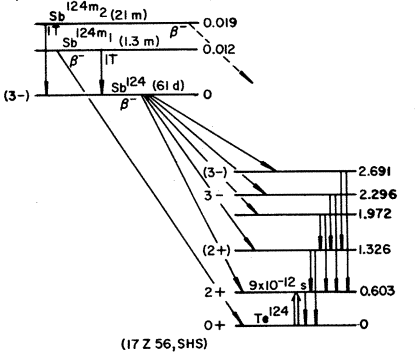
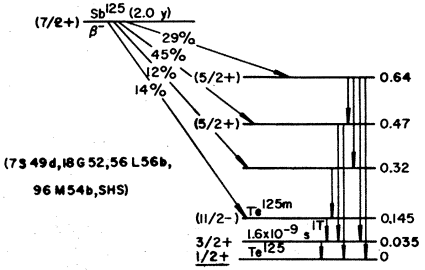
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{50}Sn^{116}$		% 14.24 (1B50); μ ~0 atomic spect (87M50)	γ Coulomb excitation (in Sn^{116}): 1.27 ($t_{1/2}$ 5×10^{-13} s) scint spect (121S57b, 121S57); see also gammas of In^{116} and Sb^{116}	see In^{116} and Sb^{116}
Sn^{m}	1.7×10^{-4} s (18V56b)	☢ IT (18V56b); E excit (18V56a, 18V56b)	γ 0.117, 0.163, 0.504 scint spect (18V56a, 18V56b)	
Sn^{117m}	14.0 d (10C51a)	☢ IT (68M50); A chem (12L39c); chem, sep isotopes, cross bomb (68M50); others (37L50)	γ 0.159 (e/γ very large, K/L 2.2, L_I/L_{III} ~1), 0.162 (e_K/γ 0.10) spect conv, e-γ coinc, x-γ coinc (63M50, 63M52a); 0.156 (e/γ large, K/L ~7), 0.159 spect conv (10C51a); 0.154, 0.325 spect conv, scint spect (112K56); 0.157 (K/L 2.2) spect conv (61H50a); others (102G56); see also gammas of In^{117m}, In^{117}, and Sb^{117}	Q_{IT} 0.320 (SHS)  (63M50, 18G52, SHS)
Sn^{117}		% 7.57 (1B50); I 1/2 atomic spect (87M50); μ -0.9949 nucl induct (67K56); others (61W53, 87M50)	γ Coulomb excitation (in Sn^{117}) (52F56)	
Sn^{118}		% 24.01 (1B50); μ ~0 atomic spect (87M50)	γ Coulomb excitation (in Sn^{118}): 1.22 ($t_{1/2}$ 5.6×10^{-13} s) scint spect (121S57b)	 (121S57b)
Sn^{119m}	~250 d (63M50)	☢ IT (63M50); A chem, n-capt, sep isotopes (63M50)	γ γ_1 0.0653 (K/L 0.51), γ_2 0.0242 (L/M ~4) spect conv (67H51); γ_2 0.0238 (e/γ ~7) scint spect, ion ch, γ-γ coinc (28B51); γ_1 0.065, γ_2 0.024 scint spect, ion ch conv (17S51b); γ_2: $t_{1/2}$ 1.9×10^{-8} s delay coinc (22O57); others (63M52a); see also Sb^{119}	Q_{IT} 0.089 (SHS)  (17S51b, 28B51, 18G52, 22O57)
Sn^{119}		% 8.58 (1B50); I 1/2 atomic spect (87M50); μ -1.0409 nucl induct (67K56); others (61W53, 87M50)	γ Coulomb excitation (in Sn^{119}) (52F56); 0.024 level of Sn^{119}: $t_{1/2}$ 1.9×10^{-8} s delay coinc (22O57)	
Sn^{120}		% 32.97 (1B50); μ ~0 atomic spect (87M50)	γ Coulomb excitation (in Sn^{120}): 1.16 ($t_{1/2}$ 7×10^{-13} s) scint spect (121S57b, 121S57); 2.51 level of Sn^{120}: $t_{1/2}$ 1.1×10^{-5} s delay coinc (66M58a); see also gammas of Sb^{120}	 (121S57b)
Sn^{121m}	>400 d (19N50)	☢ β⁻ (19N50); E sep isotopes, n-capt (19N50)	β⁻ 0.42 spect (19N50)	
Sn^{121}	27.5 h (19N50); 28 h (23D49c)	☢ β⁻ (12L39c); A chem, excit (12L39c); chem, sep isotopes (37L48a); others (2S47, 39L49, 37L50, 7N49a, 6O48)	β⁻ 0.383 spect (23D49c); 0.4 abs (37L48a, 39L49); γ no γ (23D49c, 37L48a)	Q_{β^-} 0.383 (64K54)  (18G52)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{50}Sn^{122}$		%	4.71 (1B50)	γ	Coulomb excitation (in Sn^{122}): 1.13 ($t_{1/2}$ 7.5 x 10^{-13} s) scint spect (121S57b, 121S57); see also gammas of Sb^{122}	see Sb^{122}
Sn^{123}	39.5 m (23D49c); 40 m (12L39c, 39L49, 19N50); 41.5 m (60M48)	☢ A	β⁻ (12L39c); chem (12L39c); chem, sep isotopes, excit (39L49, 19N50); others (2S47, 1P37, 60M48, 7H49)	β⁻ γ	1.26 spect (23D49c); 1.3 abs (39L49); 1.1 abs (19N50); 0.153 spect conv, β-conv coinc (23D49c); 0.153 scint spect (76B51c); see also gammas of Sb^{123}	Q_{β^-} 1.41 (64K54) 
Sn^{123}	136 d (38G51); 125 d (10C51a); 130 d (39L49, 40L51); 126 d (19N50)	☢ A	β⁻ (40L51); chem (40L46, 40L51); chem, sep isotopes, cross bomb (39L49); others (7N49a, 38G46, 38G48)	β⁻ γ	1.42 spect (24K50b); 1.3 abs (39L49); no γ (39L49, 19N50, 10C51a, 38G51)	Q_{β^-} 1.42 (64K54)  (18G52)
Sn^{124}	$t_{\beta\beta}$ >2 x 10^{17} y sp act (41K52, 32F52, 70H52); others (72M53, 59F52, 41L51, 25P52)	%	5.98 (1B50)	γ	Coulomb excitation (in Sn^{124}): 1.13 ($t_{1/2}$ 8.5 x 10^{-13} s) scint spect (121S57b)	 (121S57b)
Sn^{125}	9.5 m (19N50); 9.8 m (39L49)	☢ A	β⁻ (12L39c); chem, excit, n-capt (12L39c); chem, sep isotopes (23D50a, 39L49); others (2S47)	β⁻ γ	2.04, 1.17, 0.51 (?) spect (23D50a); 2.06, ~0.5 abs (19N50); γ_1 0.326 (99.7%, coinc with γ_4 and 2.0 β⁻), γ_2 0.64 (0.3%), γ_3 1.07 (0.3%, coinc with γ_2), γ_4 1.39 (1.9%) scint spect, β-γ, γ-γ coinc (82B57); γ_1 0.326, others >1 (weak) spect, spect conv (23D50a); others (19N50, 76B51c)	Q_{β^-} 2.37 (64K54) 
Sn^{125}	9.4 d (19N50); 10.0 d (39L49)	☢ A	β⁻ (12L39c); chem (12L39c); chem, excit, sep isotopes (39L49); chem, sep isotopes, n-capt, genet (19N50); parent Sb^{125} (19N50); not parent Sb^{125} (7N49b); others (2S47, 65C47, 7N49a)	β⁻ γ	2.37 (~95%), 0.40 (~5%) spect (61H50b); 2.33 spect (24K50b); 2.35, ~1.3 (coinc with γ_6), ~0.4 (coinc with γ_4, γ_5, γ_6, and γ_8) scint spect, β-γ coinc (82B57); others (26M52a, 65C47, 39L49, 77S51a, 157M52); γ_1 0.230, γ_2 0.340 (†9, coinc with γ_3), γ_3 0.47 (†16, coinc with γ_1), γ_4 0.81 (†50, coinc with γ_1 and γ_6), γ_5 0.90 (†30), γ_6 1.07 (†100, coinc with γ_1, γ_2, γ_3, and γ_5), γ_7 1.41 (†6, coinc with γ_3), γ_8 1.96 (†24) scint spect, γ-γ coinc (70D56); γ_2 0.342 (†9, coinc with γ_3), γ_3 0.47 (†10), γ_4 0.81 (†20, coinc with γ_6), γ_5 0.90 (†18), γ_6 1.07 (†73, coinc with γ_2, γ_3, and γ_5), γ_7 1.41 (†3, coinc with γ_3), γ_8 1.97 (†24, not coinc with γ) scint spect, γ-γ coinc (82B57); others (26M52a)	Q_{β^-} 2.35 (64K54)  (82B57, 70D56)
Sn^{126}	~50 m yield (80B51)	☢ B	β⁻ (80B51); chem, genet (80B51); parent Sb^{126} (9 h) (80B51)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{50}Sn^{127}$	2.1 h (128C56); 1.5 h yield (80B51)	☢ β^- (80B51); B chem, genet (80B51, 128C56); parent Sb^{127} (80B51, 128C56)		
Sn^{128}	57 m (57F55)	☢ [β^-] (57F55); D chem, genet (57F55); parent Sb^{128} (57F55, 57F56a)		
Sn^{130}	2.6 m (30P56)	☢ [β^-] (30P56); D chem, genet (30P56); parent Sb^{130} (9.2 m) (30P56); others (57F55)		
Sn^{131}	3.4 m (30P56)	☢ [β^-] (30P56); B chem, genet (30P56); parent Sb^{131} (30P56)		
Sn^{132}	2.2 m (30P56)	☢ [β^-] (30P56); B chem, genet (30P56); parent Sb^{132} (30P56)		
$_{51}Sb$	7 m (94R57)	☢ [EC] (94R57); E chem (94R57)		
Sb	30 m (94R57)	☢ [EC] (94R57); D chem (94R57)	γ 1.3 (?) scint spect (94R57)	
Sb	4.0 h (94R57)	☢ [EC] (94R57); D chem (94R57)	γ 0.25 scint spect (94R57)	
Sb^{115}	60 m (94R57)	☢ β^+ (94R57); D chem (94 R57)	β^+ 0.75, 1.10 spect (94R57); γ 0.060, 0.090 scint spect (94R57)	
Sb^{116}	60 m (27T49, 25A54)	☢ β^+ (27T49); β^+, EC (25A54); A chem, excit, mass spect (27T49)	β^+ 1.45 spect (27T49); γ 0.41 (γ/β^+ 0.15), 0.95 (γ/β^+ 1.4), 1.31 (γ/β^+ 1.5) scint spect (25A54); see also gammas of In^{116m}	
Sb^{116}	16 m (106S53b); 14 m (25A54)	☢ β^+ (106S53b, 25A52); B chem, excit (106S53b)	β^+ 2.40 spect (106S53b, 47B50); 2.3 abs (25A56, 25A52); 2.4, 1.5 scint spect, β-γ coinc (106S55); γ 0.90 (†31), 1.30 (†140), 2.20 (†16) spect (106S53b, reassigned from 47B50); 0.90 (†31), 1.31 (†92), 2.22 (†8), 1.31 γ coinc with 2.4 β^+ and 0.90 γ, scint spect, β-γ, γ-γ coinc (106S55); others (25A54); see also gammas of In^{116m} and Sn^{116}	Q_{EC} 4.72 (64K54) see In^{116m}  (106S55, SHS)

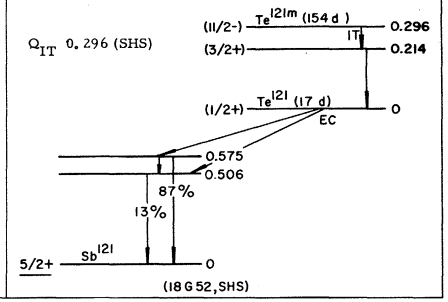
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{51}Sb^{117}$	2.8 h (65C47, 27T49)	☢ EC 97.4%, β^+ 2.6% (66M55);	γ	0.161 (K/L+M 8.3), no 0.565 γ scint spect, spect conv (66M55); 0.156 spect conv (27T49); see also gammas of In^{117m}, In^{117}, and Sn^{117m}	see In^{117m} and Sn^{117m} 
		A chem (12L39d); chem, excit, mass spect (27T49)			
Sb^{118m}	3.5 m (37L48a); 3.6 m (27R40)	☢ β^+, IT (?) (33F53);	β^+	3.10 spect (33F53); 3.1 abs, spect (37L48a);	
		B excit (27R40); daughter Te^{118} (37L48a); parent Sb^{118} (?) (33F53)	γ	0.108 (not coinc with β^+) spect conv, β-γ coinc (33F53); 1.22 (γ/β^+ 0.05), no 1.03 γ scint spect (66M58)	
Sb^{118}	5.1 h (65C47, 27T49)	☢ EC, no β^+ (lim 0.4%) (66M58); β^+ (33F53);	β^+	0.7 (coinc with γ) abs, β-γ coinc (33F53);	
		A chem, cross bomb (65C47); chem, excit, mass spect (27T49); daughter Sb^{118m} (?) (33F53)	γ	0.040, 0.256 (e_K/γ 0.039, K/L+M 5.4), 1.03 (↑100), 1.22 (↑100) spect conv, scint spect, γ-γ coinc (66M58); 0.260 spect conv (27T49); others (65C47)	
Sb^{119}	38.0 h (22O57); 39 h (65C47, 37L48a)	☢ EC (65C47);	EC	internal bremsstrahlung endpoint: 0.53 scint spect (22O57); Sn K-x (65C47, 37L48a);	Q_{EC} 0.58 (22O57); see Sn^{119} 
		A chem, cross bomb (65C47); chem, genet energy levels (22O57); daughter Te^{119} (37L48a, 37L50)	γ	0.02383 (e/γ 6.3, $L_I/L_{II}+L_{III}$ >4) spect conv, scint spect (22O57); 0.024 γ: $t_{1/2}$ 1.9 x 10^{-8} s delay coinc (22O57); see also gammas of Sn^{119m}	
Sb^{120}	5.8 d (66M55a); 6.0 d (37L48a)	☢ EC (37L48a); no β^+ or IT (lim 0.3%) (66M55a);	γ	γ_1 0.089 (γ_1/γ_2 0.9, K/L+M 8), γ_2 0.199 (K/L+M 4.6), γ_3 1.04 (γ_3/γ_4 1.0), γ_4 1.18, all γ's coinc with each other scint spect, spect conv, γ-γ coinc (66M58a); others (37L48a); γ_1: $t_{1/2}$ 1.1 x 10^{-5} s delay coinc (66M58a); see also gammas of Sn^{120}	
		B chem, sep isotopes (37L48a); chem, cross bomb (66M55a); others (11G49, 47B51, 30K51a)			
Sb^{120}	16.4 m (22J50); 16.6 m (12P48, 106S53b); 17 m (6H37, 12L39d)	☢ β^+, EC (47B50);	β^+	1.70 spect (47B50);	Q_{EC} 2.72 (64K54); see Sn^{120} 
		A chem, excit (37B39, 6H37, 7C37); chem, excit, cross bomb (12L37a); others (37L48a, 1P37, 21J44, 7C37, 12P48, 27M49, 25W48, 9K41a, 23R46)	γ	1.18 (γ/β^+ 0.03) scint spect (66M55a); no γ (106S53b); see Sb^{116}; 0.90 (↑31), 1.30 (↑140), 2.20 (↑16) spect (47B50); see also gammas of Sn^{120}	
Sb^{121}		% 57.25 (24W48);	γ	Coulomb excitation (in Sb^{121}) (27T54)	
		I 5/2 atomic spect (87M50); μ +3.3418 nucl induct (67K56, 61W53); q -0.5 atomic spect (88M54); -0.8 microwave (60J55); others (87M50, 100W55, 212S53, 47D51)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{51}Sb^{122m}$	3.5 m (38M47)	☢	IT (38M47);	γ	0.0607, 0.0753 spect conv, scint spect, γ-γ coinc (67L55a); 0.068 scint spect (38M51)	Q_{IT} 0.136 (67L55a)
		A	chem, n-capt, sep isotopes (38M47)			
Sb^{122}	2.80 d (47B51); 2.75 d (10C54); 2.8 d (12L39b)	☢	β^- 97%, EC 3.0%, β^+ ~0.01% (51G55); β^- 97%, EC 3.1%, no β^+ (lim 0.1%) (69F55);	β^-	β_1 0.74 (4%), β_2 1.40 (63%), β_3 1.97 (30%) spect (69F55); β_1 0.72 (†12), 0.90 (†7), β_2 1.41 (†60), β_3 1.97 (†21) spect β-γ coinc (96M54a); β_1 0.73 (†4), β_2 1.42 (†69), β_3 1.99 (†27) spect (51G55); others (23M51, 43M46, 26M48d, 14M40, 10C54, 101W57);	Q_{β^-} 1.97 (69F55); Q_{EC} 1.55 calc (51G55)
		A	chem (12A35); chem, cross bomb (12L39d); others (22J50, 2S47, 50H51, 37L50, 11G49);	γ	γ_1 0.5639 cryst spect (76R55); γ_1 0.566 (66%, coinc with γ_2, e_K/γ 5.2 x 10^{-3}, K/L+M 5.3), γ_2 0.686 (3.4%), γ_3 1.137 (0.7%), γ_4 1.258 (0.7%), no other γ, spect, spect conv, γ-γ coinc (69F55); γ_1 0.563 (73%, coinc with γ_2, e_K/γ 5.2 x 10^{-3}, K/L+M 5.4), γ_2 0.693 (3.6%), γ_3 1.15 (0.8%), γ_4 1.26 (0.8%) spect, spect conv, scint spect, γ-γ coinc (51G55, 51G52); 0.095, 0.553 (K/L ~1), 0.566 (K/L 7), 0.616, 0.647, 0.694, 1.10, 1.2 (?), 1.9 (?) spect, spect conv, scint spect, γ-γ, β-γ coinc (10C54); γ_1: $t_{1/2}$ 1.5 x 10^{-10} s delay coinc (111C55); others (80R55, 28C48d, 28K48, 11R47, 65L57b); see also gammas of Te^{122} and Sn^{122}	 (51G55,SHS)
Sb^{123}		%	42.75 (24W48);	γ	Coulomb excitation (in Sb^{123}): 0.161 (coinc with 0.376 γ), 0.376 scint spect, γ-γ coinc (52F58); others (27T54); see also gammas of Sn^{123}	
		I	7/2 atomic spect (87M50);			
		μ	+2.533 nucl induct (67K56, 61W53); -0.7 atomic spect (88M54); -1.0 microwave (60J55); others (87M50, 100W55, 212S53)			
		q				

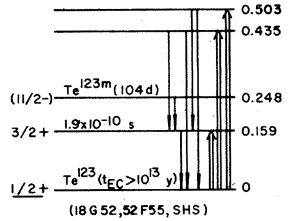
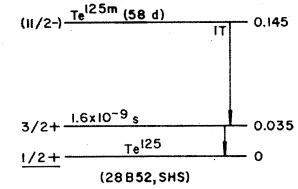
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{51}Sb^{124m_2}$	21 m (38M47)	☢ IT, β^- (38M47);	γ	0.0185 (e/γ very large) (18G50);	Q_{IT} 0.019 (18G50)
		B chem, n-capt, sep isotopes (38M47)			
Sb^{124m_1}	1.3 m (38M47)	☢ IT, β^- (38M47);	β^-	3.2 abs (38M47);	Q_{IT} 0.012 (18G50)
		B chem, n-capt, sep isotopes (38M47)	γ	0.012 (e/γ very large) (18G50)	
Sb^{124}	60.9 d (109W57); 60 d (12L39d, 55J57); 54 d (16D55)	☢ β^- (12L39d); no β^+, no EC (10L50b);	β^-	2.32 (21%), 1.60 (7%), 0.97 (9%), 0.61 (49%). 0.24 (14%) spect (10L53, 28C48d, 10L50b); 2.31 (22%), 1.60 (7%). 0.94 (9%), 0.62 (53%), 0.25 (9%) spect, β-γ coinc (96M54c); 2.39 (22%), 1.68 (6%), 1.07 (4%), 0.63 (56%), 0.28 (12%) spect (71A55); 2.31 (28%), 1.59 (10%), 0.93 (4%), 0.61 (49%), 0.20 (9%) spect (17Z56); others (28K48, 7J47, 54H43, 47M47, 43M46, 14M40, 37W47, 44A56, 48M53, 75A54, 17Z54, 84A57);	Q_{β^-} 2.92 (10L53)
		A chem (12L37a); chem, excit, cross bomb (12L39d); others (47B51, 54H43, 2S47, 37L50, 28T38, 11G49)	γ	0.603 (†100, e_K/γ 3.7×10^{-3}, K/L+M 6.1), 0.646 (†6, e_K/γ 4.4×10^{-3}), 0.714 (†4, e_K/γ 2.5×10^{-3}), 0.723 (†11, e_K/γ 2.7×10^{-3}), 0.970 (†5), 1.047 (†2), 1.298 (†1.3), 1.326 (†2), 1.361, 1.370, 1.692 (†52, e_K/γ 2×10^{-4}, K/L+M 4), 2.088 (†7) spect, spect conv (17Z56); γ_1 0.603 (e/γ 3.4×10^{-3}, K/L+M 7.9, coinc with γ_4 and γ_5), γ_2 0.641, γ_3 0.716, γ_4 1.68, γ_5 2.09 spect, spect conv, γ-γ coinc (10L53, 28C48d, 10L50b); γ_1 coinc with γ_2 and γ_3; γ_2 coinc with γ_3, γ-γ coinc (10L54); 0.604, 0.644, 0.727 spect conv, scint spect (10C54); 0.602, 0.645, 0.708, 0.713, 0.722, 0.789, 1.69, 2.09 spect conv, γ-γ coinc (7T56, 7T53); γ_1 (†100), 0.99 (†5), 1.38 (†6), γ_4 (†46), γ_5 (†10) scint spect (56L54a); γ_1 (†100), γ_3 (†12), 0.96 (†4), 1.05 (†3), 1.35 (†11), γ_4 (†65), γ_5 (†7) spect (104G52); 2.3 (0.2%) D-γ-n (16D56h); γ_1 (40-50%, e_K/γ 4.3×10^{-3}), γ_4 (e/γ 2.6×10^{-4}) spect, spect conv (44M53c, 44M52a); others (35G55, 17Z56, 16D57, 13A52b, 154M53, 58K53, 61K52, 28E53, 26H53a, 48M53, 76L54, 71A55, 17J52b, 16D56c, 17Z54, 44A56, 94H52, 28K48, 11R47, 14M40, 42W47, 85S51, 89S52, 39D51, 39D51a, 42K45, 47M47, 65L57b, 70P56, 16D56f, 16D56i); see also gammas of Te^{124} and I^{124}	
Sb^{125}	2.0 y (56L56b); ~2.7 y (40L51a)	☢ β^- (67C51);	β^-	0.616 (18%), 0.299 (49%), 0.128 (33%) spect (7S49d); 0.612 (14%, not coinc with γ), 0.444 (12%, coinc with 0.175 γ), 0.300 (45%, coinc with 0.45 γ), 0.13 (29%, coinc with 0.62 γ) spect, β-γ coinc (96M54b); others (28K49, 38G46, 15J49, 26M49b, 84S51);	Q_{β^-} 0.764 (64K54); see Te^{125} and I^{125}
		A chem (12L39d); chem, n-capt (84S51); daughter (9.4 d) Sn^{125} (19N50); not daughter (9.4 d) Sn^{125} (7N49b); parent Te^{125m} (23F48, 28K49); others (7N49a, 38G48)	γ	γ_1 0.113 (†1.4), γ_2 0.175 (†19), γ_3 ~energy of γ_2 (†0.6), γ_4 0.205 (†0.8), γ_5 0.214 (†0.6), γ_6 0.32 (†0.9), γ_7 0.38 (†3.8), γ_8 0.43 (†100), γ_9 0.46 (†30), γ_{10} 0.60 (†90), γ_{11} 0.64 (†23) scint spect, γ-γ coinc (56L56b); 0.035, 0.175, 0.425, 0.465, 0.601, 0.637 spect, spect conv, coinc (7S49d); 0.125 (weak), 0.174 (strong), 0.431 (strong), 0.466 (weak, e/γ very small), 0.609 (strong), 0.646 (weak, e/γ very small) spect, spect conv, coinc (28K49); with Te^{125m}: 0.110, 0.035 (28B52, 10C51a, 7S49d, 28K49, 67H49a); others (76L54a, 113C57); see also gammas of Te^{125m} and I^{125}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{51}Sb^{126}$	9 h (80B51)	☢ β^- (80B51); B chem, excit (80B51); daughter Sn^{126} (80B51)	β^- ~1 abs (80B51); γ 0.90, ~0.4 (both coinc with β^-) scint spect, β-γ coinc (80B51)	
$Sb^{\sim 126}$	28 d (38G46); ~30 d (80B51)	☢ β^- (38G46); D chem (38G46)	β^- 1.9 (38G46)	
Sb^{126}	19 m (57F56)	☢ β^- (57F56); D chem (57F56)	γ 0.42, 0.65 scint spect (57F56)	
Sb^{127}	88 h (206B57); 93 h (76S51b); 95 h (38G46)	☢ β^- (32A39); A chem, genet (32A39); parent Te^{127} (32A39, 33G51i); daughter Sn^{127} (80B51); parent (84%) Te^{127}, parent (16%) Te^{127m} (78B48); others (32K48)	β^- 1.57 (30%), 1.11 (20%, coinc with 0.456 γ), 0.86 (50%, coinc with 0.67 γ) scint spect, β-γ coinc (83D56); others (76S51b, 38G46); γ 0.058, 0.19, 0.240, 0.42, 0.456, 0.563, 0.67, 0.76 scint spect (83D56); 0.060 (†6), 0.248 (†26), 0.31 (†11), 0.46 (†100), 0.77 (†45) scint spect (206B57)	Q_{β^-} 1.57 (SHS)
Sb	6.2 d (206B57)	☢ [β^-] (206B57); D chem (206B57)	γ 0.42 (†26), 0.69 (†100), 0.90 (†10), 1.10 (†5), 1.35 (†1) scint spect (206B57)	
Sb^{128}	10.3 m (57F56a); 10 m (80B51); 10.7 m (103K58)	☢ β^- (57F55); D chem (57F56a); daughter Sn^{128} (57F55, 57F56a)	β^- 2.9 abs (57F55); γ 0.32, 0.75 scint spect (57F56a)	
Sb^{128}	9.6 h (57F56a); 9.9 h (103K58)	☢ β^- (57F56a); D chem (57F56a)	γ 0.32, 0.75 scint spect (57F56a)	
Sb^{129}	4.2 h (32A39)	☢ β^- (32A39); A chem, genet (32A39); parent Te^{129} (32A39); others (32K48)	β^- 1.87 (20%), others (80%) scint spect (83D56); γ 0.165, 0.308, 0.534, 0.79 scint spect (83D56)	
Sb^{130}	7.1 m (103K58); 10 m (80B52)	☢ β^- (80B52); D chem (30P56); daughter Sn^{130} (30P56)		
Sb^{130}	33 m (103K58); 40 m (80B52)	☢ β^- (80B52); D chem, excit (fission yield) (80B52)		
Sb^{131}	23.1 m (30P51); ~20 m (68C51)	☢ β^- (30P51); A chem, genet (30P51, 68C51); parent Te^{131}, parent Te^{131m} (30P51, 68C51); daughter Sn^{131} (30P56)		

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{51}Sb^{132}$	2.1 m (30P56, 30P51); ~5 m (32A39); ~2 m (68C51)	☢ β^- (32A39); B chem, genet (32A39); parent Te^{132} (32A39); daughter Sn^{132} (30P56)			
Sb^{133}	4.4 m (30P51); 4.2 m (68C51)	☢ β^- (30P51); B chem, genet (30P51); parent Te^{133m} (30P51)			
$Sb^{134,135}$	~50 s (30P51); 45 s (68C51)	☢ β^- (30P51); D chem (30P51)			
$_{52}Te$	16 m (94R57)	☢ β^+ (94R57); E chem (94R57)			
Te	8 h (94 R57)	☢ [EC] (94R57); E chem (94R57)	γ	0.67 scint spect (94R57)	
Te	1.4 h (94R57)	☢ β^+ (94R57); D chem (94R57)	γ	0.75, others (?) scint spect (94R57)	
$Te^{<118}$	2.5 h (37L48a)	☢ β^+ (37L48a); D chem (37L48a)			
Te^{118}	6.0 d (37L48a)	☢ EC (37L48a); B chem, genet (37L48a); parent Sb^{118m} (37L50, 37L48a)			
Te^{119}	4.5 d (37L48a)	☢ EC (37L48a); B chem, genet (37L48a); parent Sb^{119} (37L48a, 37L50); others (11G49)	γ	(37L48a, 37L50)	
Te^{120}		% 0.089 (1B50)	γ	Coulomb excitation (in Te^{120}): 0.56 ($t_{1/2}$ 1.0×10^{-11} s) scint spect (27T56a)	
Te^{121m}	154 d (67H51d); 143 d (14E46a); 125 d (13S40); 140 d (10C51a)	☢ IT (14E46a); A chem, excit, cross bomb (13S40); chem, n-capt, sep isotopes (10C51a); parent Te^{121} (82B46); others (37L50)	γ	0.0818 (coinc with 0.214 γ), 0.214 (e_K/γ 0.072, K/L 6.3) spect conv, scint spect, conv-γ coinc (98G54, 98G55, 98G56); 0.082 (e/γ very large, K/L 0.75, coinc with 0.213 γ), 0.213 (e_K/γ 0.09, K/L 7.3) spect conv, conv-γ, conv-conv coinc (43K50); 1.13 (not coinc with other γ's) scint spect, γ-γ coinc (166B57); others (67H49, 81B46, 6Y45, 20D50, 4K42a, 10C51a)	Q_{IT} 0.296 (SHS)
Te^{121}	17 d (14E46a); ~16 d (82B46)	☢ EC (14E46a); A chem, genet (14E46a, 82B46); daughter Te^{121m} (82B46); daughter I^{121} (74M50)	γ	0.506 (13%, e/γ ~0.018, K/L+M 6), 0.573 (87%, not coinc with 0.506 γ, e/γ 0.009, K/L+M 6) spect conv, scint spect (67H52); 0.575 spect conv (10C51a); ~0.61 (e_K/γ 0.004) spect conv (43K50); 0.070 (2%, coinc with 0.506 γ) scint spect, γ-γ coinc (166B57); others (14E46a)	



(18G52, SHS)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{52}Te^{122}$		%	2.46 (1B50)	γ	Coulomb excitation (in Te^{122}): 0.57 ($t_{1/2}$ 1.0×10^{-11} s) scint spect (27T56a); 0.57 level of Te^{122}: $t_{1/2}$ 1.0×10^{-11} s Coul exc (27T56a); $t_{1/2}$ 1.5×10^{-10} s delay coinc (111C55); see also gammas of Sb^{122}	see Sb^{122}
Te^{123m}	104 d (67H51d); 121 d (10C51a)	☢ A	IT (67H49); chem, n-capt, sep isotopes (67H49)	γ	γ_1 0.0887 (coinc with γ_2), γ_2 0.159 (e_K/γ 0.17, K/L 6.6) spect conv, scint spect, conv-γ coinc (98G56, 98G55, 98G54); γ_1 0.0885 (e/γ very large, K/L 0.68, coinc with γ_2), γ_2 0.159 (e_K/γ 0.18, K/L 8.9) spect conv, γ-conv coinc, conv-conv coinc, abs (43K50); γ_1 0.0887, γ_2 0.159 spect conv (10C51a); γ_1 (L_I/L_{III} 0.5) spect conv (63M52a); γ_2 (E_K/γ 0.19) conv-γ coinc, scint spect (52M54); γ_2: $t_{1/2}$ 1.9×10^{-10} s delay coinc (14G53); no 0.25 γ (lim 0.5%) scint spect (68H51); others (4K42a, 67H49, 20D50, 52M52)	Q_{IT} 0.248 (SHS) 
Te^{123}	$t_{EC} > 10^{13}$ y sp act (133H55)	% I μ	0.87 (1B50); 1/2 atomic spect (87M50); -0.7320 nucl induct (61W53)	γ	Coulomb excitation (in Te^{123}): γ_1 0.159 (coinc with γ_2 and γ_3), γ_2 0.274, γ_3 0.342, γ_4 0.436, γ_5 0.504 scint spect, γ-γ coinc (52F55)	
Te^{124}		%	4.61 (1B50)	γ	Coulomb excitation (in Te^{124}): 0.61 ($t_{1/2}$ 9×10^{-12} s) scint spect (27T56a); others (135B53); see also gammas of Sb^{124} and I^{124}	see Sb^{124} and I^{124}
Te^{125m}	58 d (67H49a, 67H51d)	☢ A	IT (23F48); chem, genet (23F48); daughter Sb^{125} (23F48, 28K49); not daughter I^{125} (lim 0.05%) (23F51b)	γ	0.110 (e_K/γ ~160, K/L+M 1.2), 0.0355 (e_K/γ ~12, K/L 7.3) spect conv, ion ch, scint spect, x-γ coinc, x-x coinc (28B52); 0.110, 0.0353 spect conv (10C51a); 0.110 (K/L+M 1.1), 0.035 spect conv (7S49d); 0.110 (K/L 1.2) spect conv (28K49); 0.109 (e/γ >100, K/L ~1.5) spect conv (67H49a); 0.035 γ: $t_{1/2}$ 1.6×10^{-9} s delay coinc (14G53); others (21C52, 67H49, 23F50a, 28B49); see also gammas of Sb^{125} and I^{125}	Q_{IT} 0.145 (28B52); see Sb^{125} and I^{125} 
Te^{125}		% I μ	6.99 (1B50); 1/2 atomic spect (87M50); -0.8824 nucl induct (61W53)	γ	Coulomb excitation (in Te^{125}): 0.435, 0.63 scint spect (52F55); see also gammas of Sb^{125}	
Te^{126}		% μ	18.71 (1B50); ~0 atomic spect (87M50)	γ	Coulomb excitation (in Te^{126}): 0.66 ($t_{1/2}$ 7×10^{-12} s) scint spect (27T56a); 0.67 ($t_{1/2}$ 4×10^{-12} s) scint spect (121S57b); see also gammas of I^{126}	see I^{126}

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{52}Te^{127m}$	105 d (20K56); 115 d (10C51a); 90 d (13S40)	☢ IT 98%, β^- 2% (20K56); A chem, excit, genet (13S40); parent Te^{127} (13S40, 33G51i, 43W51); daughter (16%) Sb^{127} (78B48); others (2S47, 38G46, 43W48, 38G48)	γ with IT: 0.0885 (K/L 0.75) spect conv (67H49, 67H49a); 0.0887 spect conv (10C51a); 0.086 (e/γ very large, K/L 0.75) spect conv (2H41); 0.089 (†13) scint spect (20K56); with β^-: 0.059 (†66), 0.67 (†1.7) scint spect (20K56); see also gammas of I^{127} and Xe^{127}	Q_{IT} 0.089 (SHS) (11/2-) Te^{127m} (105 d) IT 98% β^- 2% 0.089 (3/2+) Te^{127} (9.4 h) β^- 1% 99% 0 0.418 Q_{β^-} 0.69 (SHS); see Xe^{127} 0.203 (7/2+) I^{127} 0.057 5/2+ 0 see I^{128} (20K56, 18G52, SHS)
$_{-}Te^{127}$	9.4 h (20K56); 9.3 h (13S40)	☢ β^- (32A39); A chem (28T38, 32A39); chem, excit, cross bomb (13S40); daughter Te^{127m} (13S40, 33G51i, 43W51); daughter (84%) Sb^{127} (32A39, 33G51i, 78B48); others (2S47, 28T38, 43W48)	β^- 0.70 (99%) spect (20K56); 0.68 scint spect (83D55); others (33G51i, 110K56); γ γ_1 0.059 (0.05%, coinc with γ_2 and γ_5), γ_2 0.145 (0.007%), γ_3 0.203, γ_4 0.215, γ_5 0.360 (0.1%), γ_6 0.418 (0.8%) scint spect, γ-γ coinc (20K56); see also gammas of I^{127} and Xe^{127}	
Te^{128}		% 31.79 (1B50); μ ~0 atomic spect (87M50)	γ Coulomb excitation (in Te^{128}): 0.75 ($t_{1/2}$ 4×10^{-12} s) scint spect (27T56a); 0.75 ($t_{1/2}$ 3×10^{-12} s) scint spect (121S57b); see also gammas of I^{128}	
Te^{129m}	33.5 d (10C51a); 32 d (13S40, 1N51a); 41 d (88G56a)	☢ IT (13S40); IT, β^- (?) (88G56a); A chem, genet (13S40); parent Te^{129} (13S40, 38G46, 43W51); others (2S47, 28T38, 25W48, 16H43b, 43W48, 1N51a, 30P51a, 33G48)	β^- 1.53 (?) spect (88G56a); γ 0.1063 (K/L+M ~1) spect conv (88G56a); 0.1060 spect conv (10C51a); 0.106 (K/L ~1) spect conv (67H49); 0.102 (e/γ very large, K/L ~1) spect conv (2H41); with Te^{129}: 0.0268, 0.21, 0.475, 0.72, 1.14 scint spect, spect conv (88G56a)	Q_{IT} 0.106 (SHS) (11/2-) Te^{129m} (33 d) β^- (?) IT 0.106 (3/2+) Te^{129} (72 m) β^- 0 Q_{β^-} 1.48 (SHS) 10% 4% 15% 71% 1.12 0.74 0.49 0.027 7/2+ I^{129} 0 (88G56a, SHS)
Te^{129}	72 m (13S40); 70 m (32A39, 33G51i); 74 m (88G56a); 67 m (25W48)	☢ β^- (13S40); A chem, excit (37B39, 13S40); daughter Te^{129m} (13S40, 38G46, 43W51); daughter Sb^{129} (32A39); others (2S47, 28T38, 25W48, 6H37, 72B51, 16H43b, 43W48, 1N51a)	β^- 0.29 (10%, coinc with γ_5), 0.69 (4%, coinc with γ_4), 0.99 (15%, coinc with γ_3), 1.45 (71%, coinc with γ_1) spect, β-γ coinc (88G56a); 1.01 (20%, coinc with γ_3), 1.46 (80%, coinc with γ_1) scint spect, β-γ coinc (83D55); others (11R47, 33G51i); γ γ_1 0.0268 (coinc with γ_3 and γ_5), γ_2 0.21 (coinc with γ_3), γ_3 0.475, γ_4 0.72 (not coinc with γ_1), γ_5 1.14 scint spect, spect conv, γ-γ coinc (88G56a); 0.44 (9%), 1.08 (0.7%) scint spect (155M55); 0.46 (†10), 0.78 (?), 1.07 (†1) scint spect (156S55); ~0.035, 0.450 scint spect (83D55); others (33G51i)	
Te^{130}	$t_{\beta\beta}$ $\sim 10^{21}$ y Xe ratios, mass spect (3I50b); others (59F52, 112S53, 11F52)	% 34.49 (1B50); μ ~0 atomic spect (87M50)	γ Coulomb excitation (in Te^{130}): 0.85 ($t_{1/2}$ 2.4×10^{-12} s) scint spect (27T56a); 0.85 ($t_{1/2}$ 1.9×10^{-12} s) scint spect (121S57b)	2+ 2.2×10^{-12} s 0.85 0+ Te^{130} 0 (27T56a)

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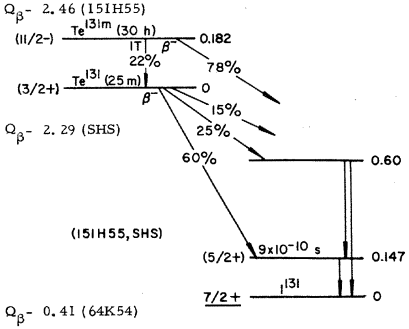
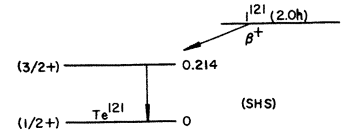
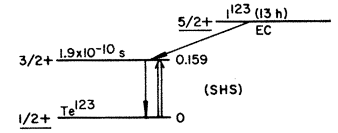
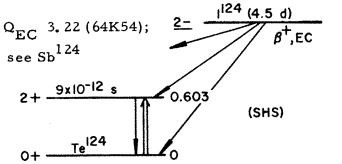
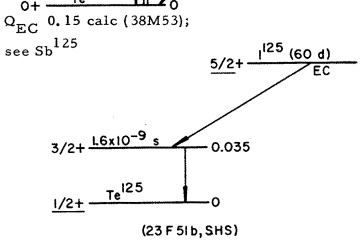
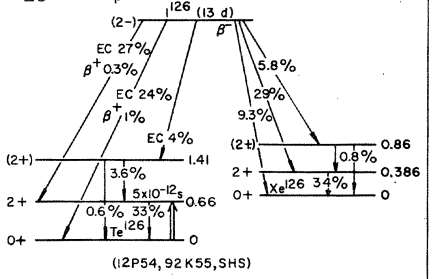
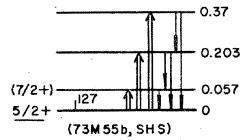
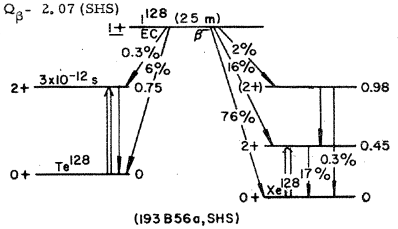
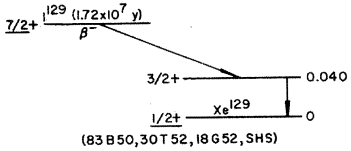
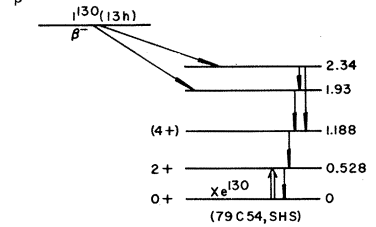
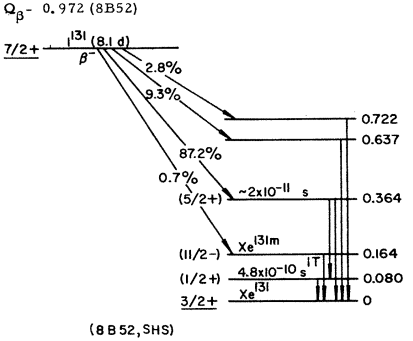
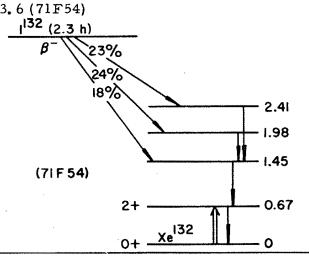
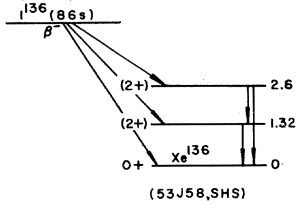
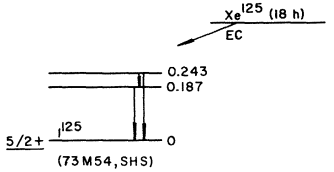
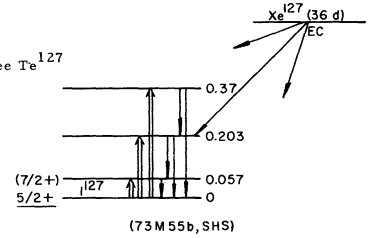
$_{52}Te^{131m}$	30 h (32A39, 13S40)	☢ β^- 78%, IT 22% (151H55); A chem, genet (13S40); parent Te^{131} (32A39, 13S40, 43W51); daughter Sb^{131} (68C51); others (2S47, 16H39a, 32K51d, 30P51a)	β^- γ	0.42 (52%), 0.57 (17%), 0.98 (4.6%), 2.46 (4.7%) spect (151H55); 0.1817 (with IT, K/L 2.3) spect conv (86A57); 0.180 (with IT), 0.051 (?), 0.099, 0.147, 0.24, 0.28, 0.33, 0.45, 0.58, 0.77, 0.84, 1.12, 1.63 spect, spect conv (151H55); 0.15, 0.77, 1.14 scint spect (155M55); 0.177 (K/L 2) spect conv (2H41)	Q_{IT} 0.182 (86A57); Q_{β^-} 2.46 (151H55) 
Te^{131}	24.8 m (37G52); 25 m (13S40)	☢ β^- (13S40); A chem, excit (13S40); daughter Te^{131m} (32A39, 13S40, 43W51); parent I^{131} (32A39, 13S40, 30P51, 68C51); daughter Sb^{131} (30P51, 68C51); others (2S47)	β^- γ	1.35 (15%), 1.69 (25%), 2.14 (60%) spect (151H55); 1.4 (~45%), 2.0 (~55%) abs, β-γ coinc (37G52); γ_1 0.15 (†100), γ_2 0.45 (†24), γ_3 0.60 (†~6), γ_4 0.95 (†~4), γ_5 1.14 (†~8) scint spect (155M55); γ_1: $t_{1/2}$ 9×10^{-10} s delay coinc (60W56, 64G56b); others (37G52, 151H55)	Q_{β^-} 2.29 (SHS)
Te^{132}	77.7 h (30P51a); 77 h (32A39); others (58F56)	☢ β^- (32A39); A chem, genet (32A39); fission fragment range (32K48); parent I^{132} (32A39, 16H39a, 16H39e, 1N51b, 44W51); daughter Sb^{132} (32A39); others (7N49a, 16H39d, 72B51, 21T51)	β^- γ	0.22 spect (10L51a); 0.3, ~0.1 abs (1N51b); ~0.3 abs (70B43a); 0.231 scint spect (10L51a); 0.22 abs (1N51b)	Q_{β^-} 0.41 (64K54)
Te^{133m}	63 m (30P52); 60 m (32A39, 16W40); 53 m (86A57)	☢ β^- 87%, IT 13% calc (86A57); A chem, genet (32A39); parent Te^{133} (30P52); daughter Sb^{133} (30P51); ancestor I^{133} (32A39, 16H39a, 24S40, 16W40, 16W45, 30P51); others (32K48)	γ	0.3340 (with IT, K/L 4.5) spect conv (86A57); ~0.4 scint spect (30P52); with Te^{133}: 0.6, 1.0 abs (30P52)	
Te^{133}	2 m (30P52)	☢ β^- (30P52); B chem, genet (30P52); daughter Te^{133m} (30P52); parent I^{133} (30P52a)	β^- γ	2.4 (~30%), 1.3 (~70%) abs (30P52); 0.6, 1.0 abs (30P52)	Q_{β^-} 3.0 (64K54)
Te^{134}	44 m (30P51a); 43 m (32A39)	☢ β^- (32A39); A chem, genet (32A39); parent I^{134} (32A39, 16H39a, 30P51a); others (32K48, 9P40)			
Te^{135}	<2 m (33G51j, 22D40, 32K51e)	☢ β^- (22D40); E genet (22D40); parent I^{135} (33G51j, 32K51e)			
Te	~1 m (16H43b)	☢ β^- (16H43b); E chem (16H43b)			

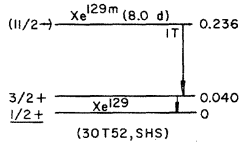
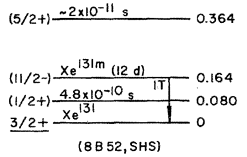
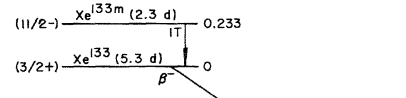
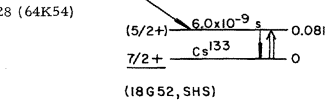
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{53}I^{118}$	~10 m (89A57)	E mass spect (89A57)		
I^{119}	18 m (82R54); 19 m (89A57); 30 m (74M50)	☢ β^+ (74M50); B chem (74M50); mass spect (89A57); others (74M51, 82R54)	β^+ 4.0 abs, spect (74M50)	
I^{120}	1.4 h (89A57)	☢ [EC] (89A57); C mass spect (89A57)		
I^{121}	2.0 h (89A57); 1.5 h (73M54a, 40D52); 1.4 h (82R54); 1.8 h (74M50)	☢ β^+ (74M50); A chem, genet (74M50); mass spect (89A57); parent Te^{121} (74M50); daughter Xe^{121} (73M54a, 40D52); others (37T52, 74M50)	β^+ 1.2 abs, spect (74M50); 1.2, 4.0 (weak) (40D52); γ 0.210 spect conv, scint spect (73M54a); others (74M50); see also gammas of Te^{121m}	
I^{122}	3.5 m (73M54a); 3.6 m (7Y51); 3.4 m (40D52); 4 m (74M50)	☢ β^+ (74M50); A chem, excit (74M50); sep isotopes (7Y51); daughter Xe^{122} (37T52, 40D52)	β^+ 3.12 spect (73M54a); 2.9 abs (74M50); 3.1 abs (7Y51); γ no γ (73M54a)	Q_{EC} 4.14 (SHS)
I^{123}	13.0 h (14M49); 13 h (74M50, 73M54a)	☢ EC (74M50); A chem, excit (74M50); chem, sep isotopes (14M49); daughter Xe^{123} (40D52, 73M54a); others (74M51, 37T52); I 5/2 atomic beam (87L57)	γ 0.159 spect, spect conv (14M49); 0.160 spect conv, scint spect (73M54a); see also gammas of Te^{123m}	
I^{124}	4.5 d (74M50); 4.0 d (12L38e); 3.4 d (89A57); 4.4 d (124G57)	☢ EC ~70%, β^+ ~30% (74M50); A chem, excit, cross bomb (12L38e); others (74M51, 11G49, 89A57); I 2 atomic beam (120G57a)	β^+ 2.20 (†51), 1.50 (†44), 0.7 (†5) spect (14M49); 2.1 spect, abs (74M50); γ 0.603, 0.73, 1.72, 1.95 spect, spect conv (14M49); 0.605, 0.73, 1.50, 1.69, 2.09, 2.3, 2.7 scint spect (124G57); no γ coinc with 2.2 β^+, β-γ coinc (85S51); γ-γ, β-γ coinc (37M49); see also gammas of Te^{124} and Sb^{124}	
I^{125}	60.0 d (23F51b); 56 d (17R46a)	☢ EC (L/K 0.23) (38M53); EC (L/K 0.3) (23F51b); no β^+ (33G47); A chem (17R46a); chem, excit (33G47); genet (67B51b); daughter Xe^{125} (67B51b); not parent Te^{125m} (lim 0.05%) (23F51b); others (74M50, 11G49); I 5/2 microwave (70F57); μ ±2.6 microwave (70F57); q -0.66 microwave (70F57)	γ 0.0354 (K/L+M ~4.4) spect conv (67B52); 0.035 ion ch (23F51b); see also gammas of Te^{125} and Sb^{125}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{53}I^{126}$	2.6 h (89A57)	E mass spect (89A57)		
I^{126}	13.3 d (12P54); 13.0 d (12L38e); 13.1 d (89A57)	☢ EC 55%, β^- 44%, β^+ 1.3% (12P54); EC (K) 51% (38E57); EC 55%, β^- 44%, β^+ 1.2% (92K55); A excit (28T38); chem, excit, cross bomb (12L38e); others (74M51, 74M50, 12P49, 85S51a, 27M49, 3O50, 11G49)	β^- 0.39 (†5.8), 0.87 (†29), 1.25 (†9.3) spect, β-γ coinc (92K55); 0.85 (†32), 1.27 (†12) spect (14M49); 0.87 (†32), 1.26 (†12) spect (54M53); β^+ 0.46 (†0.3), 1.11 (†1.0) spect (92K55); 1.21 spect (54M53); 1.19 scint spect (12P54); γ γ_1 0.382 (†100, coinc with γ_2 and 0.87 β^-), γ_2 0.48 (†9.6, coinc with β^-), γ_3 0.65 (†96, coinc with γ_4, not coinc with β^-), γ_4 0.74 (†11, not coinc with β^-), γ_5 0.86 (†1.8 coinc with 0.39 β^-), γ_6 1.42 (†1.1) scint spect, β-γ, γ-γ coinc, spect conv (12P54, 12P51); γ_1 0.386 (34%, e_K/γ 0.017, K/L+M 7, coinc with γ_2), γ_2 0.48 (5%), γ_3 0.65 (33%, coinc with γ_4), γ_4 0.75 (3.6%), γ_5 0.86 (0.8%) spect conv, scint spect, γ-γ coinc (92K55); 0.386 (†100, e_K/γ 0.017, K/L+M ≥8), 0.670 (†98) spect, spect conv (54M53); others (14M49, 85S51); see also gammas of Te^{126} and Cs^{126}	Q_{EC} 2.14, Q_{β^-} 1.24 (33L57)  (12P54, 92K55, SHS)
I^{127}		% 100 (6N37); I 5/2 atomic spect, microwave (87M50); μ +2.7935 nucl induct (67K56, 61W53); q -0.69 atomic spect (88M55b); -0.82 atomic beam (79L53); others (88M54a, 21OS55, 30J53, 111K52)	γ Coulomb excitation (in I^{127}): 0.060, 0.201, 0.44, 0.63, 0.75 scint spect (45D56); 0.058, 0.200, 0.365, 0.48 scint spect (27T56a, 97H54); 0.060, 0.205 scint spect (41A56, 41A56a); 0.212 scint spect (141M55); see also gammas of Te^{127} and Xe^{127}	see Te^{127} and Xe^{127}  (73M55b, SHS)
I^{128}	24.99 m (69H41); 25.4 m (89A57)	☢ β^- 93.6%, EC 6.4% (193B56a); β^- 95%, EC 5% (28R50); β^- 94%, EC 6% (41M51a); A chem, n-capt (12A35); others (28T38, 2S47, 7S46, 9O49, 50H51, 12L38e, 89A57); I 1 atomic beam (234S57)	β^- 2.12 (76%), 1.67 (16%), 1.13 (2%) spect (193B56a); 2.02 spect (7S46); γ 0.75 (0.3%, with EC), 0.46 (17%, coinc with 0.54 γ), 0.54 (1.8%), 0.99 (0.3%) scint spect, γ-γ coinc (193B56a); 0.75 (†~0.5), 0.44 (†100), 0.52 (†<1.5), 0.96 (†3) scint spect (103G56); 0.46 (†100), 0.98 (†3) scint spect (47W53b); others (156S55, 7S46, 90G53); see also gammas of Te^{128}, Cs^{128}, and Xe^{128}	Q_{β^-} 2.07 (SHS)  (193B56a, SHS)
I^{129}	1.72×10^7 y sp act (32K51f); 3×10^7 y sp act (26P49b); others (62P56)	☢ β^- (32K47); A chem, n-capt (32K47); I 7/2 microwave (87M50); μ +2.603 nucl induct (67K56, 61W53); q -0.49 quadrupole res (calc from 79L53a, 88M55b)	β^- 0.150, no 0.188 β^- spect (38M54a); 0.12 abs (26P49b); ion ch (83B50); 0.13 abs (32K51f); γ 0.038 (e_K/γ 22, K/L ~10) spect conv, ion ch (38M54a); 0.039 (coinc with β^-, e_K/γ ~6, K/L ~40) ion ch, β-γ coinc (83B50); see also gammas of Xe^{129m} and Xe^{129}	Q_{β^-} 0.188 (64K54)  (83B50, 30T52, 18G52, SHS)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{53}I^{130}$	12.6 h (12L38e); 12.5 h (89A57)	☢	β^- (12L38e);	β^-	0.60 (54%), 1.02 (46%) spect (79C54); 0.61 (~40%), 1.03 (~60%) spect (33R43);	Q_{β^-} 2.95 (SHS) 
		A	chem, cross bomb (12L38e); others (32K47, 16W40, 89A57)	γ	γ_1 0.409 (†30, e_K/γ 1.6×10^{-2}, K/L+M 11, coinc with γ_4), γ_2 0.528 (†100, e_K/γ 6×10^{-3}, K/L+M 8, coinc with γ_4 and γ_5), γ_3 0.660 (†90, e_K/γ 3×10^{-3}, K/L+M 16, coinc with γ_4 and γ_5), γ_4 0.744 (†80, e_K/γ 3×10^{-3}, K/L+M 4), γ_5 1.15 (†40, e_K/γ 3×10^{-4}) spect conv, scint spect, γ-γ coinc (79C54); 0.417 (coinc with 0.6 β^-, e_K/γ 1.2×10^{-2}), 0.537 (e_K/γ 7×10^{-3}), 0.667 (e_K/γ 4×10^{-3}), 0.744 (e_K/γ 3×10^{-3}) spect, spect conv, β-γ, γ-γ coinc (33R43); see also gammas of Xe^{130}	
I^{131}	8.08 d (213S53); 8.05 d (106B53b); 8.14 d (39S51a); 8.06 d (55L53); 8.16 d (17K51); 8.04 d (38S51)	☢	β^- (12L38e);	β^-	0.815 (0.7%), 0.608 (87.2%), 0.335 (9.3%), 0.250 (2.8%) spect, β-γ coinc (8B52); 0.810, 0.606, 0.335, 0.250 spect, β-γ coinc (24K51); 0.807, 0.606, 0.339 spect (40R52); E (average) 0.189 ion ch (77C52); others (69C52, 8V51, 20N51, 10C51b, 30T51, 11B51, 22F50, 28K49, 44M48, 25D42, 207B52);	Q_{β^-} 0.972 (8B52) 
		A	chem (12L38e); chem, genet (13S40); daughter Te^{131} (12L38e, 32A39, 16H39a, 13S40, 30P51, 68C51); parent (~1%) Xe^{131m} (48B49, 67B50b); others (33R41a, 7N49a, 16F41, 21T51, 32A39, 16H39a, 38G46, 23S51j, 1Y47, 32K51g, 38G48, 28F51, 89A57);	γ	0.080 (2.2%, coinc with 0.284 γ, e_K/γ 1.73, K/L 7), 0.163, 0.284 (5.3%, coinc with 0.608 β^-, e_K/γ 0.047, K/L 5), 0.364 (80%, coinc with 0.608 β^-, e_K/γ 0.018, K/L 8), 0.637 (9%, coinc with 0.335 β^-, e_K/γ 0.0037, K/L 9), 0.722 (3%, coinc with 0.250 β^-, e_K/γ 0.0028, K/L 8) spect, spect conv, β-γ delay coinc, scint spect (8B52, 8B52a); 0.08016, 0.28431, 0.36447 cryst spect (152H53, 29L49a); 0.0802 (L_I/L_{II} ~10), 0.1638, 0.1771 spect conv (119S56a); 0.284 (†6, e_K/γ 0.05, K/L+M 3.3), 0.364 (†100, e_K/γ 0.02, K/L+M 5.6), 0.638 (†10, e_K/γ 4×10^{-3}), 0.723 (†3, e_K/γ 3×10^{-3}) spect, spect conv (93H52a); 0.177 spect conv (10C50h, 67B54a); 0.080 γ: $t_{1/2}$ 4.8×10^{-10} s delay coinc (14G51a, 8B52, 8B52a); 0.364 γ: $t_{1/2}$ ~2×10^{-11} s delay coinc (14S57); others (69C52a, 69C52, 86S52, 8V51, 30T51, 24K51, 10C51b, 22F50, 28K49, 48B49, 44M48, 13O48, 25D42, 40R52, 52W51, 24E51, 67B54a, 10C50h, 181S54a, 20N54, 86S53, 6W52b, 79A52); see also gammas of Te^{131}, Xe^{131m}, and Xe^{131}; 0.147 level of I^{131}: $t_{1/2}$ 9×10^{-10} s delay coinc (60W56, 64G56b)	
		I	7/2 microwave (79L53); 7/2 atomic beam (87L57);			
		q	-0.35 microwave (calc from 79L53, 88M55b)			
I^{132}	2.26 h (24E54); 2.30 h (1W55)	☢	β^- (32A39);	β^-	2.12 (18%), 1.53 (24%), 1.16 (23%), 0.9 (20%), others (15%) spect (71F54); others (1N51b, 75S49, 70B43a);	Q_{β^-} 3.6 (71F54) 
		A	chem, genet (32A39); chem, mass spect (89A57); daughter Te^{132} (32A39, 16H39a, 16H39e, 1N51b, 44W51); others (16F41, 72B51, 21T51, 9P40, 38G46, 38G48)	γ	γ_1 0.53 (†25, coinc with γ_3 and γ_4), γ_2 0.62 (†6, coinc with γ_3), γ_3 0.67 (†94, e_K/γ 2.7×10^{-3}, coinc with 2.12 β^-, γ_4 and γ_8), γ_4 0.78 (†80, coinc with 2.12 β^-, γ_5, γ_6, and γ_7), γ_5 0.96 (†20), γ_6 1.16 (†8), γ_7 1.40 (†11), γ_8 1.96 (†~5), γ_9 2.2 (†~2) spect, spect conv, scint spect, β-γ, γ-γ coinc (71F54); 0.69 (†94), 1.41 (†10), 2.0 (†3), ~0.8 (very weak) scint spect, γ-γ coinc (46M51); see also gammas of Cs^{132} and Xe^{132}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{53}I^{133}$	20.8 h (32K53); 20.9 h (1W55); 22.4 h (30P51a)	☢	β^- (32A39, 16H39a);	β^-	1.3 (~91%), 0.4 (~9%) abs (30P52a); 1.4 (~94%), 0.5 (~6%) abs, β-γ coinc (48B49a); 1.4 abs (23S51j);	Q_{β^-} 1.83 (64K54)
		A	chem (32A39); chem, genet (16W40); descendant Te^{133m} (32A39, 16H39a, 24S40, 16W40, 16W45, 30P51); parent Xe^{133} (24S40, 16W40, 16W45); parent Xe^{133m} (2.4%) (8Z51, 24K51a); daughter Te^{133} (30P52a); others (16F41, 30P51, 23S51k, 28F51, 89A57)	γ	0.53 (94%), 0.85 (5%), 1.4 (1%) scint spect, γ-γ coinc (48B49a); 0.53 spect (6P47b)	
I^{134}	52.5 m (30P51a); 52.4 m (1W55); 54 m (32A39)	☢	β^- (32A39);	β^-	2.5, 1.5 scint spect, β-γ coinc (99M54);	Q_{β^-} 3.4 (64K54)
		A	chem (32A39); fission fragment range (32K48); chem, mass spect (89A57); daughter Te^{134} (16H39a, 32A39, 30P51a); others (16F41, 22D39, 1Y47, 9P40, 9P40a, 28F51, 1Y53)	γ	0.12 (?), 0.20 (?), 0.86 (coinc with 2.5 β^-), 1.10, 1.78 scint spect (99M54); see also gammas of Xe^{134}	
I^{135}	6.68 h (6P47b); 6.7 h (33G51j, 32K51e); 6.8 h (1W55)	☢	β^- (1W55);	β^-	0.5 (35%), 1.0 (40%), 1.4 (25%) spect (6P47b); 1.4 abs (32K51e); 1.5 abs (23S51j);	
		A	chem, genet (22D40, 24S40); daughter Te^{135} (33G51j, 32K51e); parent Xe^{135m} (30%), parent Xe^{135} (70%) (6P47b); parent Xe^{135m} (40G40, 16W45); parent Xe^{135} (24S40, 22D40, 40G40, 16W45); others (72B51, 16W40, 28F51, 89A57)	γ	0.42 (6.9%), 0.53 (with Xe^{135m}, 27%), 0.86 (11%), 1.04 (9%), 1.14 (37%), 1.28 (34%), 1.46 (12%), 1.72 (19%), 1.80 (11%) scint spect (80H58); 1.8, 1.27 spect (6P47b); others (23S51j, 32K51e)	
I^{136}	86 s (84S49)	☢	β^- (65S40);	β^-	7.0, 5.6, 4.2, 2.7 (?) scint spect, β-γ coinc (53J58); 6.3, 5.0, 3.7 scint spect, β-γ coinc (99M54, 84S49);	Q_{β^-} 7.0 (53J58)  (53J58,SHS)
		D	chem (65S40); others (66S43)	γ	0.210, 0.270, 0.388, 0.493, 0.87, 1.32 (strong, coinc with 5.6 β^-, 4.2 β^-, 0.19 γ, 0.28 γ, 0.39 γ, 0.56 γ, 0.87 γ, and 1.32 γ), 1.55, 1.89, 2.32, 2.61, 2.84, 3.18 scint spect, γ-γ, β-γ coinc (53J58); 1.38 (coinc with 5.0 β^-), 2.9 (coinc with 3.7 β^-), ~1.4 (coinc with 1.38 γ) scint spect, β-γ, γ-γ coinc (99M54, 84S49)	
I^{137}	22.0 s (n) (28H48a); 22.5 s (n) (34R47); 19.3 s genet (63S49); others (129K57)	☢	β^-, β^- n (~6% of disintegrations) (19L51a);	n	(mean): 0.56 abs paraffin (28H48a); 0.67 p recoil in cl ch (71B46)	
		A	chem (65S40, 26S47); chem, genet (66S43, 63S49); parent Xe^{137} (66S43, 63S49); others (34R47, 63S47a)			
I^{138}	5.9 s (63S49); others (129K57)	☢	β^- (63S49); n (59P57a);			
		B	chem, genet (63S49); ancestor Cs^{138} (63S49)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{53}I^{139}$	2.7 s (63S49)	☢	β^- (63S49);			
		B	chem, genet (63S49); parent Xe^{139}, ancestor Ba^{139} (63S49)			
$_{54}Xe^{121}$	40 m (40D52, 73M54a); 70 m (37T52)	☢	β^+ (73M54a);	γ	0.096 spect conv (73M54a)	
		B	chem, genet (40D52, 37T52); parent I^{121} (40D52)			
Xe^{122}	19.5 h (37T52); 20.0 h (40D52); 19 h (73M54a)	☢	EC (73M54a);	γ	0.182, 0.235 scint spect, spect conv (73M54a)	
		A	chem, genet (37T52, 40D52, 73M54a); parent I^{122} (37T52, 40D52)			
Xe^{123}	2.1 h (37T52); 1.7 h (40D52); 1.8 h (73M54a)	☢	EC, β^+ (73M54a);	β^+	1.7 scint spect, abs (73M54a);	
		A	chem, genet (37T52, 40D52, 73M54a); parent I^{123} (37T52, 40D52); daughter Cs^{123} (73M54a, 73M54)	γ	0.148 scint spect, spect conv (73M54a)	
Xe^{124}		%	0.096 (6N50a)			
Xe^{125m}	55 s (73M54)	☢	IT (?) (73M54);	γ	0.110, 0.075 (?) scint spect (73M54)	
		B	genet (73M54); daughter Cs^{125} (~0.1%) (73M54)			
Xe^{125}	18.0 h (67B52); 20 h (33A50)	☢	EC, no β^+ (67B51b, 33A50);	γ	0.054 (K/L+M 4.3), 0.096, 0.106, 0.187 (K/L+M 4.6), 0.243 (K/L+M ~7), 0.46 scint spect, spect conv (67B52, 67B51b); 0.056 (coinc with 0.187 γ), 0.187, 0.243, ~0.46 scint spect, γ-γ coinc (73M54)	
		A	chem, sep isotopes (33A50); chem, mass spect (67B51b); parent I^{125} (67B51b); daughter Cs^{125} (73M54)			
Xe^{126}		%	0.090 (6N50a)			
Xe^{127m}	75 s (29C40b)	☢	IT (29C40b, 73M54);	γ	0.125, 0.175 spect conv (29C40b); scint spect (73M54); see also gammas of Cs^{127}	
		B	chem (29C40b); genet (73M54); daughter Cs^{127} (0.01%) (73M54)			
Xe^{127}	36.41 d (208B54); 34 d (29C40b); 32 d (33A50); 25 d (67B51d)	☢	EC, no β^+ (73M55b);	γ	0.057 (K/L+M 6.2), 0.145, 0.170, 0.203 (K/L+M 4.7), 0.37 spect conv, scint spect (67B52, 67B51c); 0.056 (coinc with 0.145 γ and 0.170 γ), 0.145, 0.170, 0.200 (coinc with 0.170 γ), 0.368 scint spect, γ-γ coinc (73M55b); see also gammas of Te^{127} and I^{127}	
		A	chem (29C40b); chem, sep isotopes (33A50); mass spect (67B51c); daughter Cs^{127} (33F50)			
Xe^{128}		%	1.919 (6N50a)	γ	Coulomb excitation (in Xe^{128}): 0.445 scint spect (60P58)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{54}Xe^{129m}$	8.0 d (67B51c)	☢	IT (67B51c);	γ	0.0400 (K/L+M 4.3), 0.196 (e_K/γ 11, K/L+M 2.1) spect conv, scint spect (30T54b, 67B54, 67B52, 30T52, 67B51c); see also gammas of I^{129}, Cs^{129}, and Xe^{129}	Q_{IT} 0.236 (SHS) 
		A	chem, mass spect (67B51c)			
Xe^{129}		%	26.44 (6N50a);	γ	Coulomb excitation (in Xe^{129}): 0.290 scint spect (60P58, 27T56a); see also gammas of Xe^{129m}, Cs^{129}, and I^{129}	
		I	1/2 atomic spect (87M50);			
		μ	−0.7725 nucl induct (67K56, 61W53); others (173B54b, 209B52)			
Xe^{130}		%	4.08 (6N50a)	γ	Coulomb excitation (in Xe^{130}): 0.535 scint spect (27T56a, 60P58); see also gammas of I^{130}	see I^{130} and Cs^{130}
Xe^{131m}	12.0 d (67B50b, 12P53)	☢	IT (48B49, 44C44);	γ	0.1639 (e_K/γ 29, K/L 2.3) spect conv, scint spect (67B54, 67B52, 67B50b, 67B51c); 0.163 (K/L+M 1.7) spect conv (8V51); 0.165 (e/γ ~20) abs conv, abs (48B49); see also gammas of I^{131} and Xe^{131}; others (123G57)	Q_{IT} 0.164 (67B52); see I^{131} 
		A	chem (44C44); chem, genet (48B49); mass spect (67B50b); daughter (~1%) I^{131} (48B49, 67B50b); not daughter Cs^{131} (43C51c, 165S54b); daughter Cs^{131} (?) (70C50)			
Xe^{131}		%	21.18 (6N50a);	γ	0.080 level of Xe^{131}: $t_{1/2}$ 4.8×10^{-10} s delay coinc (14G51a, 8B52, 8B52a); 0.364 level of Xe^{131}: $t_{1/2}$ $\sim 2 \times 10^{-11}$ s delay coinc (14S57); Coulomb excitation (in Xe^{131}): 0.290, 0.355 scint spect (60P58, 27T56a); see also gammas of I^{131}	
		I	3/2 atomic spect (87M50);			
		μ	+0.68680 nucl induct (67K56, 61W53, 173B54b);			
		q	−0.12 atomic spect (209B52); others (87M50, 13T47)			
Xe^{132}		%	26.89 (6N50a);	γ	Coulomb excitation (in Xe^{132}): 0.67 scint spect (27T56a, 60P58); see also gammas of I^{132} and Cs^{132}	see I^{132} and Cs^{132}
		μ	~0 atomic spect (87M50); others (13T47)			
Xe^{133m}	2.3 d (67B51a); 2.1 d (24K51a)	☢	IT (24K50c);	γ	0.233 (e_K/γ 4.4, K/L 4.4) spect conv, scint spect (67B54, 67B51a); 0.235 (e_K/γ 4.2) spect conv, scint spect (24K51a)	Q_{IT} 0.233 (67B51a) 
		A	chem (24K50c); mass spect (67B51a); daughter I^{133} (2.4%), (8Z51, 24K51a); others (67B50c)			
Xe^{133}	5.270 d (76M50); 5.3 d (18E51)	☢	β^- (22D40);	β^-	0.347 spect (67B52, 67B50c); 0.34 abs (18E51); 0.35 abs (13E51e);	Q_{β^-} 0.428 (64K54) 
		A	chem (20L39, 22D40, 24S40); chem, excit (16W40); mass spect (13T47, 30T49); daughter I^{133} (24S40, 16W40, 16W45); others (52C41, 21R43, 16W40, 16W45, 66S43b, 44C44, 70B43a, 8Z51)	γ	0.081 (e_K/γ 1.5, K/L+M 4.9) spect conv, scint spect (67B54, 67B52, 67B50c); 0.081 (e_K/γ 1.8, K/L 8) scint spect, β-γ coinc (14G53); 0.081 γ: $t_{1/2}$ 6.0×10^{-9} s delay coinc (14G53); others (13E51e, 84B51, 26S58); see also gammas of Cs^{133} and Ba^{133}	

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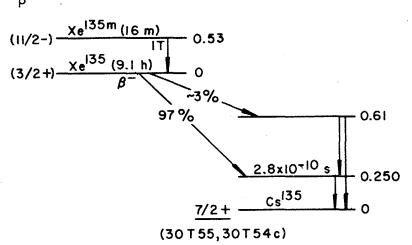
$_{54}Xe^{134}$		% 10.44 (6N50a); μ ~0 atomic spect (87M50); others (13T47)	γ Coulomb excitation (in Xe^{134}): no γ (60P58, 27T56a)	
Xe^{135m}	15.6 m (21R43); 15.3 m (6P47b); 13 m (1N51c)	☢ IT (16W45); A chem, genet (40G40, 16W45); daughter I^{135} (40G40, 16W45); daughter I^{135} (~30%) (6P47b); parent Xe^{135} (16W45); others (21R46, 66S43b, 13T47)	γ 0.53 (e_K/γ 0.16) scint spect (80H58a); 0.52 spect (6P47b); 0.5 (e/γ ~0.2) abs, abs conv (16W45, 1N51c)	
Xe^{135}	9.13 h (60B53b); 9.2 h (7N51, 58H51c, 67B52); 9.1 h (30T49)	☢ β^- (24S40); A chem (24S40, 22D40); chem, excit (16W40); mass spect (30T49); daughter I^{135} (24S40, 22D40, 40G40, 16W45); daughter I^{135} (~70%) (6P47b); daughter Xe^{135m} (16W45); parent Cs^{135} (63S49a); others (21R43, 52C41, 66S43b, 84B51)	β^- 0.91 spect (67B52, 67B51); 0.93 spect (6P47b); 0.55 (3%) spect, β-γ coinc (30T55, 30T54c); others (70B43a, 16W45, 7N51, 58H51c); γ 0.250 (†100, e_K/γ 0.054, K/L+M 6.5), 0.61 (†0.5) scint spect, spect conv (67B52, 67B51, 67B51d); 0.25 (†100, coinc with 0.36 γ and 0.55 β^-), 0.36 (†~0.1), 0.60 (†3) scint spect, β-γ, conv-γ coinc (30T55, 30T54c); 0.248 (K/L 7.0) spect conv, scint spect, β-γ coinc (14G53); 0.25 γ: $t_{1/2}$ 2.8 x 10^{-10} s delay coinc (14G53); others (6P47b)	Q_{β^-} 1.17 (64K54) 
$_{54}Xe^{136}$		% 8.87 (6N50a); μ ~0 atomic spect (87M50); daughter I^{137} (~6% of dis) (19L51a); others (13T47)		
Xe^{137}	3.9 m (63S49); 3.8 m (66S43); 3.4 m (21R43)	☢ β^- (66S43); A chem (66S43); mass spect (30T49); daughter I^{137} (66S43, 63S49); parent Cs^{137} (21T51b, 33G51k); others (66S43b)	β^- 3.5 abs (43N55); ~4 abs (66S43, 70B43a)	
Xe^{138}	17 m (36G40); others (16H40a)	☢ β^- (16H39a); A chem (16H39a); mass spect (30T49); parent Cs^{138} (16H39a, 16H40a, 36G40, 66S43b)	β^- 2.4 abs (43N55); γ 0.42 (†100), 0.51 (†20), 1.78, 2.01 scint spect (30T55)	
Xe^{139}	41 s (24D51)	☢ β^- (16H39a, 6H39); A chem, genet (16H39a, 6H39); daughter I^{139} (63S49); ancestor Ba^{139} (16H39a, 6H39, 24D51); parent Cs^{139} (16H39a, 6H39, 16H40, 16H40a); others (25A39, 16H40)		

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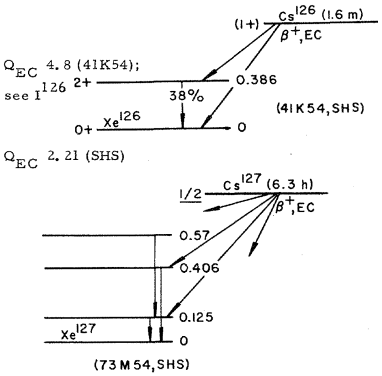
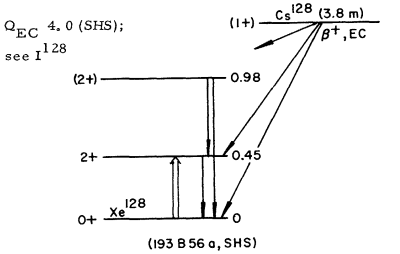
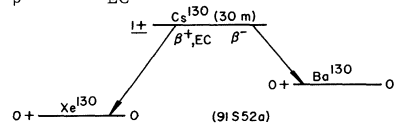
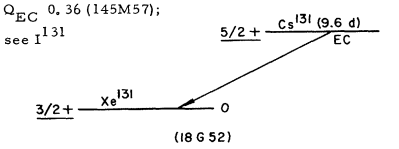
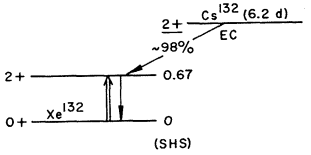
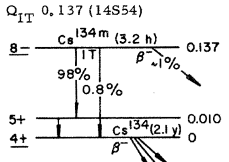
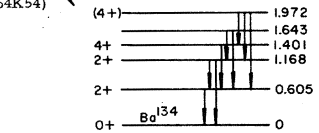
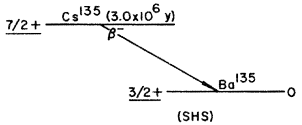
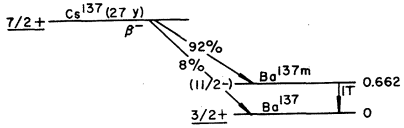
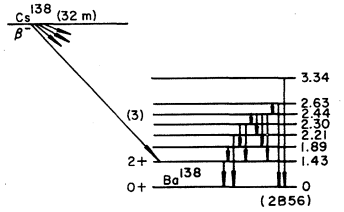
$_{54}Xe^{140}$	16.0 s (24D51); 9.8 s (11O51); others (16H40)	☢	β^- (16H40a);		
		A	chem, genet (16H40a); ancestor Ba^{140} (16H40a, 24D51a, 24D51, 11O51, 17B51)		
Xe^{141}	1.7 s (32K46, 11O51); 3 s (24D51)	☢	β^- (17B51);		
		B	chem, genet (17B51); ancestor La^{141} (17B51); ancestor Ce^{141} (24D51a, 24D51, 11O51); ancestor Ba^{141} (17B51, 11O51, 24D51)		
Xe^{143}	1.0 s (24D51)	☢	β^- (17B51);		
		B	chem, genet (17B51); ancestor Ce^{143} (17B51, 24D51)		
Xe^{144}	~1 s (24D51)	☢	β^- (24D51a);		
		B	chem, genet (24D51a); ancestor Ce^{144} (24D51a, 24D51)		
$_{55}Cs^{123}$	6 m (73M54)	☢	β^+ (73M54);		
		B	chem, genet (73M54); parent Xe^{123} (73M54, 73M54a)		
Cs^{125}	45 m (73M54)	☢	β^+, EC (73M54);	β^+	2.05 spect (73M54);
		A	chem, mass spect (73M54, 105M54); parent Xe^{125m} (0.1%), parent Xe^{125} (73M54)	γ	0.112 (K/L+M 3.6) spect conv, scint spect, γ-γ coinc (73M54)
Cs^{126}	1.6 m (41K54)	☢	β^+ 82%, EC 18% (41K54);	β^+	3.8 abs, scint spect (41K54);
		A	chem, mass spect (41K54); daughter Ba^{126} (41K54)	γ	0.385 (38%, not coinc with 3.8 β^+) scint spect, β-γ coinc (41K54); see also gammas of I^{126}
Cs^{127}	6.3 h (73M54); 6.1 h (105M54, 20N55); 5.5 h (33F50)	☢	EC, β^+ (EC/β^+ >15) (73M54);	β^+	0.677 (3%), $\beta_0 + \beta_{125}$ (2.5%) spect (20N55);
		A	chem, mass spect (33F50, 105M54); parent Xe^{127} (33F50); daughter Ba^{127} (37L52a); parent Xe^{127m} (~0.01%) (73M54);		0.68, 1.06 spect (73M54);
				γ	0.124 (†10, K/L+M 6.7), 0.287, 0.411 (‡50, K/L+M 5.5) scint spect, spect conv (20N55); 0.125 (†10, K/L+M 8, coinc with β^+ and 0.44 γ), 0.17 (?), 0.20 (?), 0.29 (?), 0.36 (?), 0.406 (†80, K/L+M 6, coinc with β^+), 0.44 (very weak) scint spect, spect conv, γ-γ coinc (73M54); 0.125, 0.41 scint spect (47W53b); see also gammas of Xe^{127m}
		I	1/2 atomic beam (36N56);		
		μ	±1.41 atomic beam (208S57)		

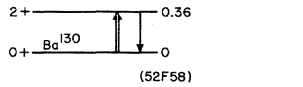


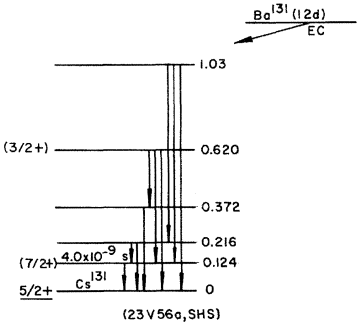
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{55}Cs^{128}$	3.8 m (37L52a); 3.9 m (47W53b); 3.5 m (33F53a); 2.5 m (161M55)	☢ β^+ 75%, EC 25% (13H55); B chem, genet (33F51); daughter Ba^{128} (37L52a, 33F51, 13H55)	β^+ 3.0 (†70), 2.5 (†30), 1.5 (†3) spect (13H55); 3.1 (not coinc with γ), 1.1 spect, abs, β-γ coinc (33F53a); others (161M55, 33F50a, 32T50); γ 0.44, 0.98 scint spect, spect conv (13H55); 0.46 (20%), 1.5 scint spect (47W53b); 0.135 (†30), 0.29, 0.46 (†10), 0.97 (weak) scint spect (33F53a); see also gammas of I^{128} and Xe^{128}	Q_{EC} 4.0 (SHS); see I^{128} 
Cs^{129}	30.7 h (20N55); 31 h (33F50)	☢ EC, no β^+ (33F50); A chem, mass spect (33F50, 105M54); daughter Ba^{129} (33F50a, 32T50); I 1/2 atomic beam (36N56, 208S57); μ ±1.47 atomic beam (36N56, 208S57)	γ 0.040, 0.092, 0.174, 0.279, 0.319, 0.371 (†0.371 γ + 0.411 γ: 100), 0.411 0.545 (†0.545 γ + 0.585 γ: 7), 0.585 scint spect, spect conv (20N55); 0.38 (†100), 0.42 (†9), 0.59 (†23) scint spect (22N55); 0.39 (†95), 0.56 (†5), no 0.040 γ scint spect (47W53b); 0.40, 0.55 scint spect (39R55); see also gammas of Xe^{129}	
Cs^{130}	30 m (91S52a, 105M54); ~30 m (27R48, 33F50)	☢ β^+, EC, β^- (β^+/β^- 27.5) (91S52a); A chem (27R48); chem, excit (91S52a); chem, mass spect (105M54); I 1 atomic beam (36N56a, 36N56); μ +1.32 atomic beam (36N56b, 36N56a)	β^+ 1.97 spect (91S52a); β^- 0.442 spect (91S52a); γ no γ (91S52a); Xe K-x (91S52a)	Q_{β^-} 0.442, Q_{EC} 2.99 (91S52a) 
Cs^{131}	9.6 d (1Y49); 10.2 d (32K47a); 10.0 d (5Y47)	☢ EC, no β^+ (28F47, 43C51c, 38K50a); EC (L/K ~0.1) (33F55); A chem, genet (32K47a); chem, mass spect (7K49); daughter Ba^{131} (32K47a, 5Y47, 1Y49, 43C51c); not parent Xe^{131m} (43C51c, 165S54b); parent Xe^{131m} (?) (70C50); I 5/2 atomic beam (98B53, 36N56a); μ +3.48 atomic beam (98B53)	EC internal bremsstrahlung spectrum endpoint: 0.33 scint spect (145M57); 0.32 scint spect (165S54b, 153H56); Xe K-x (43C51c, 5Y47, 1Y49, 32K47a, 28F47); γ no γ (43C51c, 32K47a, 38K50a, 113S52); others (145M56); see also gammas of Ba^{131}; 0.124 level of Cs^{131}: $t_{1/2}$ 4.0×10^{-9} s delay coinc (23V56b, 23V56)	Q_{EC} 0.36 (145M57); see I^{131} 
Cs^{132}	6.2 d (39R55); 7.1 d (44C44)	☢ EC (44C44); no β^- (lim 5%) (166B56); A chem, excit (44C44); genet energy levels (166B56, 39R55); I 2 atomic beam (36N56a); μ +2.20 atomic beam (36N56a, 36N56b)	γ 0.67 (†100), 1.08 (†0.6), 1.20 (†0.6), 1.30 (†1) scint spect (166B56); 0.669 (†100), 1.10 (†0.7), 1.27 (†0.8) scint spect (39R55); 0.69 scint spect (47W53b); see also gammas of I^{132} and Xe^{132}	
Cs^{133}		% 100 (6N37, 64W56); I 7/2 atomic spect, atomic beam (87M50); μ +2.5642 nucl induct (61W54); q -0.003 nucl induct (74A54); -0.003 atomic beam (174B56); others (67K56, 61W53, 87M50, 214S41)	γ Coulomb excitation (in Cs^{133}): 0.082 (coinc with ~0.080 γ and 0.302 γ), 0.163, 0.302, 0.385 scint spect, γ-γ coinc (52F58); 0.081, 0.163 scint spect (27T54, 27T56a); 0.081 level of Cs^{133}: $t_{1/2}$ 6.0×10^{-9} s delay coinc (14G53); see also gammas of Xe^{133} and Ba^{133}	see Xe^{133} and Ba^{133}

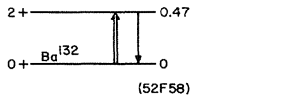
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{55}Cs^{134m}$	3.2 h (5S45); 3 h (45K40); others (2S47)	☢	IT (18G48a, 42C50); β^- ~1% (95K55);	β^-	~0.55, no 2.18 β^- (95K55);	Q_{IT} 0.137 (14S54)
		A	chem, n-capt (12A35, 77M35); chem, excit, n-capt (45K40);	γ	γ_1 0.0105 (e/γ ~200, coinc with γ_2), γ_2 0.1271 (e_K/γ 2.6), γ_3 0.1374 (K/L ~2) scint spect, spect conv, ion ch, γ-γ coinc (14S54, 14S51); 0.128 (K/L 0.64) spect conv (42C50); 0.128 (L_{II}/L_{III} ~1) spect conv (63M52a); others (18G48a, 5S45)	
		I	8 atomic beam (100G55b, 100G54, 105G55, 105G54);			
		μ	+1.10 atomic beam (105G55, 105G54, 100G55b, 100G54)			
Cs^{134}	2.07 y (93G57); 2.19 y (131M57); 2.3 y (33G51ℓ); 1.7 y (45K40); others (69S38, 2S47)	☢	β^- (45K40); no EC (lim 1%) (95K55); no EC (180B55a, 7S48, 31W50); no β^+ (lim 0.009%) (41M51);	β^-	0.683 (13%), 0.655 (50%), 0.31 (5%, complex), 0.083 (32%) spect, β-γ coinc (95K55); 0.657 (81%), 0.410 (6%), ~0.21 (3%), ~0.08 (10%) spect (10C53b); 0.648 (75%), 0.09 (25%) spect (20P51); 0.65 spect (31W50); 0.66 (~72%), 0.09 (~28%) spect (4E47); 0.676, 0.640, ~0.08 (~24%) spect (87S52); no 1.45 β^- (lim 5 x 10^{-3}%) spect (6W56); others (37M49, 7S47e, 45K40, 37W47, 180B55a, 180B56a, 51F55a, 51F55b, 44A56, 71A55a, 104G52a, 117B54);	Q_{β^-} 2.05 (64K54)  (14S54, 10C53b, SHS)
		A	n-capt (30A38); chem, n-capt, excit (45K40);			
		I	4 atomic beam (30J52, 98B53);			
		μ	+2.973 atomic beam (21S57)	γ	0.473 (†2, e_K/γ ~0.009), 0.563 (†9, e_K/γ ~0.007), 0.569 (†13, e_K/γ ~0.011), 0.605 (†100, K/L 7.7), 0.796 (†91, e_K/γ ~0.003, K/L 7.0), 0.801 (†18, e_K/γ ~0.001), 1.038 (†0.9, K/L+M ~7), 1.168 (†3, K/L+M ~6), 1.367 (†5, K/L+M ~10), no 0.203 spect, spect conv (95K55); 0.200 (†4), 0.208 (†4), 0.475 (†4), 0.565 (†15), 0.571 (†20), 0.606 (†100, K/L 6.3), 0.662 (†2, ?), 0.797 (†100, K/L 8.0), 0.802 (†15), 1.035 (†4), 1.168 (†4), 1.370 (†4) spect, spect conv (29V54); γ_1 0.203, γ_2 0.475 (K/L ~5), γ_3 0.563 (K/L ~10), γ_4 0.570, γ_5 0.605 (K/L 6.4, coinc with γ_3 and γ_8), γ_6 0.663, γ_7 0.797 (K/L 7.3), γ_8 0.803 (coinc with γ_3), γ_9 1.039 (K/L ~10), γ_{10} 1.168 (K/L ~10), γ_{11} 1.368 (K/L ~10) spect conv, γ-γ coinc (10C53b); γ_5 coinc with γ_7 and γ_{11}; γ_8 coinc with γ_{10} scint spect, γ-γ coinc (39E55); γ_4 (e/γ 9 x 10^{-3}), γ_5 (e/γ 5.3 x 10^{-3}), γ_7 (e/γ 2.4 x 10^{-3}), γ_{11} (e/γ 4.9 x 10^{-4}) spect, spect conv (21O56); others (87S52, 31W50, 47R52, 88S51, 4E47, 23W50, 7S48, 20P51, 20D50, 8B49, 45W50, 17B50, 44M50a, 85S51, 85B50, 39R51, 61K52, 23K55, 154M53, 51F55a, 117B54, 44A56, 51F55b, 39R52, 104G52a, 71A55a, 113C56, 17Z54, 36J56, 180B56a, 180B55a, 39J54, 216S55, 76L54b, 88W54)	
Cs^{135}	3.0×10^6 y sp act (8Z49); 2.1×10^6 y yield (63S49a)	☢	β^- (63S49a);	β^-	0.21 spect (33L53); abs (63S49a); ~0.19 abs (8Z49);	Q_{β^-} 0.207 (64K54)  (SHS)
		A	chem, genet (63S49a); chem, mass spect (3I49a); daughter Xe^{135} (63S49a);	γ	no γ (63S49a, 8Z49); 0.25 level of Cs^{135}: $t_{1/2}$ 2.8 x 10^{-10} s delay coinc (14G53); see also gammas of Xe^{135}	
		I	7/2 atomic beam (87M50);			
		μ	+2.7134 atomic beam (21S57); others (67K56, 87M50, 61W53)			
Cs^{136}	12.9 d (22O54a); 13.7 d (33G49)	☢	β^- (33G51m);	β^-	0.341 (93%), 0.657 (7%) spect (22O54a); 0.35 abs (33G49); 0.28 β-γ coinc, abs (28F51b);	Q_{β^-} 2.85 (33L57)
		A	chem (33G46, 33G51m); chem, excit (33G49); others (7N49a, 21T51, 38G48)	γ	0.0672 (K/L 3.5), 0.153 (K/L 5.9, coinc with 0.162 γ and 1.25 γ), 0.162 (K/L 1.0), 0.265, 0.335 (K/L 5.2), 0.822 (K/L 3.0), 1.04, 1.25, 1.41, 2.35, 2.49 spect conv, ion ch, scint spect, γ-γ coinc (22O54a); others (33G49, 28F51b)	

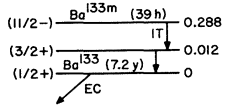
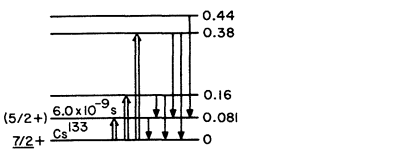
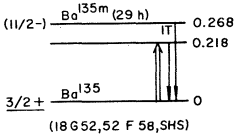
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{55}Cs^{137}$	26.6 y sp act + mass spect (95W55a); 30.0 y sp act + mass spect (60B55); 33 y (38W53, 33G51n)	☢ β^- (78M41); A chem, genet (78M41); chem, mass spect (60H46a, 3I49a); daughter Xe^{137} (21T51b, 33G51k); parent Ba^{137m} (31T48); others (7N49a, 21T51, 60H48, 3I49a, 33G51n, 38G48, 28F51); I 7/2 atomic beam (87M50); μ +2.8219 atomic beam (21S57); others (87M50, 67K56, 61W53)	β^- 0.514 (92%) spect (12IK57); 0.523 spect (22O54, 16A50); 0.51 (92%), 1.17 (8%) spect (10L51); 0.52 spect (71A54a, 47W54c); 0.52, ~1.2 spect (20P49); 0.52, ~1.18 spect (15O49); others (31W51, 10L49, 31T48, 118B53, 137M54a, 73D55, 56R57, 87G58); γ with Ba^{137m}: 0.6616 cryst spect (100M52); see also gammas of Ba^{137m}	Q_{β^-} 1.18 (SHS)  (31W51, 10L51, SHS)
Cs^{138}	32.2 m (106B56); 32.1 m (2B56); 32.9 m (19E51); 33 m (25A39, 16H39a); 32 m (33G51k, 36G40)	☢ β^- (16H39a); A chem (16H39a, 6H39); chem, mass spect (30T49); descendant I^{138} (63S49); daughter Xe^{138} (16H39a, 16H40a, 36G40, 66S43b); others (16H40, 2G39)	β^- 3.40 (coinc with γ_9) spect, β-γ coinc abs (10L53a); 2.68 spect (30T49); 2.65 abs (35B46a, calc from 36G40); γ γ_1 0.1389 (2%, coinc with γ_5, γ_7, and γ_9), γ_2 0.193 (0.8%), γ_3 0.229 (1.6%, coinc with γ_{10}), γ_4 0.411 (3%, coinc with γ_5 and γ_9), γ_5 0.463 (23%, coinc with γ_6 and γ_9), γ_6 0.550 (8%, coinc with γ_9), γ_7 0.87 (4%, coinc with γ_9), γ_8 1.01 (25%, coinc with γ_9), γ_9 1.43 (73%), γ_{10} 2.21 (18%), γ_{11} 2.63 (9%), γ_{12} 3.34 (0.5%) spect conv, scint spect, γ-γ coinc (2B56); 0.463 (†33), 0.98 (†43), 1.44 (†100) spect conv, scint spect (10L53a); 0.128 (†20), 0.460 (†20), 0.55 (†3), 0.98 (†25), 1.44 (†100), 2.24 (†20), 2.68 (†10) scint spect (30T55); see also gammas of La^{138}	Q_{β^-} 4.83 (SHS)  (2B56)
Cs^{139}	9.5 m (63S50); 10 m (25A39, 6H39); 7 m (16H40a)	☢ β^- (16H39a); A chem, genet (16H39a, 6H39); daughter Xe^{139} (16H39a, 6H39, 16H40, 16H40a); descendant I^{139} (63S49); parent Ba^{139} (16H39a, 6H39, 16H40, 16H40a, 63S50)		
Cs^{140}	66 s (63S50)	☢ β^- (16H40a); A chem (16H40a); chem, genet (63S50); parent Ba^{140} (63S50)		
Cs^{141}	short (17B51, 24D51, 11O51)	☢ [β^-] (17B51); F genet (17B51); [daughter Xe^{141}] (17B51, 24D51, 11O51); [ancestor La^{141}] (17B51)		
Cs^{142}	~1 m (16H42a)	☢ β^- (16H42a); D chem, genet (16H42a); parent Ba^{142} (16H42a)		
Cs^{143}	short (17B51, 24D51, 11O51)	☢ [β^-] (17B51); F genet (17B51); [daughter Xe^{143}] (17B51, 24D51); [ancestor Ce^{143}] (17B51, 24D51)		

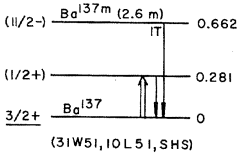
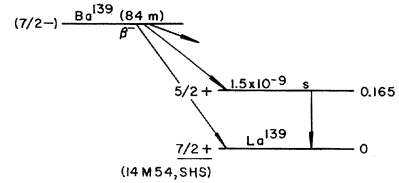
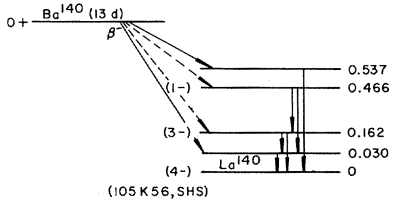
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{55}Cs^{144}$	short (24D51a, 24D51)	☢ F	[β^-] (24D51a); genet (24D51a); [daughter Xe^{144}] (24D51); [ancestor Ce^{144}] (24D51a, 24D51)		
$_{56}Ba^{126}$	97 m (41K54)	☢ A	EC (41K54); chem, genet (41K54); parent Cs^{126} (41K54)	γ	0.23 (↑100), 0.70 (↑33), 0.9 (?, weak) scint spect (41K54)
Ba^{127}	12 m (37L52a, 41K54)	☢ B	β^+ (37L52a); chem, genet (37L52a); parent Cs^{127} (37L52a)		
Ba^{128}	2.4 d (33F50a, 32T50)	☢ B	EC (33F53a, 37L52a); chem (33F50a, 32T50); parent Cs^{128} (33F51, 37L52a, 13H55)	γ	0.270 spect conv, scint spect (13H55)
Ba^{129}	2.45 h (163H57); 2.0 h (33F50a); 1.8 h (32T50)	☢ A	β^+ (33F50a, 32T50); chem, genet (32T50, 33F50a); parent Cs^{129} (33F50a, 32T50)	β^+	1.6 spect (33F53a)
$\underline{Ba^{130}}$		%	0.101 (6N38b); 0.13 (87A56)	γ	Coulomb excitation (in Ba^{130}); 0.36 scint spect (52F58)
Ba^{131}	11.5 d (210B56); 12.0 d (32K47a, 109W57); 11.8 d (10C53c); 11.7 d (5Y47)	☢ A	EC (32K47a); no β^+ (5Y47, 28F47); chem, n-capt, excit (32K47a); parent Cs^{131} (32K47a, 5Y47, 1Y49, 43C51c); others (11G49, 1Y49)	γ	0.055 (K/L ≤1), 0.079 (K/L 10), 0.092, 0.124 (K/L 3.6), 0.133 (K/L 5.8), 0.216 (K/L 9), 0.239 (K/L ≥6), 0.249 (K/L ≥6), 0.374 (K/L 6.0), 0.489, 0.498 (K/L 8), 0.585, 0.620 spect, spect conv (10C53c); ~0.083 (?), 0.122 (e_K/γ 0.39, coinc with 0.50 and 0.92 γ), 0.214 (coinc with 0.82), 0.245 (coinc with 0.37), 0.37, 0.50, 0.62, 0.82, 0.92, 1.03 scint spect, γ-γ coinc (23V56a); 0.083 (complex), 0.122 (↑200), 0.214 (↑150), 0.372 (↑100), 0.496 (↑360), 0.62 (↑33), 0.82 (↑2), 0.92 (↑7), 1.03 (↑11), no 0.10, no 0.196, no 0.585 scint spect (210B56); 0.122 (K/L 6.0), 0.214 (↑140, e_K/γ ~0.18, K/L 2.8), 0.241 (↑56), 0.370 (↑100, e_K/γ ~0.01), 0.494 (↑1400, e_K/γ ~0.005, K/L 2.5) spect, spect conv (25E52); 0.090, ~0.12, 0.133, 0.158, ~0.21, 0.239, 0.249, ~0.37, 0.405, ~0.50, 0.585, 0.62, 0.83, 0.92, 1.04 spect conv (76A57); 0.122 γ: $t_{1/2}$ 4.0 x 10^{-9} s delay coinc (23V56b, 23V56); $t_{1/2}$ 4.1 x 10^{-9} s delay coinc (111C55); others (76L55, 63P53, 103G56a, 43C51c, 38K50a, 39C51, 32K47a, 28D50a, 10Z50, 65L57d)
$\underline{Ba^{132}}$		%	0.097 (6N38b); 0.19 (87A56)	γ	Coulomb excitation (in Ba^{132}): 0.47 scint spect (52F58)



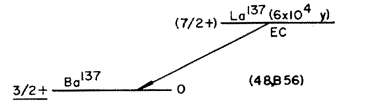
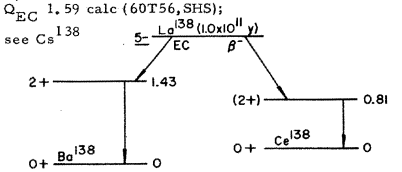
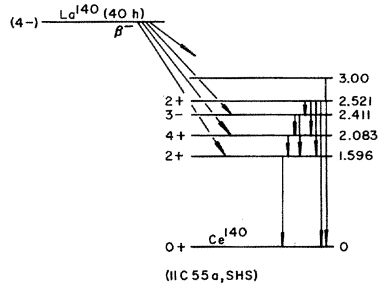




Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{56}Ba^{133m}$	38.8 h (46W43a); 38.9 h (5Y48)	☢	IT (10C41);	γ	0.276 (e_K/γ~3) spect conv, scint spect (67H51a);	Q_{IT} 0.288 (67H51b) 
		A	chem, excit (10C41, 2D40); parent Ba^{133} (5Y48); others (60M48, 13P47, 11G49)		0.0117 (e/γ ~130) γ-γ coinc, ion ch (67H51b); 0.276 (K/L 3.2) spect conv (10C41); others (64L53, 10C53c)	
Ba^{133}	7.2 y (32K52a, 32K56, 32K57)	☢	EC (L/K <0.7), no β^+ (118C57); EC (L/K ⩾9) (64L56, 64L54c, 64L55a);	γ	γ_1 0.070 (↑6, e_K/γ 2.4, coinc with γ_3), γ_2 0.081 (↑32, e_K/γ 1.8, coinc with γ_3 and γ_4), γ_3 0.292 (↑26), γ_4 0.360 (↑74) scint spect, abs, γ-γ coinc (64L56, 64L54c, 64L55a);	
		A	chem, n-capt, excit (32K47a); chem, genet (5Y48); daughter Ba^{133m} (5Y48)		γ_2 0.079 (↑32, e_K/γ 1.3, K/L 7.5, coinc with γ_3 and γ_4), γ_3 0.302 (↑23, e_K/γ 0.11), γ_4 0.355 (↑67, e_K/γ 0.07), 0.158, 0.276, no 0.057 γ (lim ↑5) scint spect, spect conv, γ-γ coinc (118C57); γ_1 0.057 (1%, coinc with γ_2 and γ_3), γ_2 0.082 (22%, e/γ 3.5, coinc with γ_3 and γ_4), γ_3 0.300 (31%), γ_4 0.357 (69%) scint spect, γ-γ coinc (61H54);	
					γ_2 (e/γ 2.6) scint spect (192B57); γ_2: $t_{1/2}$ 6.0 x 10^{-9} s delay coinc (59L55); others (5Y48, 32K47a); see also gammas of Xe^{133} and Cs^{133}	(64L56, 52F58, SHS)
Ba^{134}		%	2.42 (6N38b); 2.60 (87A56);			
		μ	~0 atomic spect (87M50)			
Ba^{135m}	28.7 h (5Y48)	☢	IT (46W43, 5Y48);	γ	0.268 spect conv (10C53c); 0.269 (e_K/γ ~3.5, K/L ~2) spect conv, scint spect (67H51c); 0.267 spect conv, spect, scint spect (39C51a)	Q_{IT} 0.268 (10C53c) 
		A	chem (45K40); chem, n-capt, sep isotopes (67H51a)			
Ba^{135}		%	6.59 (6N38b); 6.7 (87A56);	γ	Coulomb excitation (in Ba^{135}): 0.218 scint spect (52F58)	(18G52, 52 F 58, SHS)
		I	3/2 atomic beam, atomic spect (87M50);			
		μ	+0.8323 nucl induct (61W56); others (67K56, 61W53, 87M50)			
Ba^{136}		%	7.81 (6N38b); 8.1 (87A56);			
		μ	~0 atomic spect (87M50)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{56}Ba^{137m}$	2.60 m (14M49a); 2.63 m (31T48)	☢	IT (31T48);	γ	γ_1 0.6616 cryst spect (100M52); 0.6617 spect, spect conv (49L53a); 0.6614 (K/L+M 4.6) spect conv (59G52, 10L50d); γ_1 (e_K/γ 0.092, K/L 5.8) spect conv (47W54c); γ_1 (e_K/γ 0.097) spect, spect conv (31W51); γ_1 (e_K/γ 0.095) scint spect (80H52, 52M57b); γ_1 (e_K/γ 0.098, K/L 5.7) spect conv (121K57); γ_1 (K/L+M 4.5) spect conv (154M53); γ_1 (e_K/γ 0.096, K/L 4.6) spect conv (42A54); γ_1 (K/L 5.5) spect conv (79B52); others (40K52, 14M49a, 15O49, 31T48, 20P49, 29V54, 211B54, 72D53, 73D55, 56R57, 67A56, 67A56a)	Q_{IT} 0.662 (SHS); see Cs^{137} 
		A	n-capt (12A35); chem, genet (31T48); daughter Cs^{137} (31T48); others (1P37, 45K40)			
Ba^{137}		%	11.32 (6N38b); 11.9 (87A56);	γ	Coulomb excitation (in Ba^{137}): 0.281 scint spect (52F58)	
		I	3/2 atomic spect, atomic beam (87M50);			
		μ	+0.9311 nucl induct (61W56); others (67K56, 61W53, 87M50)			
Ba^{138}	$t_{\beta\beta} > 10^{15}$ y sp act (59F52)	%	71.66 (6N38b); 70.4 (87A56);			
		μ	~0 atomic spect (87M50)			
Ba^{139}	84.0 m (136B57); 85.0 m (24D51c); 84 m (92S48); 86 m (1P37a, 16H40a)	☢	β^- (1P37a);	β^-	2.38 (15%), 2.23 (66%), 0.82 (19%) spect (14M54); 2.27 spect (92S48); others (32K51i, 70B43a);	Q_{β^-} 2.38 (14M54) 
		A	chem, n-capt (12A35); chem, excit (1P38a); daughter Cs^{139} (16H39a, 6H39, 16H40, 16H40a, 63S50); descendant Xe^{139} (16H39a, 6H39, 24D51); others (45K40, 1P37, 2S47, 1Y49a, 46W43, 42L40, 25A39, 72B51, 32K48, 28F51)	γ	0.163 (e_K/γ 0.22, K/L+M 7.0, coinc with 2.23 β^-), 1.43 spect, spect conv, β-γ coinc (14M54); 0.163 (26%, e/γ 0.20, K/L ~6), 1.05 (0.6%) spect conv, abs (92S48); 0.165 (e_K/γ 0.20) scint spect (34N54c); ~0.16 γ (23%) scint spect (10M57); ~0.16 γ: $t_{1/2}$ 1.5×10^{-9} s delay coinc (64G55, 60W56); see also gammas of Ce^{139}	
Ba^{140}	12.80 d (13E51f)	☢	β^- (16H39a);	β^-	1.02 (60%), 0.48 spect (86B49); 1.05 spect (4W51); 1.0 (~75%), ~0.4 (~25%) abs (13E51g);	Q_{β^-} 1.05 (105K56) 
		A	chem, genet (16H39, 16H39a); parent La^{140} (16H39, 16H39a, 16H40a, 36G40, 16H42a, 38G46, 28F51c); descendant Xe^{140} (16H40a, 17B51, 24D51, 24D51a, 11O51); others (32K51k, 7N49a, 6O48, 72B51, 21T51, 6H39, 38G46, 63S50, 32K48, 28F51, 1Y54)	γ	0.0296, 0.132, 0.162, 0.304, 0.537 spect conv (10C51c); γ_1 ~0.03 (coinc with γ_5), γ_2 ~0.13 (coinc with γ_4), γ_3 0.162 (coinc with γ_4), γ_4 0.304, γ_5 0.436, γ_6 0.537 scint spect, γ-γ coinc, sum scint spect (105K56); 0.541 (e_K/γ 6×10^{-3}, K/L+M 5.2) spect, spect conv (80R55); 0.540 (K/L+M ~6) spect conv (154M53); 0.03, 0.16, 0.31, 0.54 spect, spect conv, scint spect, γ-γ coinc (86B49); others (4W51, 26M49c)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{56}Ba^{141}$	18 m (16H42a, 52G51)	☢ β^- (16H42a); A chem, genet (16H42a); daughter Cs^{141} (16H42a); parent La^{141} (16H42a); descendant Xe^{141} (17B51, 11O51, 24D51); others (16H39c, 16H39, 52G51a, 42L40)	β^- 2.8 abs (32L48); γ (52G51)	
Ba^{142}	6 m (16H42a)	☢ β^- (16H42a); D chem, genet (16H42a); daughter Cs^{142} (16H42a); parent La^{142} (16H42a); others (16H39c, 16H39, 42L40)		
Ba^{143}	<0.5 m (16H42a)	☢ β^- (16H42a); F chem (16H39); [descendant Xe^{143}] (17B51, 24D51); others (16H39c, 16H42a, 11O51)		
Ba^{144}	short (24D51, 24D51a)	☢ β^- (24D51); F genet (24D51); [descendant Xe^{144}, ancestor Ce^{144}] (24D51, 24D51a)		
$_{57}La^{131}$	58 m (53G51)	☢ β^+ (53G51); B chem, mass spect (53G51)	β^+ 1.6 abs (53G51)	
La^{132}	4.5 h (53G51)	☢ β^+ (53G51); A chem, mass spect (53G51); daughter Ce^{132} (111W58)	β^+ 3.8 scint spect (111W58); 3.5 abs (53G51); γ 1.0 abs (53G51)	
La^{133}	4.0 h (21N50)	☢ EC, β^+ (weak) (21N50); A chem, mass spect (21N50); daughter Ce^{133} (93S51)	β^+ ~1.2 abs, spect (21N50); γ 0.8 abs (21N50)	
La^{134}	6.5 m (93S51)	☢ β^+ ~44%, EC ~56% (93S51); B chem, genet (93S51); daughter Ce^{134} (93S51)	β^+ 2.7 abs, spect (93S51); γ no γ (93S51)	Q_{EC} 3.7 (64K54)
La^{135}	19.5 h (73C48, 14M57); 19 h (21N50)	☢ EC (81M42, 73C48); no β^+ (14M57); A chem (81M42); chem, excit (73C48); chem, mass spect (21N50); daughter Ce^{135} (73C48)	γ ~0.095, 0.219 (coinc with 0.300 γ and 0.367 γ), 0.300 (coinc with 0.367 γ), 0.367, 0.481 (K/L 6.3), 0.588, 0.862, 1.59 scint spect, spect conv, γ-γ coinc (14M57, 14M58); 0.49 (↑6), 0.66 (↑1) scint spect (47W53c); others (73C48, 46W43b)	
La^{136}	9.5 m (21N50); 9.0 m (36R50a); 10 m (3M47)	☢ EC ~67%, β^+ ~33% (21N50); A chem (3M47); chem, excit, sep isotopes (36R50a)	β^+ 2.1 spect (21N50); abs (3M47); 1.8 abs (36R50a)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{57}La^{137}$	6×10^4 y sp act (48B56); others (73C48, 3I48b, 48B55)	☢ EC (48B56) A mass spect (3I48b); chem (48B56)	EC γ	Ba K-x ion ch, scint spect (48B56); no γ (48B56)	
La138	1.0×10^{11} y sp act (60T56); 1.1×10^{11} y sp act (106G57); ~2.0×10^{11} y sp act (18P51); ~7×10^{10} y sp act (85M52a)	☢ EC ~70%, β^- ~30% (106G57); EC ~94%, β^- ~6% (85M52a); EC 53% (L/K 1.4), β^- 47% (60T56); A chem, mass spect (3I47a); % 0.089 (3I47a, 64W56); I 5 nucl induct (162S55); μ +3.685 nucl induct (162S55); q ~±0.9 nucl induct (calc from 162S55, 67K56)	β^- γ	0.21, no 1.0 β^- ion ch (106G57); 1.0 abs (85M52a); 0.81 (not coinc with 1.44 γ), 1.44, no 0.54 γ scint spect, γ-γ coinc (106G57); 0.81 (†36, not coinc with 1.43 γ), 1.43 (†41), no 0.54 γ scint spect, γ-γ coinc (60T56); 0.81 (†65), 1.39 (†100), 0.54 (†30) scint spect (18P51); see also gammas of Cs^{138}	Q_{β^-} 1.02 (106G57); Q_{EC} 1.59 calc (60T56, SHS); see Cs^{138} 
La139		% 99.911 (64W56, 3I47a); I 7/2 atomic spect (87M50); μ +2.761 nucl induct (67K56, 61W53); q +0.27 atomic beam (44T57a); others (88M55d, 88M55, 81L55, 81L55a, 88M54b, 88M53, 67K56, 88M57)	γ	Coulomb excitation (in La^{139}): no γ (97H55, 97H54); 0.165 level of La^{139}: $t_{1/2}$ 1.5×10^{-9} s delay coinc (64G55, 60W56); see also gammas of Ba^{139} and Ce^{139}	
La140	40.22 h (73K54); 40.27 h (74P57); 40.31 h (1Y54a); 40.0 h (72B51d, 9B50, 46W43b)	☢ β^- (1P38a); A n-capt (82M35); chem, excit, n-capt (1P38a); chem, mass spect (60H48); daughter Ba^{140} (16H39, 16H39a, 16H40a, 36G40, 38G46, 28F51c, 16H42a); others (1P37a, 81M42, 82M35, 40G42, 2S47, 72B51, 21T51, 16H42a, 38G48, 38G47, 28F51, 106B53b)	β^- γ	2.15, 1.67, 1.34, 1.10, 0.83 spect (20P54); 2.20 (8%), 1.62 (14%), 1.36 (30%), 1.15 (20%), 0.86 (12%), 0.42 (16%) spect (117B54a, 44A56); 2.26 (~10%), 1.67 (~20%), 1.32 (~70%), others <1.3 (very weak) spect (86B49); 2.12, 1.40, 0.90 spect (1O46); others (46W43b, 37B46, 4W51a); 0.3286, 0.4867, 0.8151, 1.596 spect (12H52); γ_1 0.328 (†40, e/γ 0.035, K/L+M 7.4, coinc with γ_3 and γ_5), γ_2 0.438 (†6, coinc with γ_3), γ_3 0.490 (†50, e/γ 8.3×10^{-3}, K/L+M 7.4, coinc with γ_5), γ_4 0.815 (†46, e/γ 4.1×10^{-3}, coinc with γ_5), γ_5 1.60 (†100, e/γ 8×10^{-4}), γ_6 2.50 (†1), γ_7 3.00 (†0.04) spect conv, scint spect, γ-γ coinc (123B55a); 0.069, 0.110, 0.131, 0.173, 0.241, 0.265, 0.329, 0.431, 0.486, 0.752, 0.816, 0.926, 1.597, 1.904 spect conv (10C51d); 0.093 (†<2), 0.335 (†6), 0.49 (†40), 0.82 (†30), 1.62 (†100), 2.55 (†6) scint spect (87B51); γ_1 (†16), γ_3 (†37), γ_4 (†35), 0.93 (†11), γ_5 (†100), γ_6 2.54 (†6) spect (16D56); γ_1 (†25, coinc with γ_3 and γ_5), γ_3 (†48, coinc with γ_5), γ_4 (†27, coinc with γ_5), 0.89 (†11, coinc with γ_5), γ_5 (†100), γ_6 2.57 (†4) scint spect, γ-γ coinc (11C55a); 0.489 (e_K/γ 5×10^{-3}, K/L+M 4) spect, spect conv (80R55); γ_5 (88%) scint spect (10M57); others (117B54a, 20P54, 9B55a, 105K56, 154M53, 86B49, 11R47, 43M46, 39R51a, 9B50, 42W47, 26M48a, 81A55)	Q_{β^-} 3.78 (64K54) 
La141	3.8 h (92R58); 3.7 h (32K51j); 3.5 h (16H42a); 3.9 h (93A58)	☢ β^- (16H42a); A chem (16H42a); chem, genet (50B51, 23D51b); daughter Ba^{141} (16H42a); parent Ce^{141} (50B51, 23D51b); descendant Xe^{141} (17B51); others (32K49, 4C39, 72B51)	β^- γ	2.43 (~95%), 0.9 (~5%) spect (23D51b); 1.3-1.6 (?, weak) scint spect, β-γ coinc (23D51b)	Q_{β^-} 2.43 (64K54)

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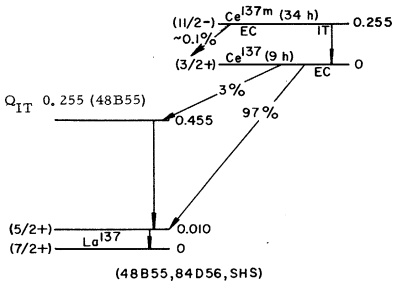
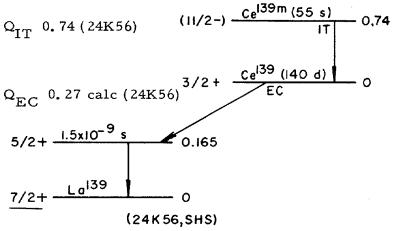
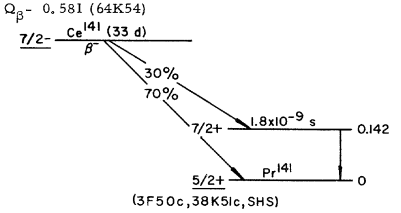
$_{57}La^{142}$	77 m (32K51j, 231B53); 81 m (92R58); 74 m (16H42a)	☢ β^- (32K51j); D chem (16H42a); daughter Ba^{142} (16H42a); others (16H39c)	β^- >2.5 abs (231B53); γ 0.63 (†100, coinc with 0.87 γ, 1.0 γ, 1.8 γ, 2.0 γ, and 2.9 γ), 0.87 (†30, coinc with 1.0 γ and 2.0 γ), 1.0 (†20), 1.8 (†15), 2.0 (†30), 2.4 (†55), 2.9 (†15), 3.4 (†5) scint spect, γ-γ coinc (92R58); 0.63 (†100), 0.87 (†11) scint spect (231B53)	
La^{143}	~19 m genet (54G51); ~15 m (16H43b)	☢ β^- (54G51); A chem, genet (54G51); parent Ce^{143} (54G51); others (16H42a)		
La^{144}	short (24D51a)	☢ [β^-] (24D51a); F genet (24D51a); [descendant Xe^{144}, parent Ce^{144}] (24D51a)		
$_{58}Ce^{131}$	30 m (111W58)	☢ β^+ (111W58); D chem, decay charac (111W58)	β^+ 4.2 scint spect (111W58)	
Ce^{132}	4.2 h genet (111W58)	☢ β^+ (111W58); B chem, genet (111W58); parent La^{132} (111W58)		
Ce^{133}	6.30 h (93S51)	☢ EC, β^+ (93S51); B chem, genet (93S51); parent La^{133} (93S51)	β^+ 1.3 spect, abs (93S51); γ 1.8 abs (93S51)	
Ce^{134}	72.0 h (93S51)	☢ EC (93S51); B chem, excit (93S51); parent La^{134} (93S51)	γ K-x, no γ (93S51)	
Ce^{135}	22 h (93S51)	☢ EC, $\beta^+ \leqslant 1\%$ (93S51); A chem, genet (73C48); parent La^{135} (73C48); daughter Pr^{135} (29H54); others (22N52)	β^+ 0.81 spect (93S51)	
$\underline{Ce^{136}}$		% 0.193 (3I47a)		
Ce^{137m}	34.5 h (48B55); 34.1 h (84D56); 36 h (73C48)	☢ IT (48B55); EC ~0.1% (84D56); A chem, excit (73C48); n-capt, sep isotopes (67H51c); others (93S51);	γ 0.255 (e_K/γ 6, K/L 2.3) spect conv, scint spect (48B55); 0.257 (K/L ~4) spect conv (67H51c); 0.253 (K/L ~10) spect conv (11K51); others (84D56)	
Ce^{137}	8.7 h (48B55); 9 h (84D56)	☢ EC (48B55); B chem, n-capt (48B55); daughter Pr^{137} (84D56)	γ 0.445 (3%, e_K/γ ~0.02, coinc with 0.010 γ), 0.010 (e/γ ~140) spect conv, ion ch, scint spect, γ-γ coinc (48B56, 48B55); 0.440 (2.3%) (84D56)	
$\underline{Ce^{138}}$		% 0.250 (3I47a)		

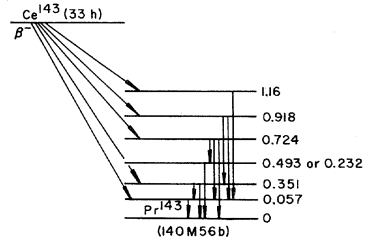


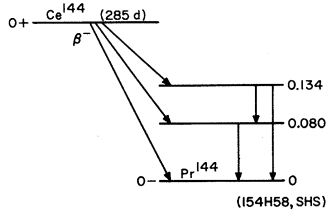
(48B55, 84D56, SHS)

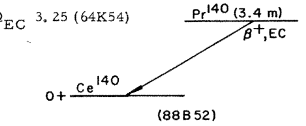
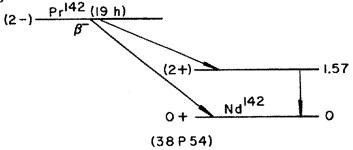
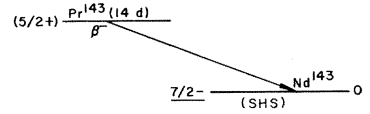
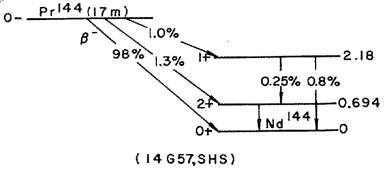
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{58}Ce^{139m}$	55 s (24K56)	☢ IT (24K56);	γ	0.74 (e_K/γ 0.08) scint spect, ion ch (24K56)		Q_{IT} 0.74 (24K56)
		B n-capt (24K56)				
Ce^{139}	140 d (1P43, 1P48)	☢ EC (L/K 0.37) (24K56);	γ	0.166 (e_K/γ 0.22, K/L+M 5.7) spect conv, scint spect (24K56);		Q_{EC} 0.27 calc (24K56)
		A chem (1P43);		0.166 (e_K/γ 0.20, K/L+M 6.6) spect conv, scint spect (64P54);		
		chem, excit, cross bomb (1P48, 36M47);		0.166 (K/L ~10), 0.275 spect conv (11K51);		
		n-capt, sep isotopes (67H51c);		0.166 (K/L ⩾4) spect conv (67H51c);		
		daughter Pr^{139} (93S51, 29H54);		others (29H54)		
		others (83M50, 11G49);				
		μ ±0.84 (assuming I = 3/2) nucl alignment (7G58)				
Ce^{140}		% 88.48 (3I47a)	γ	Coulomb excitation (in Ce^{140}): no γ (97H55)		
Ce^{141}	33.1 d (49W49); 32.5 d (3F50c); 30.6 d (1P48)	☢ β^- (16H40c);	β^-	0.581 (33%), 0.442 (67%) spect (3F50c);		Q_{β^-} 0.581 (64K54)
		A chem (16H40c);		0.574 (25%), 0.432 (75%) spect, β-γ coinc (56J55);		
		chem, excit, n-capt, cross bomb (1P43, 72B51e);		0.591 (33%), 0.447 (67%) spect (19Z57);		
		chem, mass spect (60H48);		0.58 (30%), 0.44 (70%) spect (38K52, 38K51, 38K51c);		
		daughter La^{141} (50B51, 23D51b);		others (92S48a, 11T49a, 26M49e, 1P48, 37B46, 89R57);		
		descendant Xe^{141} (11O51, 24D51);	γ	0.1416 spect conv (140M56b);		
		others (72B51e, 50B51, 11G49, 72B51, 21T51, 16H40c, 28F51);		0.1449 (e_K/γ 0.22, K/L 6.4, coinc with 0.432 β^-) spect, spect conv, scint spect, β-γ coinc (56J55);		
		I 7/2 paramag res (113K57);		0.142 (e_K/γ 0.48) scint spect (17J52a);		
		μ ±0.89 paramag res (113K57)		0.145 (e_K/γ 0.25, K/L 5.5) spect conv, spect (3F50c);		
				0.143 (K/L 6.5) spect conv (38K52, 38K51, 38K51c);		
				0.145 (e_K/γ 0.37, K/L 6.2) scint spect, spect conv (19Z57);		
				0.142 γ: $t_{1/2}$ 1.8 x 10^{-9} s delay coinc (60W55a, 60W56);		
				others (77A55, 129C55, 28E53, 80H52a, 67H51c, 11K51, 11T49a, 92S48a, 23D51b, 26M49e, 4B49, 42H47a);		
				see also gammas of Pr^{141}		
Ce^{142}	5 x 10^{15} y sp act (21R57)	☢ α (21R57);	α	1.5 range emuls (21R57)		
		% 11.07 (3I47a)				
Ce^{143}	33 h (140M56b, 72B51e, 95S50, 37B46); 34 h (38K51c); 36 h (4B49, 1P43)	☢ β^- (63S46);	β^-	1.40 (37%), 1.13 (40%), 0.74 (5%), 0.50 (12%), ~0.2 (6%) spect, scint spect, β-γ coinc (140M56b);		Q_{β^-} 1.44 (SHS)
		A chem (63S46, 1P43);		1.39 (†1.0), 1.09 (†1.3), 0.71 (†1.0) spect (50B52);		
		chem, cross bomb (1P48);		1.37 (†1.0), 1.09 (†1.3), 0.37 (?) spect (38K52, 38K51, 38K51c);		
		chem, genet (72B51e);				
		mass spect (3I48b);	γ	γ_1 0.0574 (e_K/γ 5.9, coinc with γ_3, γ_7, γ_9, and γ_{10}), γ_2 0.232 (coinc with γ_5), γ_3 0.294 (K/L 6.1, coinc with γ_6), γ_4 0.351, γ_5 0.493, γ_6 0.565, γ_7 0.668, γ_8 0.722, γ_9 0.861, γ_{10} 1.10 spect conv, scint spect, γ-γ coinc (140M56b);		
		daughter La^{143} (54G51);				
		parent Pr^{143} (1P43, 37B46, 72B51e);				
		descendant Xe^{143} (17B51, 24D51);		0.057 (K/L 1), 0.283 (†70, e_K/γ 0.03, K/L 6), 0.649 (†15, e_K/γ 0.01), 0.705 (†15), no 0.348 γ spect, spect conv, scint spect, β-γ coinc (38K51c, 38K52);		
		others (7N49a, 6O48, 24D51, 63S51, 32K48)		0.035, 0.126, 0.16, 0.289, 0.356, 0.660, 0.720 spect, spect conv, scint spect (50B52);		
				0.0575 (K/L <1), 0.291 (K/L ~10), 0.348 spect conv (11K51);		
				0.29 (43%) scint spect (10M57);		
				others (95S50)		







Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{58}Ce^{144}$	285 d (53S56, 131M57); 275 d (50B51a); 290 d (19J44)	☢ β^- (16H40c);	β^-	0.309 (76%), 0.175 (25%, coinc with 0.081 γ and 0.134 γ) spect, β-γ coinc (34P56); 0.304 (70%) spect (19P52, 2E54); 0.327 (75%), 0.258 (~5%), 0.16 (20%) spect (10C54a); 0.320 (65%), 0.245 (5%), 0.184 (30%) spect (154H58); others (70C52, 17N51b, 26M50a, 89R57);	Q_{β^-} 0.309 (34P56)
		A chem (16H40c); chem, mass spect (60H48); parent Pr^{144} (16H43b, 7N51a); descendant Xe^{144} (24D51, 24D51a); others (7N49a, 6O48, 21T51, 70B43a, 38G48, 28F51)	γ	γ_1 0.0334 (coinc with γ_5 and γ_7), γ_2 0.0408 (coinc with γ_5 and γ_7), γ_3 0.0532, γ_4 0.0590 (K/L <1), γ_5 0.0799 ($K/L_I/L_{III}$ = 3.5/1.0/0.2), γ_6 0.0950, γ_7 0.1335, ($K/L_I/L_{II}/L_{III}$ = 5.8/1.0/0/~0.1), γ_8 0.1452, no 0.047 γ, no 0.060 γ, no 0.100 γ, no 0.231 γ spect conv, γ-γ coinc (10C54a); 0.012 (?), γ_1 0.0338 (coinc with γ_9), γ_2 0.042, γ_3 0.0539 (coinc with γ_5), γ_5 0.0810 (†3, e_K/γ 1.2, K/L_I 5.8), γ_9 0.1003 (†1), γ_7 0.1344 (†7.5, e_K/γ 0.7, K/L_I 7.1), no 0.145 γ spect conv, ion ch, scint spect, γ-γ coinc (34P56); 0.0337, 0.054, 0.0807 (e/γ large, K/L ~4), 0.100, 0.134 (K/L ~9) spect conv, spect (19P52); 0.034, 0.041, 0.053, 0.081 (K/L 5), 0.094, 0.100, 0.134 (K/L 8) spect conv, scint spect (2E54); others (82K54a, 154H58, 11K51, 70C52, 40K52, 13A52a, 2E51)	
Ce^{145}	3.0 m (158M54); 1.8 h activity not observed (78C53, 72B51f)	☢ β^- (158M54);	β^-	~2.0 abs (158M54);	
		D chem, excit (158M54); parent Pr^{145} (158M54)	γ	(158M54)	
Ce^{146}	13.9 m (78C53); 14.6 m (53S45); 11m (40G46)	☢ β^- (40G43);	β^-	0.7 scint spect (21B54); ~0.9 abs (78C53);	
		B chem, genet (40G43); parent Pr^{146} (40G43, 16H43b, 40G46, 78C53)	γ	0.05 (weak, coinc with 0.27 γ), 0.110 (†20, coinc with 0.22 γ and 0.25γ), 0.142 (†42, coinc with 0.22 γ), 0.22 (†50), 0.25 (weak), 0.27 (†12), 0.32 (†100, not coinc with γ) scint spect, γ-γ coinc (21B54)	
$_{59}Pr^{135}$	22 m (29H54)	☢ β^+, EC (29H54);	β^+	2.5 abs, scint spect (29H54);	
		B chem, excit, genet (29H54); parent Ce^{135} (29H54)	γ	0.080, 0.22, 0.30 scint spect (29H54)	
Pr^{136}	70 m (29H54)	☢ β^+ (29H54);	β^+	2.0 abs, scint spect (29H54);	
		B chem, excit (29H54)	γ	0.17, ~0.8 (?), ~1.1 (?) scint spect (29H54)	
Pr^{137}	1.4 h (44D52); no 1.4 h activity observed (29H54)	☢ EC 83%, β^+ 17% (84D56);	β^+	1.8 (84D56);	
		E chem, mass spect (44D52); not seen: chem, excit (29H54); parent Ce^{137} (84D56)	γ	no γ (84D56)	
Pr^{138}	2.0 h (93S51, 44D52, 29H54)	☢ EC ~90%, β^+ ~10% (93S51);	β^+	1.4 abs, spect (93S51); abs, scint spect (29H54);	see La^{138}
		A chem, excit (93S51); chem, mass spect (44D52)	γ	0.30, 0.80, 1.05, ~1.4 (?), ~1.7 (?) scint spect (29H54); see also gammas of La^{138}	
Pr^{139}	4.5 h (93S51, 29H54); 4.2 h (44D52)	☢ EC ~94%, β^+ ~6% (93S51);	β^+	1.0 abs, spect (93S51); abs, scint spect (29H54);	Q_{EC} 2.0 (33L57)
		A chem, genet (93S51); chem, mass spect (44D52); parent Ce^{139} (93S51, 29H54)	γ	1.3, 1.6 scint spect (29H54)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{59}Pr^{140}$	3.4 m (29D42, 29H54); 3.5 m (1P38a)	☢ β^+ ~54%, EC ~46% (42R57a, recalc from 88B52); A excit (12A35); excit (1P38a); daughter Nd^{140} (2W49, 88B52); others (93S51, 34H45, 12P49)	β^+ 2.23 spect (88B52); γ no γ (88B52)	Q_{EC} 3.25 (64K54)  (88B52)
Pr^{141}	t_a >2 x 10^{16} y sp act (37P54)	% 100 (3I48c, 98C57); I 5/2 atomic spect (87M50); 5/2 paramag res (85D51); μ +3.8 atomic beam (62L53a); +4.0 atomic spect (88M54c); 3.9 paramag res (181B55); q -0.054 atomic beam (62L53a); ~0 atomic spect (88M54c); others (61W53)	γ Coulomb excitation (in Pr^{141}); no γ (97H55, 97H54b, 97H55); 0.142 level of Pr^{141}: $t_{1/2}$ 1.8 x 10^{-9} s delay coinc (60W55a, 60W56); $t_{1/2}$ 1.6 x 10^{-9} s nucl res fluor (calc from 44M56, 56J55); others (135B53)	see Ce^{141}
Pr^{142}	19.2 h (37B46); 19.1 h (13J50); 19.3 h (29D42)	☢ β^- (29D42); no β^+ or EC (lim 0.5%) (28R50b); A n-capt (12A35, 82M35); others (1P37, 1P38a, 2S47); μ ±0.15 (assuming I = 2) nucl alignment (7G58)	β^- 2.17 (92%), 0.59 (8%) spect, β-γ coinc (38P54); 2.12 (97%), 0.70 (3%) abs, β-γ coinc (173S55a); 2.14 spect (96M52, 29D42); 2.23, 0.66 spect (41R50); others (96M52, 29D42, 26M49d, 15J49); γ 1.572 spect, scint spect (38P54); 1.61, no 0.134 γ, no 0.329 γ, no 0.624 γ scint spect (173S55a); 1.57 (4.1%) scint spect (10M57); others (13J50, 13J52, 10C48, 15J49, 165S55)	Q_{β^-} 2.14 (64K54)  (38P54)
Pr^{143}	13.76 d (109W57); 13.59 d (74P57); 13.6 d (113H57e); 13.7 d (15F49a); 13.8 d (72B51h); others (87R56, 1P48, 140M56b)	☢ β^- (72B51g, 19J44); A chem (72B51g, 19J44); mass spect (60H46a); daughter Ce^{143} (1P43, 37B46, 72B51e); others (16H43b, 28F51)	β^- 0.932 spect (15F49a); 0.922 spect (49B50a); 0.920 spect (11T49a); 0.92 spect (38K52, 38K51); 0.93 spect (140M56b); others (160S57, 26M49e, 75L57b); γ no γ (72B51g, 72B51h, 1P48, 165S55)	Q_{β^-} 0.929 (64K54)  (SHS)
Pr^{144}	17.27 m (74P57); 17.5 m (7N51a, 77S51b); 17.0 m genet (113H57e)	☢ β^- (7N51a); A chem, genet (7N51a, 16H43b); daughter Ce^{144} (16H43b, 7N51a); others (21T51, 28F51, 13Z56a); I 0 nucl alignment (7G57c)	β^- 2.98 (95%), 2.3 (2%), 0.8 (3%) spect (2E54); 2.97 (>99%), other β^-'s (<1%) spect (19P52); 2.99, 2.28 spect, scint spect, β-γ coinc (61L56); 3.15 (95%), 2.45 (3%), 0.90 (2%) spect (154H58); β_0 (98%), 2.30 (~1.3%), 0.79 (~1.0%) spect (14G57); others (17N51b, 19J44, 50B51a, 70B43a, 16H43b, 26M50a, 70C52, 10C54a, 61D56a, 13A52a); γ 0.0603, 0.696 (weak), 1.5 (weak), 2.19 (weak) scint spect, spect, spect conv (19P52); 0.70 (1.6%, coinc with 1.50 γ), 1.50 (0.25%), 2.20 (0.8%) scint spect, γ-γ coinc (14G57) 0.695 (†100), 1.48 (†40), 2.19 (†110) spect, β-γ, γ-γ coinc (13A52a); 0.688, 1.49, 2.18, no 0.060 γ scint spect, spect conv (10C54a); 0.060 (K/L 1), 0.70 (1.3%) spect conv, scint spect (2E54); 0.70 (†100), 1.5 (†20), 2.2 (†50) scint spect (82K54a); others (11K51, 17N51b, 77S51b, 28E53, 83R53, 82S54, 154H58)	Q_{β^-} 3.01 (SHS)  (14G57,SHS)
Pr^{145}	5.95 h (158M54); 5.8 h (93A58)	☢ β^- (158M54); D chem, excit, genet (158M54); daughter Ce^{145} (158M54); others (78C53, 72B51f)	β^- ~1.7 abs (158M54); γ no γ (158M54)	

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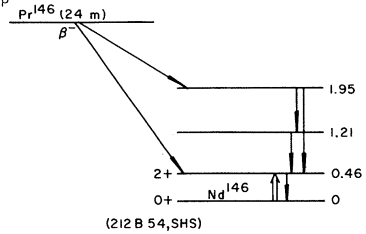
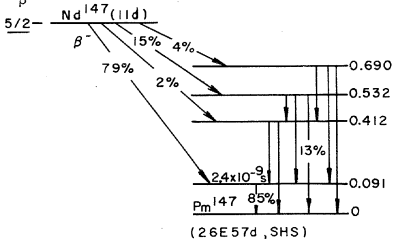
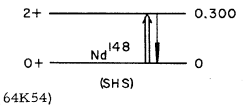
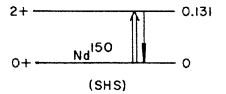
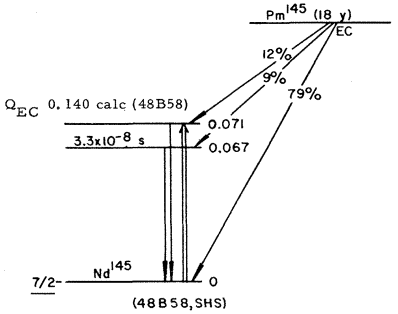
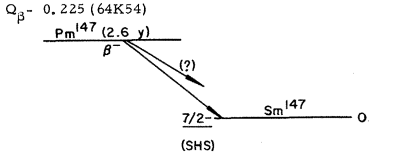
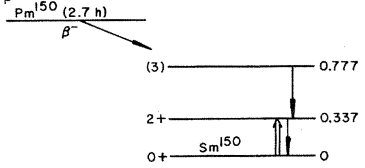
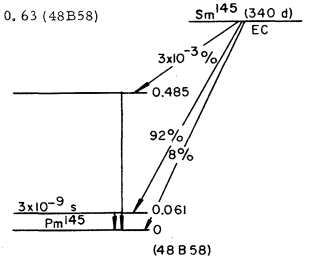
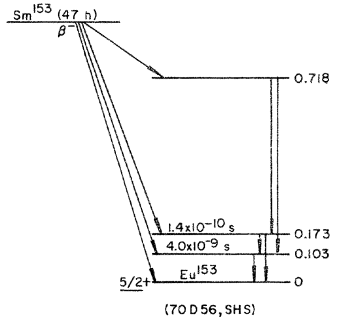
$_{59}Pr^{146}$	24.4 m (78C53); 24.0 m (20K51a); 24.6 m (53S45a); 25 m (40G46)	☢ β^- (40G43); B chem, genet (40G43); daughter Ce^{146} (40G43, 16H43b, 40G46, 78C53)	β^- 3.7, 2.3 scint spect (212B54); 3.8 abs (78C53); ~3 abs (53S45a); γ γ_1 0.46 (†100, coinc with 3.7 β^-, $\gamma_3 + \gamma_4$, and γ_5), γ_2 0.59 (?), γ_3 0.75 (complex, coinc with 2.3 β^- and γ_4), γ_4 ~0.75 ($\gamma_3 + \gamma_4$ †22), γ_5 1.49 (†33, coinc with 2.3 β^-) scint spect, β-γ, γ-γ coinc (212B54); 0.49, 0.78 scint spect (20K51a); see also gammas of Nd^{146}	Q_{β^-} 4.2 (64K54)  (212B54,SHS)
$_{60}Nd^{138}$	22 m (93S51)	☢ β^+ (93S51); D chem, excit (93S51)	β^+ ~2.4 abs (93S51)	
Nd^{139}	5.50 h (93S51)	☢ EC ~90%, β^+ ~10% (93S51); B chem, genet (93S51); ancestor Ce^{139} (93S51)	β^+ 3.1 abs, spect (93S51); γ 1.3 abs (93S51)	
Nd^{140}	3.3 d (2W49)	☢ EC (88B52); A chem, excit, genet (2W49); parent Pr^{140} (2W49, 88B52); others (93S51)	EC Pr K-x (88B52); γ no γ (lim 10%) (88B52); γ (126G57)	
Nd^{141}	2.42 h (2W49); 2.5 h (47K42)	☢ EC 98%, β^+ 1.9% (76P58); EC ~98%, β^+ ~2% (2W49); A excit (47K42); chem, excit (2W49); others (1P38a)	β^+ 0.7 abs (2W49); 0.8 abs (47K42); γ 1.14 (0.5%), 1.30 (0.3%), no 0.142 γ (lim 1%) scint spect (76P58)	Q_{EC} 1.7 (64K54)
Nd^{142}		% 27.13 (3I48c); 27.09 (102W53); 27.3 (64W56)		
Nd^{143}		% 12.20 (3I48c); 12.14 (102W53); 12.32 (64W56); I 7/2 paramag res (97B50); 7/2 atomic spect (88M51); μ -1.1 atomic spect (88M54d); 1.0 paramag res (97B54c); q ±~1 paramag res (97B54c); others (3I50a, 67K56, 61W53)	γ Coulomb excitation (in Nd^{143}): no γ (97H55)	
Nd^{144}	5×10^{15} y sp act (37P56, 37P54); 2×10^{15} y sp act (103W54)	☢ α (103W54, 37P54, 37P56); % 23.87 (3I48c); 23.83 (102W53); 23.8 (64W56); others (3I50a)	α 1.9 range emuls (103W54); 1.8 range emuls (37P54, 37P56); γ Coulomb excitation (in Nd^{144}): no γ (217S55)	

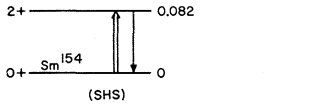
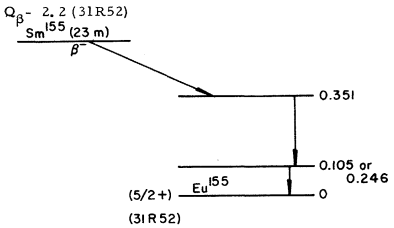
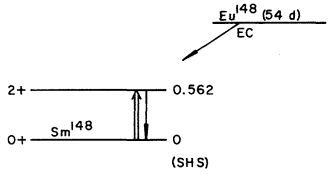
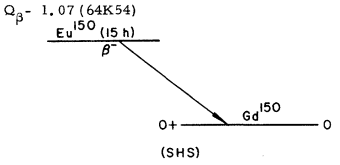
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{60}Nd^{145}$		%	8.29 (64W56, 102W53); 8.30 (3I48c);	γ	Coulomb excitation (in Nd^{145}): 0.070 scint spect (97H55); 0.071 scint spect (217S55); 0.067 level of Nd^{145}: $t_{1/2}$ 3.3×10^{-8} s delay coinc (48B58); see also gammas of Pm^{145}	see Pm^{145}
		I	7/2 paramag res (97B50); 7/2 atomic spect (88M51);			
		μ	-0.7 atomic spect (88M54d); 0.62 paramag res (97B54c);			
		q	± ~1 paramag res (97B54c); others (3I50a, 61W53, 67K56)			
Nd^{146}		%	17.18 (3I48c); 17.26 (102W53); 17.1 (64W56); others (3I50a)	γ	Coulomb excitation (in Nd^{146}): 0.46 scint spect (97H55); others (217S55); see also gammas of Pr^{146}	see Pr^{146}
Nd^{147}	11.06 d (109W57); 11.6 d (38K51a); 11.9 d (31R52); 11.1 d (2E51a); others (84M51, 37B46)	☢	β^- (84M47, 84M51);	β^-	0.81 (66%), 0.38 (18%), 0.23 (16%) spect (10C58, 10C58a); 0.83 (~60%), 0.60 (~15%), 0.38 (~25%) spect (2E51a); 0.78 (67%), 0.35 (33%) spect (38K52, 38K51a); 0.83, 0.60, 0.38 spect (31R52);	Q_{β^-} 0.91 (64K54)  (26E57d, SHS)
		A	chem, genet (84M47, 84M51a); parent Pm^{147} (84M47, 84M51a); others (47K42, 10C48b, 84M51b);	γ	0.0918 (K/L_I 6.4) spect conv (63M52); 0.0913 (coinc with 0.121 γ, 0.277 γ, 0.321 γ, 0.441 γ and 0.60 γ), 0.1206, 0.1982, 0.277, 0.321, 0.400, 0.441, 0.533, 0.60, 0.688 spect conv, scint spect, γ-γ coinc (10C58, 10C58a); 0.0907 (†550, e_K/γ 1.7, K/L 7.5), 0.1200 (†11, e_K/γ 0.7), 0.159 (†<4), 0.232 (†<10), 0.277 (†38, e_K/γ 0.045), 0.322 (†63, e_K/γ 0.036), 0.412 (†3.4, e_K/γ 0.02), 0.441 (†38, e_K/γ 0.02), 0.532 (†250, e_K/γ 0.013, K/L 5.7), 0.600 (†8), 0.690 (†15) spect conv, scint spect (26E57d); 0.0918 (†550, e_K/γ 0.8, K/L+M 6.5), 0.310 (†8, ?), 0.392 (†17, ?), 0.522 (†260) spect, spect conv (38K52, 38K51a); 0.0912 (K/L 4.9), 0.121, 0.197, 0.231, 0.260, 0.273, 0.301, 0.318, 0.398, 0.441, 0.532 (K/L ~6) (all weak except 0.091 γ) spect conv, γ-γ, β-γ coinc (31R52); 0.092 (†550, e_K/γ 1.6, coinc with 0.12 γ, 0.28 γ, 0.32 γ, 0.44 γ and 0.60 γ), 0.120 (weak, coinc with 0.32 γ), ~0.17 (†15), 0.28 (†25, coinc with 0.32 γ and 0.41 γ), 0.32 (†45), 0.41 (†30), 0.44 (†35), 0.53 (†250), 0.60 (weak), 0.69 (†15) scint spect, γ-γ coinc (155H55); ~0.09 (e_K/γ 1.8, K/L 7.3): $t_{1/2}$ 2.4×10^{-9} s delay coinc, spect conv, scint spect (14G53); others (77A56, 77A55, 9B57, 91S52d, 26M50b, 2E51a, 65L57d)	
		I	5/2 paramag res (113K57);			
		μ	±0.56 paramag res (113K57)			
Nd^{148}		%	5.72 (3I48c); 5.74 (102W53); 5.67 (64W56); others (3I50a)	γ	Coulomb excitation (in Nd^{148}): 0.300 scint spect (97H55, 217S55)	 (SHS)
Nd^{149}	2.0 h (37B46, 1P38a); 1.8 h (31R52); 1.7 h (84M51b)	☢	β^- (1P38a);	β^-	1.5, 1.1, 0.95 spect (31R52); 1.5 abs (84M51b); 1.6 abs (37B46);	Q_{β^-} 1.6 (64K54)
		A	excit (1P38a); chem, genet (84M51b); parent Pm^{149} (42K52)	γ	0.030, 0.097 (K/L 0.9), 0.112, 0.114 (K/L ~5), 0.124, 0.188, 0.198, 0.211 (K/L ~7), 0.226, 0.240, 0.266 (K/L ~10), 0.424, 0.538, 0.650 spect, spect conv, scint spect, coinc (31R52)	
Nd^{150}	t_β $>10^{16}$ y sp act (42D54); $t_{\beta\beta}$ $>2 \times 10^{18}$ y sp act (130C56); others (85M52)	%	5.60 (3I48c); 5.63 (102W53); 5.56 (64W56); others (3I50a);	γ	Coulomb excitation (in Nd^{150}): 0.132 spect conv (96H56); 0.128 scint spect (97H55); 0.131 scint spect (217S55)	 (SHS)
		μ	of 0.131 level of Nd^{150} assuming I = 2: ±0.44 ang corr attenuation (211S58)			

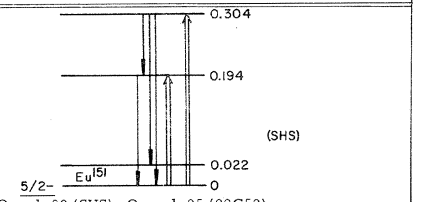
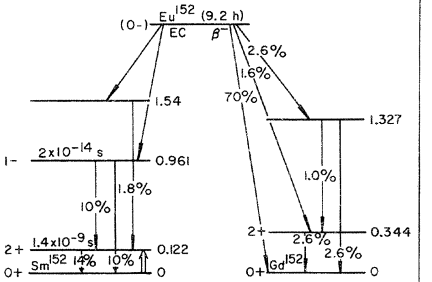
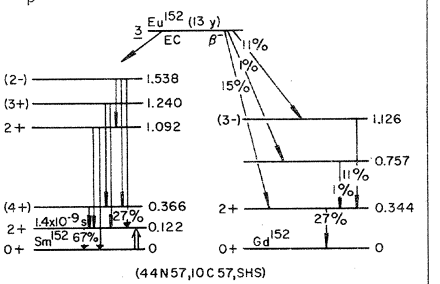
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{60}Nd^{151}$	15 m (51C52); 12 m (31R52, 84M51b)	☢ β^- (31R52); B n-capt (84M51b); sep isotopes, n-capt, Pm K-L-M difference (31R52); parent Pm^{151} (31R52)	β^- 1.93 spect (31R52); γ 0.085, 0.110, 0.117 (K/L 4), 0.421, 0.73, 1.14 spect conv, scint spect, β-γ, γ-γ coinc (31R52)	
$_{61}Pm^{141}$	20 m (34F52)	☢ β^+ (34F52); B chem, excit (34F52)	β^+ 2.6 spect (34F52)	
Pm^{142}	~30 s genet (175M58)	☢ β^+, EC (175M58); C chem, genet (175M58); daughter Sm^{142} (175M58)	β^+ 3.78 (with Sm^{142}) spect (175M58)	
Pm^{143}	270 d (43L52a); 285 d (2W50a)	☢ EC (2W50a); A chem, excit (2W50a); chem, mass spect (72B58); others (34F52)	γ 0.95 abs (2W50a)	
Pm^{144}	300 d (34F52); 330 d (43L52a)	☢ EC (34F52); D chem (34F52); chem, mass spect (72B58)	γ 0.65, 0.44, 0.17 scint spect (34F52)	
Pm^{145}	16 d (43L52a)	☢ β^+ (43L52a); F sep isotopes (43L52a)	β^+ 0.45 (43L52a)	
Pm^{145}	18 y (48B58); ~30 y yield (65B51); ~100 y yield (26P53)	☢ EC (65B51); EC to 0.067 level: L+M+N/K 0.85 (48B58); EC (L/K 1.8), no β^+ (141C58); A chem, genet (65B51, 26P52); chem, mass spect (72B58); daughter Sm^{145} (65B51, 26P52)	γ 0.067 (†10, e_K/γ 3.3, K/L 1.1), 0.072 (†23, e_K/γ 3.3, K/M 19) scint spect, spect conv, x-γ coinc (48B58); 0.073 (e_K/γ 5.4) cryst spect (141C58); 0.067 γ: $t_{1/2}$ 3.3 x 10^{-8} s delay coinc (48B58); 0.061 level of Pm^{145}: $t_{1/2}$ 3 x 10^{-9} s delay coinc (48B58); others (26P53, 26P52, 65B51); see also gammas of Nd^{145} and Sm^{145}	
Pm^{146}	~1 y (34F52); 1-2 y (43L52a)	☢ β^- (?) (34F52); B chem, excit (34F52)	β^- 0.7 abs (34F52); 0.75 abs (43L52a)	
Pm^{147}	2.64 y (131M57); 2.66 y (53S56); 2.5 y yield + mass spect (159M55); 2.3 y (3I50a); others (53S51)	☢ β^- (72B51i); A chem (84M47, 84M51a); mass spect (60H48); daughter Nd^{147} (84M47, 84M51a); parent Sm^{147} (42R50); others (38G48)	β^- 0.223 spect (10L50c); 0.227 spect (33L49); 0.229 spect (16A50); 0.218 spect (39N56); γ 0.121 (very weak) scint spect (75L56, 75L57b); no γ (84M47, 84M51a, 77S51c, 160S57); 0.092 level of Pm^{147}: $t_{1/2}$ 2.4 x 10^{-9} s delay coinc (14G53); see also gammas of Nd^{147}; others (87G58)	

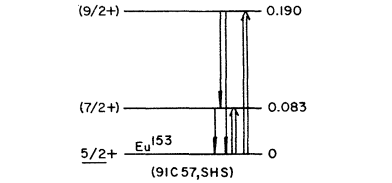
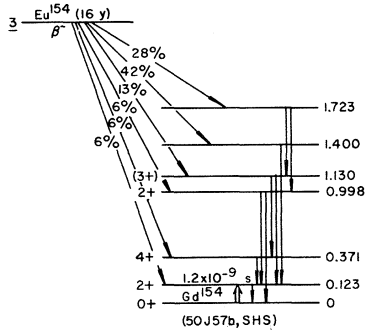
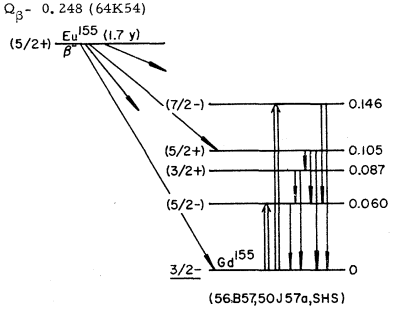
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{61}Pm^{148}$	5.3 d (47K43, 26P47)	☢	β^- (47K43);	β^-	~2.5 abs (26P47); 2 abs (47K43);	
		A	chem, n-capt, mass spect (26P47); others (43L52, 47K42)	γ	~0.8 abs (26P47)	
Pm^{148}	42 d (34F52); 43 d (6F51); 48 d (43L52)	☢	β^- (43L52);	β^-	2.4 (weak), 0.6 spect (6F51); 2.7 (weak), 0.7 abs (34F52); 1.7, 0.6 abs (43L52);	
		B	excit, sep isotopes (43L52); chem (6F51)	γ	(6F51, 34F52, 43L52)	
Pm^{149}	54 h (34F52); 55 h (3I47b); 50 h (31R52, 38K51c); 47.5 h (37B46); 47 h (84M51c, 16W4Z, 44L41)	☢	β^- (84M47, 84M51c);	β^-	1.05 spect (38K51a, 38K52, 31R52); 0.97 spect (34F54); others (26M49f, 37B46, 84M51c);	Q_{β^-} 1.34 (?) (64K54)
		A	chem (84M47, 84M51c); chem, mass spect (3I47b); daughter Nd^{149} (42K52); others (44L41, 32K48)	γ	0.285 (coinc with β^-, K/L 8), 1.3 (weak) spect conv, abs, β-γ coinc (31R52); 0.285, ~1.0 scint spect (34F54); others (38K51a, 26M49f)	
Pm^{150}	2.7 h (43L52, 34F52, 47K43)	☢	β^- (43L52);	β^-	3.05 (20%), 2.01 (80%) spect (34F54); 2.4 abs (43L52);	Q_{β^-} 5.0 (34F58)
		A	excit, sep isotopes (43L52); chem, excit, sep isotopes (34F52)	γ	0.34 (†100), 0.40, 0.57, 0.70, 0.82 (†40), 0.96 (?), 1.17 (†4), 1.24 (?), 1.33 (†4), 1.68 (†0.8), 1.95 (†0.4), 2.75, no 3.0 γ, scint spect, γ-γ coinc (34F54, 34F58); others (53H52, 84R57); see also gammas of Sm^{150}	 (53H52, 84R57, SHS)
Pm^{151}	27.5 h (31R52)	☢	β^- (31R52);	β^-	1.1 abs (31R52);	
		B	genet, Sm K-L-M differences (31R52); daughter Nd^{151} (31R52)	γ	0.065 (K/L 0.3), 0.066 (K/L 0.3), 0.070 (K/L 0.3), 0.100 (K/L ~5), 0.116, 0.144 (K/L ~9), 0.163 (K/L ~7), 0.168 (K/L ~3), 0.177 (K/L ~9), 0.208 (K/L ~4), 0.232, 0.240, 0.275 (K/L >10), 0.340 (K/L ~9), 0.715 spect conv, scint spect (31R52); 0.064, 0.100 (coinc with 0.23 γ), ~0.17 (†70), 0.230 (†40), 0.275 (†55), 0.335 (†100), 0.44 (†40), 0.65 (†18), 0.70 (†26), 1.50 scint spect, γ-γ coinc (155H55)	
Pm	12.5 h (6F51, 1P38a)	☢	β^- (1P38a);			
		E	(1P38a); chem (6F51)			
$_{62}Sm^{142}$	72 m (175M58)	☢	β^+, EC (175M58);			
		D	chem (175M58); parent Pm^{142} (175M58)			
Sm^{143}	9.0 m (218S56); 8.3 m (160M56); 8 m (65B50)	☢	β^+ (218S56, 160M56);	β^+	2.3 abs (160M56); 2.6 abs (218S56);	Q_{EC} 3.5 (33L57)
		B	chem (65B50); excit (218S56); chem, sep isotopes (160M56)	γ	no γ (160M56)	
$\underline{Sm^{144}}$		%	3.16 (3I48d); 3.15 (98C57); 3.02 (88A57)			

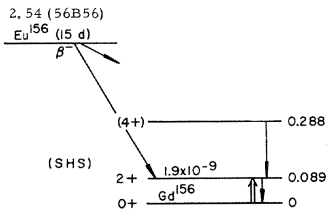
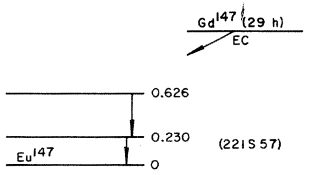
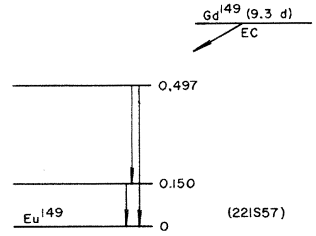
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{62}Sm^{145}$	340 d (48B58); ~410 d (65B51); >150 d (10C48b); >72 d (3I47c)	☢ EC (65B51, 31R52); EC to 0.061 level: L+M+N/K 0.2 (48B58); EC to 0.49 level: L+M+N/K 0.6 (48B58); EC (L/K 2.0) (141C58); A mass spect (3I47c); chem (65B51); chem, sep isotopes, n-capt (26P52); parent Pm^{145} (65B51, 26P52)	EC internal bremsstrahlung endpoint to 0.061 level: 0.53 scint spect, γ-γ coinc (48B58); γ 0.0613 (e_K/γ 5.7) cryst spect (141C58, 131C57); 0.061 (†100, e_K/γ 5.3, K/L 6.5), 0.485 (†0.02) scint spect, spect conv (48B58); 0.061 (K/L 1.0) spect conv (31R52); 0.061 γ: $t_{1/2}$ 3×10^{-9} s delay coinc (48B58)	Q_{EC} 0.63 (48B58) 
Sm^{146}	5×10^7 y yield (15D53)	☢ α (15D53); B chem, decay charac (15D53)	α 2.55 range emuls (15D53)	
Sm^{147}	1.3×10^{11} y sp act (213B54); others (45L47, 72H35, 31P49)	☢ α (71H32, 3L33); A chem (71H32); sep isotopes, mass spect (48W50); chem, genet, mass spect (42R50); daughter Pm^{147} (42R50); others (72B48, 1D48, 3I50a); % 15.07 (3I48d); 15.1 (98C57); 14.9 (88A57); I 7/2 paramag res (105B52); 7/2 atomic spect (88M54, 88M51); μ -0.76 atomic spect (88M54); 0.83 paramag res (40E53, calc from 105B52a); q <±0.7 paramag res (40E53, calc from 105B52a)	α 2.18 ion ch (10J50); 2.14 range emuls (74C46); 2.12 range emuls (219S53); others (72H35, 92B49)	
Sm^{148}		% 11.27 (3I48d); 11.35 (98C57); 11.22 (88A57)	γ Coulomb excitation (in Sm^{148}): 0.562 scint spect (97H55, 217S55a); 0.55 scint spect (141M55a)	see Eu^{148}
Sm^{149}		% 13.82 (88A57); 13.84 (3I48d); 14.0 (98C57); I 7/2 paramag res (105B52); 7/2 atomic spect (88M54, 88M51); μ -0.64 atomic spect (88M54); 0.68 paramag res (40E53, calc from 105B52a); q <±0.7 paramag res (40E53, calc from 105B52a); others (3I50a)	γ Coulomb excitation (in Sm^{149}): no γ (97H55)	
Sm^{150}		% 7.47 (3I48d, 98C57); 7.40 (88A57)	γ Coulomb excitation (in Sm^{150}): 0.337 scint spect (97H55, 217S55a); 0.34 scint spect (141M55a); others (53H52, 84R57); see also gammas of Pm^{150}	see Pm^{150}

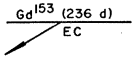
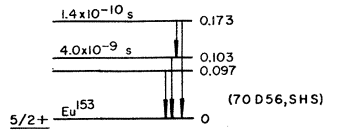
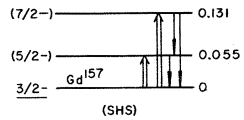
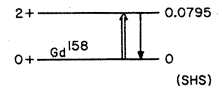
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{62}Sm^{151}$	~93 y yield + mass spect (159M55); ~73 y (7K52); ~120 y yield (3I50a)	☢	β^- (3I47c);	β^-	0.076 spect (16A50); 0.079 spect (24K49e); 0.074 spect (84M49); β_0 (99%), β_{22} (1%) est (73A57);	Q_{β^-} 0.096 (64K54); see Eu^{151}
		A	mass spect (3I47c, 3I50a); chem (84M49)	γ	0.021 ion ch (17S50); 0.019 (coinc with β^-) ion ch, β-γ coinc (33W52); ~0.02 (e_L/γ ~12, L/M+N 1.8) spect conv, scint spect (73A57); no γ (84M49, 31R52); see also gammas of Gd^{151}	
Sm^{152}		%	26.63 (3I48d); 26.6 (98C57); 26.8 (88A57);	γ	Coulomb excitation (in Sm^{152}): 0.12185 cryst spect (137C58); 0.122 level of Sm^{152}: $t_{1/2}$ 1.4×10^{-9} s delay coinc (14S55); 0.961 level of Sm^{152}: $t_{1/2}$ 2×10^{-14} s nucl res fluor (99G58); others (21IS57, 96H56, 97H55, 21 7S55a, 141M55a); see also gammas of Eu^{152} isomers	see Eu^{152} isomers
		μ	of 0.122 level of Sm^{152} assuming I = 2: ±0.42 ang corr attenuation (21IS58)			
Sm^{153}	47.1 h (10C58); 47 h (51W51, 37B46, 47K42, 31R52)	☢	β^- (47K42);	β^-	0.80 (21%), 0.69 (70%), 0.26 (9%) spect (82L53); 0.81 (†20), 0.71 (†50), 0.64 (†30) spect, β-γ coinc (14G54); 0.83 (22%, not coinc with γ), 0.72 (38%, coinc with 0.100 γ), 0.65 (40%, coinc with 0.070 γ and 0.170 γ), 0.13 (0.06%, coinc with 0.53 γ and 0.60 γ) scint spect, β-γ coinc (70D56); 0.82 (20%), 0.72 (40%, coinc with 0.103 γ), 0.65 (40%, coinc with 0.103 γ) spect, β-γ coinc (54M55a, 54M55); others (87B52, 11H50, 7S51, 31R52, 82B48, 51W51, 7S52, 39J57, 10C58, 10C58a);	Q_{β^-} 0.81 (SHS); see Eu^{153} and Gd^{153}
		A	n-capt, excit (1P38a); mass spect (60H46, 3I47b); chem (51W51); others (71H36, 44L41, 16W42, 1P38a, 7N49a)	γ	0.10318 (†100), 0.06966 (†7) cryst spect (229B57); 0.10327 (†100), ~0.07 (†10) cryst spect, scint spect (76A56); γ_1 0.070 (†25, e_K/γ 4.4, coinc with γ_2 and γ_4), γ_2 0.100 (†100, e_K/γ 1.2, coinc with γ_4 and γ_5), γ_3 0.170 (†0.07), γ_4 0.53 (†0.2), γ_5 0.60 (†0.04) scint spect, γ-γ coinc (70D56); 0.0698, 0.0833, 0.0973, 0.1031 spect conv (97C54, 97C57); 0.0690 (e/γ 6, K/L >4.6), 0.1025 (K/L >6.1), 0.17 (weak, K/L 4.5), 0.52 spect conv, β-γ, γ-γ coinc (14G54); 0.0691 (K/L 4), 0.1027 (e_K/γ 0.6, K/L 6), 0.548 (e_K/γ 8×10^{-3}, K/L 6) spect conv (82L53); 0.0698, 0.1035, 0.1736, 0.540 spect conv, scint spect, γ-γ coinc (10C58, 10C58a); 0.069, 0.084, 0.103 (e_K/γ 1.2, K/L 6.2), 0.172, 0.545 (coinc with 0.103 γ) spect conv, scint spect, γ-γ coinc (54M55a, 54M54); γ_1 (e_K/γ 3.8), γ_2 (e_K/γ 1.1) scint spect, γ-γ coinc (52M54); γ_1: $t_{1/2}$ 1.4×10^{-10} s delay coinc (14G54); γ_2: $t_{1/2}$ 4.0×10^{-9} s delay coinc (14G54, 30V56); $t_{1/2}$ 3.4×10^{-9} s delay coinc (52M54, 52M50); γ_1 (K/L 3.5, $L_I/L_{II}/L_{III}$ = 26/1.3/1.3), γ_2 (K/L 6.5, $L_I/L_{II}+L_{III}$ 19) spect conv (63M52a, 63M52b); 0.070 (†6, e_K/γ 3.5, K/L 5), 0.083 (†<4), 0.102 (†100, e_K/γ 0.7, K/L 6) spect, spect conv (39J57); others (7S51, 87B52, 31R52, 67H48a, 11H50, 43M46, 82B48, 7S52); see also gammas of Eu^{153} and Gd^{153}	

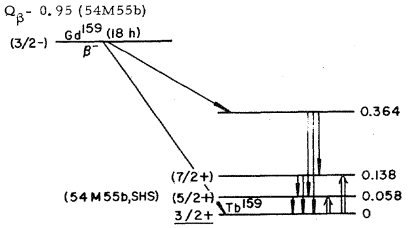
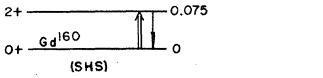
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{62}Sm^{154}$		% 22.53 (3I48d); 22.4 (98C57); 22.9 (88A57); others (3I50a) μ of 0.083 level of Sm^{154} assuming I = 2: ±0.34 ang corr attenuation (21IS58)	γ Coulomb excitation (in Sm^{154}): 0.08199 cryst spect (137C58); others (96H56, 97H55, 217S55a, 141M55a)	
Sm^{155}	23.5 m (31R52); 25 m (51W51a); 21 m (1P38a)	☢ β⁻ (47K42); B n-capt (12A35, 82M35); chem (51W51a); parent Eu^{155} (3I47c); others (71H36, 1P38a, 44L41, 2S47, 47K42)	β⁻ 1.8 (coinc with both γ's) abs, β-γ coinc (31R52); 1.9 abs (51W51a); 1.8 abs (47K42); γ 0.105 (†100, K/L 3.6, coinc with 0.246 γ), 0.246 (†100, K/L ~8) spect, spect conv, γ-γ coinc (31R52); 0.25 (3.7%) scint spect (10M57)	
Sm^{156}	9.0 h (93A58)	☢ β⁻ (51W51b); B chem, genet (51W51b); parent Eu^{156} (51W51b)	β⁻ 0.9 abs (51W51b)	
$_{63}Eu^{144}$	18 m (74H52)	☢ β⁺ (74H52); C excit, sep isotopes (74H52)	β⁺ 2.4 spect (74H52)	
Eu^{145}	5 d (74H51)	☢ EC (74H51); B chem, genet, sep isotopes, excit (74H51); daughter Tb^{149} (74H51)	γ 0.63, 0.66, 0.73, 0.89 scint spect (126G57)	
Eu^{146}	38 h (74H51)	☢ EC (74H51); C excit, sep isotopes (74H51)	γ (74H51)	
Eu^{147}	24 d (74H51, 42R53, 86M53)	☢ EC 99+%, α ~10^{-3}%, no β⁺ (74H51); B chem, excit, sep isotopes (74H51); daughter Gd^{147} (126G57)	α 2.9 ion ch (74H51); γ 0.120, 0.208 spect conv, scint spect (86M53); 0.080, 0.124, 0.200 scint spect (126G57)	
Eu^{148}	54 d (86M53, 2W50b); 50 d (74H51); 53 d (84M51d)	☢ EC, no β⁺ (74H51); A chem (84M51d); excit, sep isotopes (74H51, 86M52); others (47K43)	γ 0.58 scint spect, spect conv (86M53); 0.57 scint spect (74H52); others (84M51d, 2W50b, 86M52, 74H51); see also gammas of Sm^{148}	
Eu^{149}	120 d (86M53)	D sep isotopes, excit (74H52); chem, excit (86M53)	γ ~0.4 scint spect (74H52)	
Eu^{150}	15.0 h (2W50b); 13.7 h (86M53a); 15 h (65B50)	☢ β⁻, no β⁺ (86M53a, 86M52); A chem, excit (65B50); chem, excit, sep isotopes (74H52); excit, sep isotopes (86M52)	β⁻ 1.07 spect (86M53a, 86M52); 1.8 spect (2W50b); γ no γ (86M53a)	

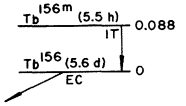
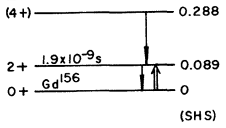
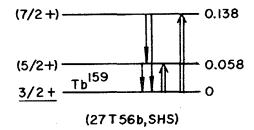
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{63}Eu^{151}$		%	47.77 (43H48); 47.86 (98C57);	γ	Coulomb excitation (in Eu^{151}): 0.110 (coinc with 0.195 γ), 0.195 (†10), 0.304 (†90) scint spect, γ-γ coinc (97H55, 97H56a); 0.111 (?), 0.193 (K/L 3.3), 0.304 (K/L 6.5), 0.284 spect conv (91C57); others (141M55a); see also gammas of Gd^{151}; ~0.18 level of Eu^{151}: $t_{1/2}$ 6×10^{-5} s (221S57a)	 Q_{β^-} 1.88 (SHS), Q_{EC} 1.85 (99G58)
		I	5/2 atomic spect (87M50); 5/2 paramag res (97B55a);			
		μ	+3.4 atomic spect (87M50);			
		q	+1.2 atomic spect (87M50);			
			others (61W53, 67K56, 166M56, 70L55a, 117K57, 91R57)			
Eu^{152}	9.2 h (1P38a, 60H49); 9.3 h (37B46)	☢	EC (K) 25%, β^- 75% (44N57); β^-, β^+ (weak) (114K56, 99G56a);	β^-	1.88, 0.55 (?) (weak) spect (11H50); 1.88, spect (114K56, 99G56a, 20T39); 1.89, 1.55 (coinc with 0.344 γ), 0.56 (coinc with ~0.98 γ and 1.32 γ) scint spect, β-γ coinc (44N57);	 (44N57, SHS)
		A	n-capt (82M35); n-capt, excit (1P38a); mass spect (60H46, 60H49); others (82M35, 1P38a, 71H36, 5F41b, 2S47, 5F39)	β^+	0.82 scint spect (114K56, 99G56a);	
				γ	(with EC) 0.122, 0.837 (†140), 0.961 (†100), 1.41; (with β^-) 0.344, 0.983, 1.300, 1.327 spect conv, scint spect, γ-γ coinc (99G56a, 114K56, 99G56b, 99G58); (with EC) 0.122 (K/L ~4); (with β^-) 0.344 (K/L ~10) spect conv (11K51); 0.122 (†270), 0.84 (†390, e_K/γ 1.6×10^{-3}), 0.96 (†400, e_K/γ 1.1×10^{-3}), 1.42 (†70), 0.344 (†100), 0.98 (†40), 1.32 (†100) scint spect, β-γ, γ-γ coinc (44N57); others (107S51, 11H50, 52W51, 20T39, 10C50c, 35F50, 23R39); see also gammas of 13 y Eu^{152} and Sm^{152}	
Eu^{152}	12.7 y (55L56, 55L53); 12.2 y (93G57); 13 y (7K52); others (51K53a, 60H49)	☢	EC (K) 73%, β^- 27% (44N57); EC ~80%, β^- ~20% (10C57);	β^-	1.46 (†21), 1.05 (†6), 0.68 (†51), 0.36 (†13), 0.22 (†9) spect (10C57); 1.46 (13%), 1.00 (2%) spect (99G56a, 114K56); 1.58, others spect (11H50); 1.58, 0.75 spect (68S48); 1.7 (~20%), 0.9 (~80%) abs (84M49a); with Eu^{152} and/or Eu^{154}: 1.85 (coinc with 0.122 γ), 1.52 (coinc with 0.34 γ), 0.95 (weak, coinc with 0.42 γ), 0.35 (coinc with 0.244 γ), 0.58 (coinc with 1.28 γ), 0.75 (coinc with 0.58 γ) scint spect, β-γ coinc (44N57);	 (44N57, 10C57, SHS)
		A	n-capt, mass spect (3I47d); chem (84M49a); others (2S47);			Q_{β^-} 1.80 (SHS)
		I	3 paramag res (65A57a, 166M57);			
		μ	±2.0 paramag res (65A57a, 166M57)			
				γ	0.12179, 0.24484 cryst spect (158H57a); 0.1223, 0.2446, 0.3443 cryst spect (78A56); (with EC) 0.1222 (K/L 1.5), 0.2453 (K/L 3.3), 0.445, 0.586, 0.692, 0.872, 0.969, 1.092, 1.118, 1.17, 1.416; (with β^-) 0.345 (K/L 4.6), 0.412, 0.507, 0.782, 1.10 spect conv, γ-γ coinc (10C57); 0.1218, 0.2443 spect conv (97C54); (with EC) 0.122, 0.244, 0.871, 0.967, 1.089, 1.41; (with β^-) 0.344, 0.411, 0.784 spect conv, scint spect (99G56a, 114K56); (with EC) γ_1 0.122 (coinc with γ_2, γ_3, γ_4, γ_6, and γ_7), γ_2 0.244 (†40, coinc with γ_3 and γ_6), γ_3 0.860 (†15, e_K/γ 4.6×10^{-3}), γ_4 0.965 (†60), γ_5 1.09 (†50), γ_6 1.20 (†20), γ_7 1.42 (†90, e_K/γ 4.7×10^{-4}); (with β^-) γ_8 0.344 (†100, coinc with γ_9 and γ_{10}), γ_9 0.420 (†4), γ_{10} 0.775 (†40, e_K/γ 1.8×10^{-3}) spect conv, scint spect, γ-γ coinc (44N57); 0.122 (K/L 1.8, $L_I/L_{II}/L_{III}$ = 1/2.2/2.2) spect conv (70K57, 70K57b); γ_1: $t_{1/2}$ 1.4×10^{-9} s delay coinc (14S55); others (11K51, 10C50c, 43K52, 35F50, 11H50, 68S48, 220S54, 82L52, 135B53, 107S52, 107S51, 16D55b, 211B57, 130B56, 27O57b); see also gammas of 9 h Eu^{152} and Sm^{152}	

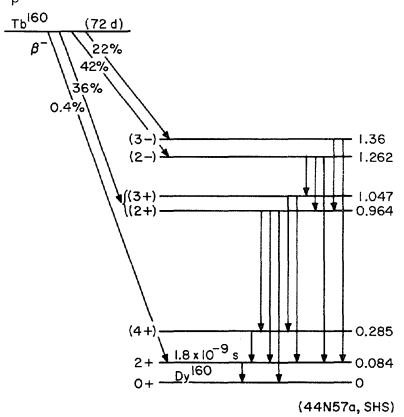
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{63}Eu^{153}$		%	52.23 (43H48); 52.14 (98C57);	γ	Coulomb excitation (in Eu^{153}): 0.082, 0.105 (†38, coinc with 0.082 γ), 0.187 (†62) scint spect, γ-γ coinc (97H55, 97H56a); 0.105 (†38), 0.187 (†50) scint spect (78G56); 0.083 (K/L 1), 0.107 (K/L 2.2), 0.190 (K/L 3.2) spect conv (91C57); 0.084 (K/L 1.7), 0.111 (K/L 5.6), 0.195 spect conv (116B57a); others (96H56, 141M55a); 0.172 level of Eu^{153}: $t_{1/2}$ 1.4×10^{-10} s delay coinc (14G54); 0.103 level of Eu^{153}: $t_{1/2}$ 4.0×10^{-9} s delay coinc (14G54, 30V56); see also gammas of Sm^{153} and Gd^{153}	see Sm^{153} and Gd^{153} 
		I	5/2 atomic spect (87M50); 5/2 paramag res (97B55a);			
		μ	+1.5 atomic spect (87M50);			
		q	+2.5 atomic spect (87M50); others (3I50a, 67K56, 97B55a, 166M56, 70L55a, 117K57, 91R57)			
Eu^{154}	16 y (7K52); 5.4 y yield (60H49); others (93G57, 51K53a)	☢	β⁻ (60H49);	β⁻	1.84 (7%), 1.60 (3%), 0.83 (20%), 0.55 (30%), 0.25 (28%), 0.15 (12%) spect (10C57); 1.85, 0.87, 0.59, 0.25 spect (50J57b); 1.9 (~10%), 0.7 (~40%), 0.3 (~50%) abs (84M49a, calc from 60H49); others (84M49a, 37B46, 26K48, 11H50, 37W47, 211B57); see also betas of 13 y Eu^{152};	Q_{β^-} 1.97 (SHS) 
		A	n-capt (69S38); mass spect (3I47d, 60H49); chem (84M49a); others (5F39, 5F41b, 2S47);			
		I	3 paramag res (65A57a);			
		μ	±2.1 paramag res (65A57a)	γ	γ_1 0.123 (35%, e/γ 1.5, L_{II}/L_{III} ~1, coinc with γ_3, γ_7, γ_8, γ_{10}, and γ_{11}), γ_2 0.248 (K/L_I 2.5), γ_3 0.593 (4%), γ_4 0.694, γ_5 0.706, γ_6 0.725 (21%, e_K/γ 2.8×10^{-3}, coinc with γ_8 and $\gamma_9 + \gamma_{10}$), γ_7 0.759, γ_8 0.875 (13%, e_K/γ 5.8×10^{-3}), γ_9 0.998 (14%, e_K/γ 2.1×10^{-3}), γ_{10} 1.007 (17%, e_K/γ 4.4×10^{-3}), γ_{11} 1.277 (42%, e_K/γ 1.7×10^{-3}), ~1.6 spect conv, scint spect, γ-γ coinc (50J57b); 0.1231 (K/L 1.2), 0.2483 (K/L 4.6), 0.535, 0.592, 0.694, 0.725, 0.759, 0.875, 0.999, 1.008, 1.281 spect conv, γ-γ coinc (10C57); 0.12307, 0.24808 cryst spect (158H57a); 0.1235 cryst spect (78A56); 0.1234, 0.2477 spect conv (97C54); 0.1232 ($L_I/L_{II}/L_{III}$ = 1/2.7/2.5, K/L 1.5) spect conv (70K57, 70K57b); γ_1: $t_{1/2}$ 1.2×10^{-9} s delay coinc (14S55); others (16D55b, 156H56, 220S54, 82L54, 82L52, 135B53, 11K51, 43K52, 26K48, 10C48b, 211B57, 130B56, 44N57, 169H57); see also gammas of Gd^{154} and Tb^{154}	
Eu^{155}	1.7 y (31R52); 2.0 y (51W51c); 1.7 y yield (60H49)	☢	β⁻ (51W51c);	β⁻	0.154 (80%), 0.243 (20%) spect, β-γ, γ-γ coinc (84M49a); 0.152 (84%), 0.252 (16%) spect (82L54); 0.15 (77%), 0.24 (23%) scint spect (70D56); others (33W52);	Q_{β^-} 0.248 (64K54) 
		A	chem (51W51c); mass spect (60H49); daughter Sm^{155} (3I47c); others (47K43, 7N49a)	γ	0.0189, 0.0265, 0.04529, 0.06000, 0.08654, 0.10532 cryst spect, spect conv (56B57); 0.0188, 0.0416, 0.0599, 0.0859, 0.0865 (†100), 0.1052 (†63) spect conv, scint spect (50J57a); 0.0453, 0.0598, 0.0863, 0.1051 spect conv (97C54, 97C57); 0.0187, 0.0593, 0.0858 (K/L ~4), 0.1045 (K/L 6.1), 0.131, 0.137 spect conv (82L54); 0.060 (weak), 0.087 (K/L ~8), 0.106 (K/L ~8), 0.132 (weak) spect conv (31R52); others (84M49a, 51W51c, 33W52, 70D56); see also gammas of Gd^{155} and Tb^{155}	

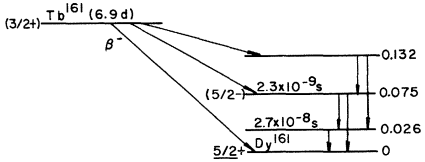
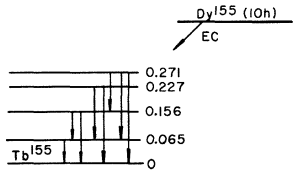
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{63}Eu^{156}$	15.4 d (51W51b, 3I47c); 14 d (97C54)	☢ β^- (51W51b); A chem (51W51b); mass spect (3I47b, 3I47c); daughter Sm^{156} (51W51b); others (7N49a, 6O48, 28F51)	β^-: 2.46, 0.45 spect (26E57); 2.45 spect, β-γ coinc (56B56); 2.4 (40%), ~0.5 (60%) abs (51W51b); γ: 0.08897, 0.1992 cryst spect, spect conv (56B56); 0.0890 (†100, K/L 0.9), 0.1992 (†3, K/L 2.9), 1.84, 1.94, 2.05, 2.14 spect conv, cryst spect, scint spect, γ-γ coinc (26E57); 0.0888, 0.1987 spect conv (97C57); see also gammas of Gd^{156} and Tb^{156}	Q_{β^-} 2.54 (56B56) 
Eu^{157}	15.4 h (51W51d)	☢ β^- (51W51d); D chem (51W51d); others (7N49a, 32K48)	β^-: ~1.0 (~75%), ~1.7 (~25%) abs (51W51d); γ: 0.6, 0.2 abs (51W51d)	
Eu^{158}	60 m (51W51d)	☢ β^- (51W51d); D chem (51W51d)	β^-: 2.6 abs (51W51d); γ: (51W51d)	
Eu^{159}	20 m (65B50)	F excit (65B50)		
$_{64}Gd$	70 d (126G57)	D chem (126G57)	γ: 0.115 (weak), 0.64, 0.75 scint spect (126G57)	
Gd^{147}	29 h (221S57); 36 h (126G57)	☢ EC, no β^+ (lim 1.2%) (221S57); B chem, genet (126G57); chem, excit (221S57); parent Eu^{147} (126G57)	γ: 0.136, 0.142, 0.147, 0.217, 0.226, 0.2295 (†12, K/L_I ~4, coinc with 0.39 γ, 0.76 γ, and 0.93 γ), 0.241, 0.261, 0.310, 0.348, 0.370 (†2), 0.374, 0.391, 0.396 (†5, K/L_I 5), 0.485, 0.502, 0.517 (†1), 0.570 (†1), 0.635 (†3), 0.770 (†5), 0.900 (†5), 1.08 (†1.5), 1.30 (†0.7) scint spect, spect conv γ-γ coinc (221S57); 0.232, 0.373, 0.39 scint spect (126G57)	
Gd^{148}	~130 y (42R53, 42R54)	☢ α (42R53); B chem, excit, sep isotopes (42R53)	α: 3.2 ion ch (42R53)	
Gd^{149}	9.3 d (221S57); 9 d (74H51)	☢ EC 99+%, α 7 x 10^{-4}%, no β^+ (lim 0.4%) (221S57, 42R53); B chem, excit, sep isotopes, cross bomb (74H51); chem, excit (221S57)	α: 3.0 ion ch (74H51, 42R53); γ: 0.107, 0.120, 0.1261, 0.132, 0.1499 (†9, K/L_I 9, coinc with 0.35 γ, 0.50 γ, and 0.76 γ), 0.244, 0.253, 0.273 (K/L 1.6), 0.299 (†6, e_K/γ 0.08, K/L_I 5.5), 0.347 (†4, e_K/γ 0.18, K/L_I 5.0), 0.461, 0.496 (†0.3), 0.517 (†0.8), 0.534 (†0.8), 0.65 (†0.6), 0.75 (coinc with 0.63 γ), 0.79, 0.94 (†0.7) spect conv, scint spect, γ-γ coinc (221S57); 0.154, 0.292, 0.350, 0.51 scint spect (126G57)	
Gd^{150}	>10^5 y yield (86M53a)	☢ α (42R53); D chem (42R53)	α: 2.7 ion ch (42R53)	
Gd^{151}	150 d (63H50)	☢ EC, no β^+ (63H50); A chem, excit (63H50); chem, genet energy levels (115B57, 221S57a); others (5F41b, 26K48)	γ: 0.0216 (†4.4, e_{L_I}/γ 5), 0.1537 (†6.0, e_K/γ 0.45, K/L_I 6.3), 0.1750 (†2.7, e_K/γ 1.8, K/L_I 4.9), 0.244 (†4.5, e_K/γ 0.022), 0.308 (†0.8, e_K/γ 0.11) spect conv, scint spect, γ-γ coinc (221S57a); 0.0213 (†4.6), 0.080, 0.144 (coinc with 0.155 γ), 0.155 (†6, K/L >10), 0.176 (K/L 4.8), 0.240 (†4, K/L ~1), 0.299 (†0.3) spect conv, ion ch, scint spect, γ-γ coinc (115B57); 0.175 γ: $t_{1/2}$ 6 x 10^{-5} s (221S57a); 0.154 γ: $t_{1/2}$ <1 x 10^{-9} s delay coinc (221S57a)	see Eu^{151}

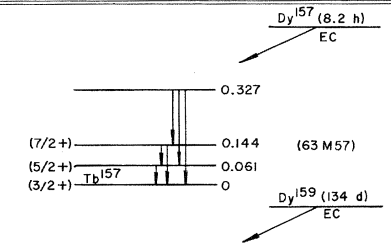
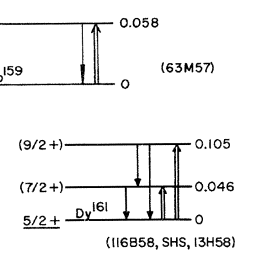
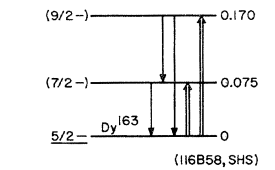
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{64}Gd^{152}$		%	0.20 (1B50); 0.21 (98C57)			
Gd^{153}	236 d (63H50); 225 d (24K49a)	☢	EC, no β^+ (63H50); EC (L/K 0.7) (115B56b); EC (L/K 0.4) (211B56); EC (L/K >1) (54M56a);	γ	0.0698, 0.0833, 0.0973, 0.1031 spect conv (97C54, 97C57); 0.104 (K/L 5.2) spect conv (10C52c); γ_1 0.069 (†20, K/L >4.5), γ_2 0.098 (†100, e_K/γ 0.3), γ_3 0.103 (†100, K/L 6) spect conv, scint spect, γ-γ coinc (54M56a); γ_3 (e_K/γ 0.70) scint spect (115B56b); γ_3 (e_K/γ 0.61) scint spect (103G56b); γ_3: $t_{1/2}$ 3.4×10^{-9} s delay coinc (52M54); others (30V56, 211B56, 24K49a, 63H50, 10C48b, 63C55a); see also gammas of Sm^{153}	Q_{EC} 0.19 calc (115B56b); see Eu^{153}  
		A	mass spect (3I47c); chem, n-capt (63H50)			
Gd^{154}		%	2.15 (1B50); 2.23 (98C57)	γ	Coulomb excitation (in Gd^{154}): 0.123 scint spect (97H55, 97H56a, 141M55a); 0.124 spect conv (96H56); 0.123 level of Gd^{154}: $t_{1/2}$ 1.2×10^{-9} s delay coinc (14S55); see also gammas of Eu^{154} and Tb^{154}; others (211S58)	see Eu^{154}
Gd^{155}		%	14.7 (1B50); 15.1 (98C57);	γ	Coulomb excitation (in Gd^{155}): 0.084 (†100), 0.145 (†26) scint spect (97H56a, 97H55); 0.060, 0.146 spect conv (214B56); 0.06003 cryst spect (137C58); others (141M55a, 116B57a); see also gammas of Eu^{155} and Tb^{155}	see Eu^{155}
		I	3/2 atomic spect (198S56); 3/2 paramag res (70L56);			
		μ	-0.30 atomic spect (198S56); 0.24 paramag res (70L56);			
		q	+1.1 atomic spect (198S56); others (88M54d)			
Gd^{156}		%	20.47 (1B50); 20.6 (98C57)	γ	Coulomb excitation (in Gd^{156}): 0.08897 cryst spect (137C58); 0.089 level of Gd^{156}: $t_{1/2}$ 1.9×10^{-9} s delay coinc (44N58a); others (211S58, 97H55, 97H56a, 141M55a, 96H56); see also gammas of Eu^{156} and Tb^{156}	see Eu^{156} and Tb^{156}
Gd^{157}		%	15.68 (1B50); 15.7 (98C57);	γ	Coulomb excitation (in Gd^{157}): 0.076 (†100), 0.131 (†27) scint spect (97H56a, 97H55); 0.055, 0.132 spect conv (214B56); 0.05454 cryst spect (137C58); others (141M55a, 116B57a)	
		I	3/2 paramag res (70L56); 3/2 atomic spect (198S56);			
		μ	-0.37 atomic spect (198S56); 0.32 paramag res (70L56);			
		q	+1.0 atomic spect (198S56); others (88M54d)			
Gd^{158}		%	24.9 (1B50); 24.5 (98C57)	γ	Coulomb excitation (in Gd^{158}): 0.07951 cryst spect (137C58); others (97H55, 97H56a, 96H56, 141M55a, 97C54)	

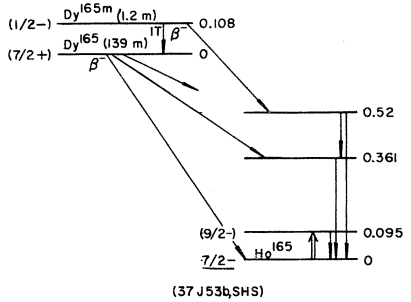
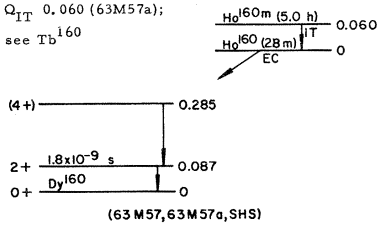
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{64}Gd^{159}$	18.0 h (65B49, 65B50, 26K48, 122B55a)	☢	β^- (26K48);	β^-	0.95 (~80%), 0.60 (~20%) spect, β-γ coinc (54M55b); 0.9 abs (26K48, 65B49); ~1.1, ~0.9 abs, β-γ coinc (37J53a);	Q_{β^-} 0.95 (54M55b) 
		A	n-capt (2S47); chem (65B49, 63H50); genet energy levels (37J53a)	γ	0.0575 (L_I/L_{III} >>1, coinc with ~1.1 β^-), 0.364 (K/L ≥5, coinc with ~0.9 β^-) spect conv, scint spect, β-γ, γ-γ coinc (37J53a); 0.056 (weak), 0.364 (e_K/γ ~0.01, coinc with 0.60 β^-) spect conv, scint spect β-γ coinc (54M55b); ~0.08, 0.22 (†2.5, coinc with 0.058 γ and 0.08 γ), 0.30 (†0.5), 0.362 (†100) scint spect, γ-γ coinc (135B56, 122B55a); 0.36 (12%) scint spect (10M57); others (65B49, 26K48); see also gammas of Tb^{159} and Dy^{159}	
Gd^{160}		%	21.9 (1B50); 21.6 (98C57)	γ	Coulomb excitation (in Gd^{160}): 0.07526 cryst spect (137C58); others (211S58, 97H55, 97H56a, 141M55a, 96H56)	
Gd^{161}	3.6 m (65B49); 3.7 m (37J53a); 3.5 m (26K48); 4.5 m (3146)	☢	β^- (24K49c);	β^-	1.5 abs (24K49c); ~1.6 (coinc with all gammas) abs, β-γ coinc (37J53a);	Q_{β^-} 1.9 (64K54)
		B	n-capt (3146, 233S57); n-capt, excit (65B49); parent Tb^{161} (24K49c)	γ	0.0568, 0.078, 0.1020, 0.1662, 0.1808, 0.267, 0.284, 0.316, 0.361, 0.482, 0.526 spect conv, scint spect, γ-γ coinc (233S57); 0.102 (coinc with 0.316 γ), 0.165 (?), 0.316, 0.36 scint spect, γ-γ coinc (37J53a); others (24K49c)	
$_{65}Tb$	>17 h (54R53)	☢	β^+ (54R53);	β^+	3.1 spect (54R53);	
		D	chem (54R53)	γ	(54R53)	
Tb^{149}	4.1 h (42R53)	☢	EC ~85%, α ~15%, no β^+ (42R53, 54R53, 83A57);	α	3.95 ion ch, spect (42R53)	
		A	chem, mass spect (42R50); parent Eu^{145} (74H51); others (3T49)			
Tb^{151}	19 h (42R53); 20 h (63M57)	☢	EC 99+%, α 3×10^{-4}% (61T57);	α	3.4 ion ch (42R53);	
		B	chem, excit (42R53, 63M57, 61T58); others (29H55a)	γ	0.1083 ($K/L_I/L_{II}/L_{III}$ ~7/1/1/1), 0.1803 (K/L_I 6), 0.1922 (K/L_I ~5), 0.252 (K/L_I 8), 0.288 (K/L_I 7) spect conv (63M57); others (126G57)	
Tb^{153}	62 h (63M57)	☢	[EC] (63M57);	γ	0.0415 ($L_I/L_{II}/L_{III}$ ~1/0.9/1), 0.0517 ($L_I/L_{II}/L_{III}$ ~7.5/1/1), 0.0681, 0.0875, 0.1021 (K/L_I 5.8), 0.1098 (K/L_I 4.8), 0.1744 (K/L_I ~6), 0.1952, 0.2122 (K/L_I ~6), 0.250 spect conv (63M57); others (126G57)	
		B	chem, excit, genet (63M57); parent Gd^{153} (63M57)			
Tb	~17 h (54R53)	☢	β^- (54R53);	β^-	2.34 spect (54R53)	
		D	chem (54R53)			

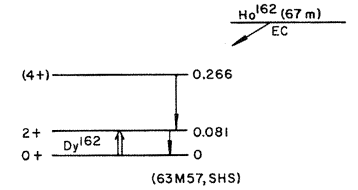
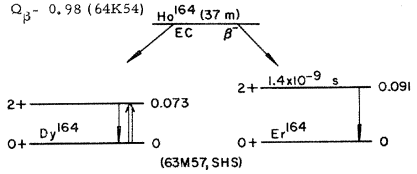
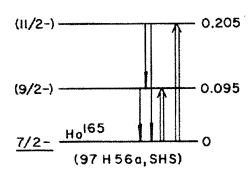
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{65}Tb^{154}$	8 h (63M57); ~7.5 h (29H55a)	☢ EC, β^+ (?) (29H55a);	γ	with 17 h Tb^{154} and 8 h Tb^{154}: 0.1232 ($K/L_I+L_{II}/L_{III}$ = 3.2/1.0/1.0), 0.2481 ($K/L_I+L_{II}/L_{III}$ ~15/3/1), 0.347 spect conv (63M57); see also gammas of Eu^{154} and Gd^{154}	see Eu^{154}
		B chem, excit (29H55a); chem, genet energy levels (63M57)			
Tb^{154}	17.2 h (2W50c, 54R53); 17.5 h (29H55a)	☢ EC 99+%, β^+ ~0.5% (2W50c);	β^+	2.75, 1.66 spect (54R53); 2.6 spect (2W50c); see 8 h Tb^{154}, Eu^{154}, and Gd^{154} others (126G57)	
		A chem, excit (2W50c); chem, genet energy levels (63M57); chem, excit, sep isotopes (29H55a)	γ		
Tb^{155}	5.6 d (104W57, 63M57); 190 d activity not observed (29H55, 2W50c)	☢ [EC] (104W57, 63M57);	γ	0.0188, 0.0210, 0.0313 (L_{II}/L_{III} 1.0), 0.0453 ($L_I/L_{II}/L_{III}$ = 1.3/0.7/1.0), 0.0601 ($L_I/L_{II}/L_{III}$ = 3.2/1.0/1.0), 0.0867 ($K/L_I/L_{II}/L_{III}$ = 12/3/0.7/1.0), 0.1012 (K/L_I ~5.5), 0.1054 (K/L_I+L_{II} 5.1), 0.1490 (K/L_I 7.0), 0.1608, 0.1615 (K/L_I 7.0), 0.1635 (K/L_I 7.0), 0.1804 (K/L_I 6.8), 0.1820, 0.2210, 0.2397, 0.263 (K/L_I 6.3), 0.341, 0.368 spect conv (104W57, 63M57); see also gammas of Eu^{155} and Gd^{155}	see Eu^{155}
		B chem, excit (2W50c); chem, sep isotopes, genet energy levels (63M57, 104W57); others (29H55a)			
Tb^{156m}	5.5 h (29H55a, 63M57a); 5.0 h (2W50c)	☢ IT (63M57a, 63M57); β^+ (weak) (166H57); EC >75%, β^+ <25% (2W50c); β^- (29H55a);	β^-	0.14 abs (29H55a);	
		B chem, excit (2W50c, 29H55a); chem, sep isotopes (63M57a)	γ	0.0884 ($K/L_I+L_{II}/L_{III}$ ~0.13/1.0/0.9) spect conv (63M57a, 63M57)	
Tb^{156}	5.6 d (63M57); 5.2 d (29H55a); 4.7 d (2W50c)	☢ EC, β^- (weak), no β^+ (29H55a);	β^-	0.2, 0.6 abs (29H55a);	see Eu^{156} 
		A chem, excit (29H55a); chem, genet energy levels (63M57)	γ	0.0891 ($K/L_I+L_{II}/L_{III}$ = 1.0/0.9/0.9), 0.1119 (K/L_I ~5), 0.1552 (K/L_I ~5.6), 0.1994 ($K/L_I+L_{II}/L_{III}$ = 7.2/1.7/1.0), 0.2627, 0.2967, 0.3566, 0.4222 spect conv (63M57); with EC: 0.13, 0.25, 0.34, 0.62 scint spect, γ-γ coinc (166H57); with β^-: 0.20, 0.54, 1.21, 1.41 scint spect, β-γ coinc (90D57); others (29H55a, 126G57); 0.089 γ: $t_{1/2}$ 1.9 x 10^{-9} s delay coinc (44N58a); see also gammas of Eu^{156} and Gd^{156}	
Tb^{157}	not observed [lim $t_{1/2}$ <10m or >25 y] (29H55a, 29H53); others (2W50c)				
Tb^{158m}	11.0 s (157H57); others (29H55a, 1P38)	☢ IT (157H57);	γ	0.111 (e_K/γ 61) scint spect, ion ch (121G57);	
		E excit (157H57)		Tb K-x abs, scint spect (157H57)	
Tb^{159}	t_a >5 x 10^{16} y sp act (37P54)	% 100 (43H48, 98C57);	γ	Coulomb excitation (in Tb^{159}): 0.05799, 0.07951 cryst spect (137C58); 0.079 (†100), 0.136 (†13) scint spect (27T56b, 97H55); others (141M55a, 96H56); see also gammas of Gd^{159} and Dy^{159}	see Gd^{159} 
		I 3/2 atomic spect (87M50); 3/2 paramag res (181B55a);			
		μ ±1.5 paramag res (181B55a)			

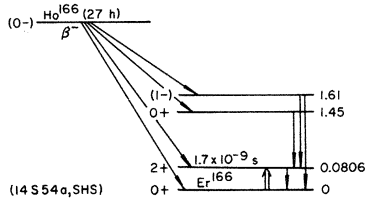
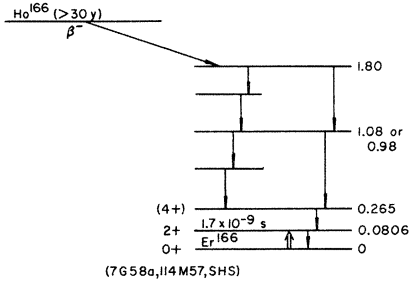
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{65}Tb^{160}$	72.3 d (115K54); 73.5 d (37B46); 73.0 d (64T57); 71 d (82B50, 222S56); 76 d (10C50d)	☢ β^- (37B43); no EC (K) (lim 0.5%) (132C57); no β^+ (82B50); A n-capt (37B43); mass spect (3I47c); chem (6F51); others (26K48, 2S47)	β^- 1.71 (0.3%), 0.861 (35%, coinc with 0.20 γ and 0.30 γ), 0.56 (51%, coinc with 0.20 γ and 0.30 γ), 0.37 (14%) spect, β-γ coinc (180B56b); 1.77 (0.4%), 0.87 (36%, coinc with 0.087 γ, 0.876 γ, and 0.964 γ), 0.58 (42%, coinc with 0.21 γ, 0.298 γ, and 1.18 γ), 0.46 (22%, coinc with 0.40 γ and 1.27 γ) spect, β-γ coinc (44N57a); 0.85 (30%), 0.56 (32%), 0.46 (19%), 0.28 (19%) spect (115K54); 0.860 (†43), 0.52 (†41) spect (82B54a, 82B50); others (52M52, 132C57, 226S55, 107S53); γ 0.0867 (†100, e_K/γ 1.5, K/L 0.7), 0.197 (†30, e_K/γ 0.18, K/L 2.3), 0.216 (†25, e_K/γ 0.04, K/L 7), 0.299 (†200, e_K/γ 0.013), 0.880 (†220, e_K/γ 3×10^{-3}), 0.97 (†260, e_K/γ 2.5×10^{-3}), 1.18 (†110, e_K/γ 7×10^{-4}), 1.27 (†60, e_K/γ 6×10^{-4}) spect conv, scint spect, cryst spect (132C57); γ_1 0.0863 (K/L 0.9, coinc with γ_3, γ_4, γ_5, γ_8, and γ_{10}), γ_2 0.0934, γ_3 0.196 (K/L ~3, coinc with γ_4 and 0.52 β^-), γ_4 0.215 (coinc with 0.52 β^-), γ_5 0.298 (coinc with γ_8 and 0.52 β^-), γ_6 0.391, γ_7 0.759, γ_8 0.873 (K/L ~5, coinc with 0.86 β^-), γ_9 0.96 (K/L ~5, coinc with 0.86 β^-), γ_{10} 1.17 (coinc with 0.52 β^-), γ_{11} 1.27 spect conv, scint spect, β-γ, γ-γ coinc (82B54a, 10C50d, 82B50); γ_1 0.087 (10%, e_K/γ 1.6, K/L 0.53, coinc with $\gamma_3 + \gamma_4$, γ_8, γ_{10}, and γ_{11}), γ_2 0.092 (?), γ_3 0.196 ($\gamma_3 + \gamma_4$: 8%, K/L 2.4), γ_4 0.216 (K/L >6), γ_5 0.298 (30%, e_K/γ 0.014, K/L 7.8, coinc with γ_8 and γ_9), γ_6 0.40 (3%, coinc with γ_8 and γ_9), 0.74 (?), 0.77 (?), γ_8 0.876 (33%, e_K/γ 3.4×10^{-3}, K/L ~7), γ_9 0.964 (35%, complex, e_K/γ ~3×10^{-3}, K/L ~8), γ_{10} 1.18 (16%, e_K/γ 8×10^{-4}), γ_{11} 1.27 (8%, e_K/γ 5×10^{-4}) spect conv, scint spect, γ-γ coinc (44N57a); 0.0873, 0.199 (2.2%), 0.219 (2.1%), 0.300 (12%), 0.368, 0.393, 0.879 (e_K/γ 2.3×10^{-3}), 0.892, 0.956 (e_K/γ 4.1×10^{-3}), 0.971, 1.04, 1.18 (1.4%, e_K/γ 9×10^{-4}), 1.28 (0.8%, e_K/γ 7×10^{-4}) spect, spect conv, scint spect (180B56b); 0.064, 0.0862, 0.093, 0.156, 0.181, 0.196, 0.214, 0.234, 0.274, 0.282, 0.297, 0.391, 0.411, 0.466, 0.569, 0.679, 0.762, 0.856, 0.876, 0.915, 0.962, 0.972, 1.03, 1.11, 1.17, 1.20, 1.25, 1.27, 1.45 spect, spect conv (115K54); γ_1 (e_K/γ 1.7) scint spect (52M52a); γ_1: $t_{1/2}$ 1.8×10^{-9} s delay coinc (52M52a, 52M52, 44N58a); others (226S55, 180B56c); see also gammas of Ho^{160m} and Ho^{160}	Q_{β^-} 1.83 (SHS)  (44N57a, SHS)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{65}Tb^{161}$	6.88 d (113H57f); 6.75 d (65B49); 7.2 d (63H50, 10C56); 6.8 d (222S56); 6.9 d (115B56c); 7 d (24K49a)	☢	β^- (26K48);	β^-	0.53 (68%), 0.45 (22%), 0.41 (10%) spect (10C56); 0.571 (14%), 0.522 (42%), 0.496 (23%), 0.439 (21%) spect (119S56b); 0.500 spect (115B56c); 0.55 spect (122B55a); others (63H50, 65B49, 24K49a);	Q_{β^-} 0.57 (119S56b); see Dy^{161}  (10C56,30V57,SHS)
		A	excit (26K48); chem, excit (24K49c); genet energy levels (10C56, 119S56b); daughter Gd^{161} (24K49c)	γ	0.0256 ($L_I/L_{II}/L_{III}$ = 1.0/0.8/0.6), 0.0277, 0.0489 ($L_I/L_{II}/L_{III}$ = 1.0/0.16/0.07), 0.0573 (L_I/L_{III} = 4), 0.0748 ($K/L_I/L_{III}$ = 1.9/1.0/0.4), 0.0783, 0.1062 spect conv, scint spect, γ-γ coinc (10C56); 0.0255 (e_L/γ 2.1, $L_I/L_{II}/L_{III}$ = 1.0/0.8/1.1), 0.0489 ($L_I/L_{II}+L_{III}$ large), 0.0569 (e_L/γ 0.15), 0.0746 (e_L/γ 0.064) spect conv, scint spect, γ-γ coinc (119S56b); 0.0259 (†100), 0.049 (†31, e/γ 1.5), 0.077 (†57) scint spect, ion ch, β-γ, γ-γ coinc (115B56c); others (122B55a, 135B56a, 10C52c, 17S50, 65B49, 24K49a); 0.0256 γ: $t_{1/2}$ 2.7 x 10^{-8} s delay coinc (30V57); 0.0748 γ: $t_{1/2}$ 2.3 x 10^{-9} s delay coinc (30V57); see also gammas of Ho^{161}	
$_{162,163}Tb$	14 m (65B50)	E	excit (65B50)			
Tb^{163}	6.5 h (93A58)	D	chem, excit (fission yield) (93A58)			
Tb^{164}	23 h (93A58)	D	chem, excit (fission yield) (93A58)			
$_{66}Dy^{149}$	8 m (61T58)	☢	EC (61T58);			
		E	excit (61T58, 61T57b)			
$Dy^{<153}$	7 m (42R53)	☢	α (42R53);	α	4.2 ion ch (42R53, 61T58)	
		E	cross bomb (42R53)			
$Dy^{<153}$	19 m (42R53)	☢	α (42R53);	α	4.1 ion ch (42R53, 61T58)	
		E	cross bomb (42R53)			
Dy^{152}	2.3 h (42R53)	☢	α (42R53);	α	3.66 ion ch (61T58, 42R53)	
		B	chem, excit (42R53, 61T58)			
Dy^{153}	5.0 h (61T58)	☢	α (61T58);	α	3.48 ion ch (61T58, 61T57b)	
		B	chem, excit, sep isotopes (61T58)			
Dy^{154}	13 h (61T58)	☢	α (61T58);	α	3.37 ion ch (61T58)	
		B	chem, excit, sep isotopes (61T58, 61T57b)			
Dy^{155}	10 h (61T58); ~20 h (63M57)	☢	EC (61T58, 61T57b);	γ	0.06543, 0.09038, 0.1154, 0.1558, 0.1614, 0.2057, 0.2270, 0.2714 spect conv (61T57); 0.23 scint spect (63M57, 61T58)	 (61T57)
Dy^{156}		%	0.0524 (3149b); 0.057 (98C57)			

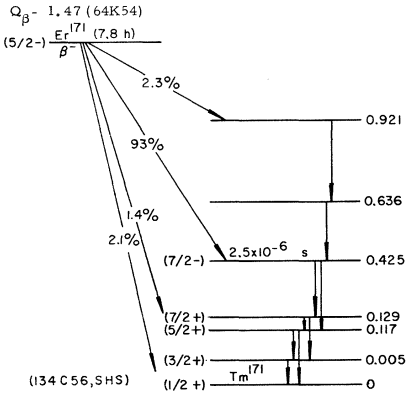
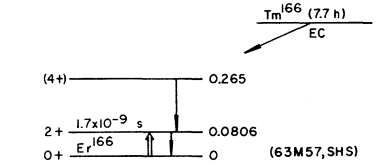
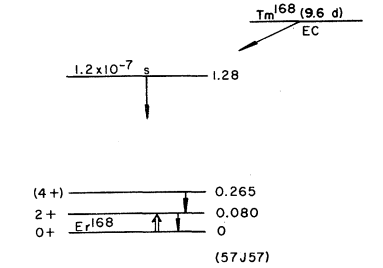
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{66}Dy^{157}$	8.2 h (29H53)	☢	EC, no β^+ (29H53);	γ	0.0608 ($L_I/L_{II}/L_{III}$ ~9/1/1), 0.0830, 0.1439 ($K/L_{II}/L_{III}$ ~4/1/1), 0.1825 (K/L_I 5), 0.2655, 0.3266 (K/L_I 7) spect conv (63M57); others (126G57)	
		B	chem, excit (29H53)			
Dy158		%	0.0902 (3I49b); 0.100 (98C57)			
Dy159	134 d (65B51a); 140 d (24K49d)	☢	EC (24K49d);	EC	Tb K, L-x (65B51a);	see Tb161
		A	chem, n-capt (24K49d); chem, cross bomb (65B51a); genet energy levels (63M57)	γ	0.0580 ($L_I/L_{II}/L_{III}$ ~8/1.1/1) spect conv (63M57); see also gammas of Tb^{159} and Gd^{159}	
Dy160		%	2.294 (3I49b); 2.35 (98C57)	γ	0.087 level of Dy^{160}: $t_{1/2}$ 1.8×10^{-9} s delay coinc (52M52a); see also gammas of Tb^{160} and Ho^{160m}	
Dy161		%	18.88 (3I49b); 19.0 (98C57);	γ	Coulomb excitation (in Dy^{161}): 0.046, 0.059, 0.105 spect conv (116B58); 0.044, 0.102 spect, p, p' and d, d' (31E57a); 0.046, 0.103 scint spect (97H57a, 97H55); 0.04383 cryst spect (137C58); 0.0256 level of Dy^{161}: $t_{1/2}$ 2.7×10^{-8} s delay coinc (30V57); 0.0748 level of Dy^{161}: $t_{1/2}$ 2.3×10^{-9} s delay coinc (30V57); see also gammas of Tb^{161} and Ho^{161}	
		I	5/2 paramag res (133C56); 3/2 atomic spect (88M56a, 88M53);			
		μ	-0.37 paramag res (133C56, 75P58);			
		q	+1.1 paramag res (75P58)			
Dy162		%	25.53 (3I49b); 25.5 (98C57)	γ	Coulomb excitation (in Dy^{162}): 0.08065 cryst spect (137C58); others (96H56, 97H57a, 97H55); see also gammas of Ho^{162}	see Ho162
Dy163		%	24.97 (3I49b); 24.9 (98C57);	γ	Coulomb excitation (in Dy^{163}): 0.075, 0.095, 0.164, 0.170 spect conv (116B58); 0.075, 0.093, 0.166 scint spect, γ-γ coinc (97H57a, 97H55); 0.074, 0.170 spect, p, p' and d, d' (31E57a); 0.07339 (?) cryst spect (137C58)	
		I	5/2 paramag res (133C56); 3/2 atomic spect (88M56a, 88M53);			
		μ	+0.51 paramag res (133C56, 75P58);			
		q	+1.3 paramag res (75P58)			
Dy164		%	28.18 (3I49b); 28.1 (98C57)	γ	Coulomb excitation (in Dy^{164}): 0.07339 cryst spect (137C58); 0.075 spect conv (96H56); scint spect (97H57a); others (97H55); see also gammas of Ho^{164}	see Ho164

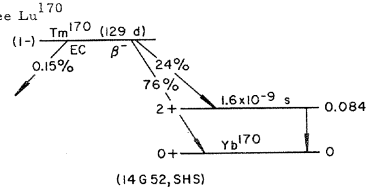
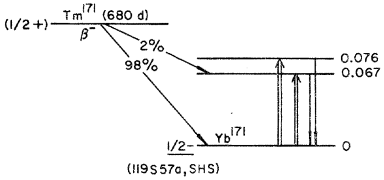
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{66}Dy^{165m}$	1.25 m (9F46)	☢ IT (9F44b); β^- (weak) (37J53b) A n-capt (9F44b); n-capt, sep isotopes (3I47e); others (2S47)	γ (with IT): 0.108 (e_K/γ ~4, $K/L_{II}/L_{III}$ = 3/10/10); (with β^-): 0.16 (coinc with 0.36 γ), 0.36, 0.52 spect conv, scint spect, γ-γ coinc (37J53b); 0.106 (K/L+M 0.15) spect conv (84W54); 0.106 spect conv (53H52); 0.109 (K/L 0.08) spect conv (42C50); 0.102 spect conv (15H48)	Q_{IT} 0.108 (37J53b); see Ho^{165}
Dy^{165}	139.2 m (109S52); 140 m (37B46); 145 m (5S46); others (162M54)	☢ β^- (1P38a) A n-capt (71H36, 82M35); n-capt, sep isotopes (3I47e); mass spect (3I47f); others (1P38a, 1M40, 2S47, 24K49d)	β^- 1.25, 0.88, 0.42 spect (5S46); others (72C42, 16D41, 10E41, 85R55) γ 0.09479, 0.175, 0.27, 0.36, ~0.67, ~0.75 cryst spect, scint spect (78A56); 0.0944 (K/L 7.7), 0.279, 0.361, 0.634, 0.71, ~1.02 spect conv, scint spect, γ-γ coinc (37J53b); 0.0951 (K/L_I 6.4) spect conv (63M52); 0.091, 0.36, 0.76 spect, spect conv (5S46); 0.093 (K/L+M 2.7) spect conv (84W54); 0.095 (e_K/γ 2.9) scint spect (156S55a); others (42C50, 43M46, 52M52, 52W51); see also gammas of Ho^{165}	 (37J53b,SHS)
Dy^{166}	82 h (65B50a); 81 h (24K49d)	☢ β^- (24K49d) A chem, genet (24K49d); parent Ho^{166} (24K49d, 65B50a)	β^- 0.2 abs (65B50a); 0.4 abs (24K49d)	
$_{67}Ho$	~4 m (42R53)	☢ α (42R53) E excit (42R53)	α 4.2 ion ch (42R53)	
Ho^{156}	~1 h (63M57)	B chem, sep isotopes (63M57)	γ 0.1381 (L_I+L_{II}/L_{III} 1) spect conv (63M57)	
Ho^{159}	33 m (61T57a, 61T57b)	☢ EC (61T57a) D chem (61T57a)	γ 0.125, 0.180, 0.250, 0.305 scint spect (61T57a)	
Ho^{160m}	5.0 h (22N55, 63M57a); 4.6 h (2W50c)	☢ IT (63M57a) A chem, genet (22N55); chem, sep isotopes (63M57a); daughter Er^{160} (22N55)	γ (with IT): 0.0601 (L_I+L_{II}/L_{III} 0.92) spect conv (63M57a); (with IT): 0.0601 (L_I+L_{II}/L_{III} 1.1) spect conv (127G57); (with Ho^{160} and/or Ho^{160m}): 0.0870 ($K/L_I+L_{II}/L_{III}$ = 0.6/1.0/1.0), 0.1975 ($K/L_I+L_{II}/L_{III}$ = 7.3/2/1.0), 0.298 spect conv (63M57); (with Ho^{160} and/or Ho^{160m}): 0.0864 ($K/L_I+L_{II}/L_{III}$ = 1.3/1.3/1.0), 0.1074 (K/L 0.4), 0.1965 (K/L 2.7), 0.215, 0.297, 0.298, 0.310, 0.365, 0.393, 0.407 (K/L 6.7), 0.515 (K/L 9), 0.540 (K/L 5.3), 0.648 (K/L 6), 0.730 (K/L 6.3), 0.755, 0.767, 0.873 (K/L 9), 0.880 (K/L 6.5), 0.963, 0.967, 1.048 (K/L 3.7), 1.069 (K/L 5), 1.133, 1.180, 1.201, 1.264, 1.273, 1.285, 1.377, 1.435, 1.719 spect conv (127G57); others (29H54a, 126G57, 22N55); see also gammas of Tb^{160}	Q_{IT} 0.060 (63M57a); see Tb^{160}  (63M57,63M57a,SHS)
Ho^{160}	28 m (61T57a); 22.5 m (2W50c); ~22 m (29H54a)	☢ EC 99+%, β^+ ~0.5% (2W50c) B excit (2W50c); chem (29H54a)	β^+ 1.3 abs (2W50c) γ 0.090, 0.20, 0.65, 0.73, 0.89, 0.97 scint spect (61T57a); see gammas of Ho^{160m} and Tb^{160}	

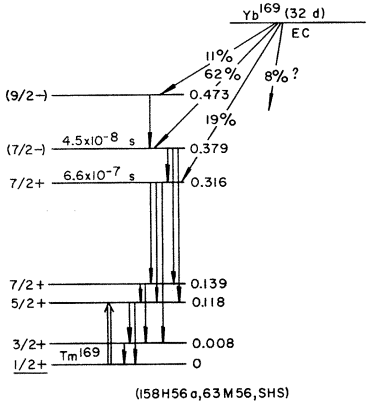
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{67}Ho^{161}$	2.5 h (29H54a, 29H54b); others (2W50c)	☢	EC (29H54a, 29H54b);	γ	0.02565 ($L_I/L_{II}/L_{III}$ ~0.8/0.7/1.0), 0.0775 ($L_I/L_{II}/L_{III}$ ~0.6/1.0/1.0), 0.1032 (K/L_I 4.5), 0.1754 spect conv (63M57); see also gammas of Tb^{161}	see Tb^{161}
		A	chem, genet, excit (29H54a, 29H54b); daughter Er^{161} (29H54a, 29H54b)			
Ho^{162}	67 m (63M57); no 65 d activity observed (29H54a, 2W50c)	☢	[EC] (63M57);	γ	0.0382 ($L_I/L_{II}/L_{III}$ ~20/1/1), 0.0577, 0.0808 ($K/L_I+L_{II}/L_{III}$ = 0.3/1.0/1.0), 0.1848 ($K/L_I+L_{II}/L_{III}$ = 5.4/1.8/1.0), 0.2828 spect conv (63M57); see also gammas of Dy^{162}	
		B	chem, sep isotopes (63M57); others (29H54a, 2W50c)			
Ho^{163m}	0.8 s (157H57); no 5 d activity observed (29H54a, 2W50c)	E	excit (157H57); others (29H54a, 29H53a, 2W50c)	γ	0.305 (e_K/γ 0.19) scint spect (121G57); 0.305 scint spect (157H57)	
Ho^{164}	36.7 m (95B54); 34.0 m (2W50c); 41.5 m (25W50)	☢	EC, β^- (EC/β^- 0.9), no β^+ (lim 0.05%), IT (?) (95B54);	β^-	0.99 spect (95B54); 0.95 spect (2W50c);	Q_{β^-} 0.98 (64K54) 
		A	excit (1P38a); others (25W48)	γ	0.0730 (with EC, $K/L_I+L_{II}/L_{III}$ ~0.3/1.0/1.0), 0.0913 (with β^-, $K/L_I+L_{II}/L_{III}$ ~0.6/1.2/1.0), no 0.0373 γ spect conv (63M57); 0.0373 (†3.6, e_L/γ ~10), 0.046 (with IT, ?, L/M 2), 0.0728 (†3.3, e_K/γ 2.7, K/L 0.16), 0.0905 (†3.5, e_K/γ 1.9, K/L ≤0.1) spect conv, ion ch, γ-γ, β-γ coinc (95B54); 0.091 γ: $t_{1/2}$ 1.4 x 10^{-9} s delay coinc (95B54); 0.073 γ (?): $t_{1/2}$ 1.4 x 10^{-9} s delay coinc (95B54); others (2W50c, 29H54a); see also gammas of Dy^{164}	
$\underline{Ho^{165}}$	t_a >6 x 10^{16} y sp act (37P54)	%	100 (28L50, 98C57);	γ	Coulomb excitation (in Ho^{165}): 0.09470, 0.10993 cryst spect (137C58); 0.094, 0.112 (†100), 0.206 (†16) scint spect (97H55, 97H56a); 0.096, 0.116 spect conv (96H56); 0.096 (K/L 5.4), 0.122 (K/L 6.9), 0.218 spect conv (116B57a); others (78G56, 27T54b); see also gammas of Dy^{165}	see Dy^{165} 
		I	7/2 atomic spect (87M50); 7/2 paramag res (181B55b);			
		μ	±3.3 paramag res (181B55b);			
		q	±2 paramag res (181B55b)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{67}Ho^{166}$	27.3 h (average of 24K49b, 31 47d, 37B46, 22G49, 10C58, 31A50, 31A50a)	☢	β^- (71H36);	β^-	1.84 (47%), 1.76 (37%), 0.87 (9%), 0.38 (5%), 0.22 (2%) spect (10C58, 10C58a); 1.85, 1.77 spect, β-γ coinc (14G55a); β_0 (~25%), β_{80} (~74%), β_{1440} (1%), β_{1610} (~0.3%) β-γ coinc (14S54a); 1.84 (~89%), 0.55 (~11%) spect (7S50a); others (22G49, 31A50, 31A50a);	Q_{β^-} 1.84 (10C58) 
		A	n-capt (71H36); mass spect (31 47d); chem (24K49b); daughter Dy^{166} (24K49d, 65B50a); others (1P38a, 1M40, 2S47)	γ	0.08025, 0.97, 1.38, 1.54, 1.62 spect conv, γ-γ coinc, scint spect (10C58, 10C58a); 0.080 (†85, e_K/γ 1.9, coinc with 1.36 γ and 1.53 γ), 1.36 (†10), 1.53 (†2), 1.61 (†1) scint spect, γ-γ coinc (14S54a); 0.081 (K/L 0.07, $L_I/L_{II}/L_{III}$ = <0.1/0.72/1.0) spect conv (63M52); 0.080 (e_L/γ ~0.4, K/L <1), 1.36 (weak) spect, spect conv, β-conv coinc (7S50a); 0.081 (e_K/γ 1.9) scint spect (52M52a, 52M57b); 0.080 γ: $t_{1/2}$ 1.7 x 10^{-9} s delay coinc (52M50a); others (14G55a, 36F55, 36F54, 10C49a, 31A50, 31A50a, 22G49, 130B56); see also gammas of Tm^{166} and Ho^{166} (>30 y)	
Ho^{166}	>30 y (65B52)	☢	β^- (65B52);	β^-	1.1 (~8%), 0.28 (~46%), 0.18 (~46%) abs (65B52);	
		A	chem, excit (65B52); chem, genet energy levels (114M55)	γ	0.0803, 0.184, 0.280 (complex), 0.42, 0.54, 0.720, 0.820 scint spect, γ-γ coinc spect, spect conv (114M57, 114M55); 0.080, 0.183, 0.277, 0.41, 0.53, 0.72 (coinc with 0.183 γ, 0.277 γ, 0.53 γ, and 0.82 γ), 0.82 (coinc with 0.183 γ, 0.277 γ, 0.41 γ, and 0.72 γ) scint spect, γ-γ coinc (7G58a); others (65B52); see also gammas of Tm^{166} and Ho^{166} (27 h)	
Ho^{167}	3.0 h (29H55b)	☢	β^- (29H55b);	β^-	0.28 (50%), 0.96 (50%) abs (29H55b);	
		B	chem, excit (29H55b)	γ	0.35 (~18%), 0.70 (~6%) scint spect (29H55b)	
Ho^{169}	96 m (65B50)	E	excit (65B50)			
$_{68}Er^{160}$	29 h (22N55)	☢	[EC], no β^+ (22N55);	γ	no γ (22N55)	
		A	chem, mass spect (22N55, 105M54); parent Ho^{160m} (22N55); others (6F51)			
Er^{161}	3.1 h (22N55); 3.6 h (29H54b)	☢	[EC], β^+ (22N55); EC, no β^+ (29H54b);	β^+	1.2 spect (22N55);	
		A	chem, cross bomb, excit (29H54b); chem, mass spect (105M54, 22N55); parent Ho^{161} (29H54b)	γ	0.065, 0.195 (?), 0.82, 1.12 scint spect (29H54b)	
Er^{162}		%	0.136 (60H50)			
Er^{163}	75 m (29H53a) 65 h activity not observed (29H53a)	☢	[EC], no β^+ (29H53a);	γ	0.43, 1.10 scint spect (29H53a)	
		B	chem, excit (29H53a)			

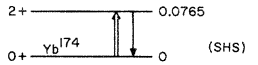
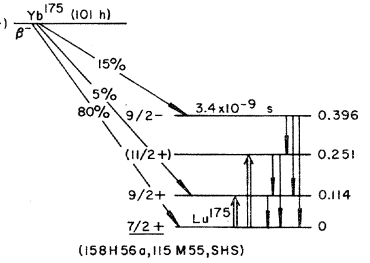
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{68}Er^{164}$		%	1.56 (60H50)	γ	Coulomb excitation (in Er^{164}) (97H55); 0.091 level of Er^{164}: $t_{1/2}$ 1.4×10^{-9} s delay coinc (95B54)	
Er^{165}	10.0 h (65B50b); 9.9 h (29K52)	☢	EC (65B50b);	γ	1.1 abs (2W50d); no γ (65B50b); others (29K52)	
		A	chem, excit (65B50b); excit (29K52); chem, mass spect (37N56); daughter Tm^{165} (29H53a, 22N54)			
Er^{166}		%	33.41 (60H50)	γ	Coulomb excitation (in Er^{166}): 0.08057 cryst spect (137C58); others (97H55); 0.080 level of Er^{166}: $t_{1/2}$ 1.7×10^{-9} s delay coinc (52M50a); see also gammas of Ho^{166} isomers and Tm^{166}	see Ho^{166}
Er^{167m}	2.5 s (38M49a, 45G51, 157H57)	☢	IT (38M49a);	γ	0.208 ($K/L_{II}/L_{III}$ = 1.3/1.0/0.7) spect conv (63M57a, 63M57); 0.210 (e_K/γ 0.55) scint spect (45G51, 24C51a); 0.213 (e_K/γ ~0.6) scint spect (157H57)	Q_{IT} 0.208 (63M57, 63M57a) (1/2-) Er^{167m} (2.5s) — IT 0.208 7/2+ Er^{167} — 0 (63M57, SHS)
		B	n-capt (38M49a); excit (157H57); genet (63M57); daughter Tm^{167} (63M57)			
Er^{167}		%	22.94 (60H50);	γ	Coulomb excitation (in Er^{167}): 0.07859 (?) cryst spect (137C58); others (97H55)	
		I	7/2 paramag res (97B51b);			
		μ	±0.5 paramag res (40E53, calc from 105B52b);			
		q	±10 paramag res (105B52b, 40E53)			
Er^{168}		%	27.07 (60H50)	γ	Coulomb excitation (in Er^{168}): 0.07980 cryst spect (137C58); others (97H55); 1.28 level of Er^{168}: $t_{1/2}$ 1.2×10^{-7} s delay coinc (57J57); see gammas of Tm^{168}	
Er^{169}	9.4 d (24K48); 9 d (65B50, 115B56d)	☢	β^- (24K48);	β^-	0.33 spect (24K48, 158H56); scint spect (11B49a); 0.34 spect (115B56d);	Q_{β^-} 0.33 (64K54) (1/2-) Er^{169} (9.4 d) — β^- 5%, 85% 3/2+ 0.008 1/2+ Tm^{169} 0 (158H56, SHS)
		A	chem, n-capt (24K48); genet energy levels (158H56)	γ	~0.0084 ($M_I/M_{II}/M_{III}$ = 3/1/1) spect conv (158H56); no γ (24K48, 11K51, 115B56d); see also gammas of Yb^{169}	
Er^{170}		%	14.88 (60H50)	γ	Coulomb excitation (in Er^{170}): 0.07931 (?) cryst spect (137C58); others (97H55)	

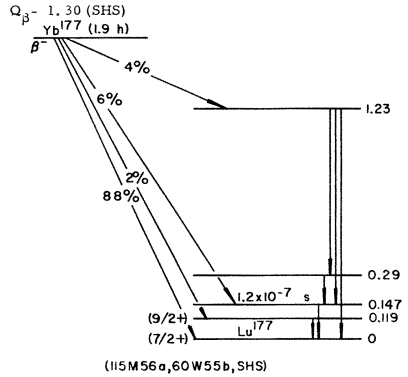
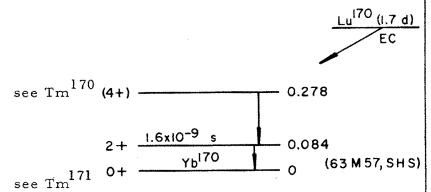
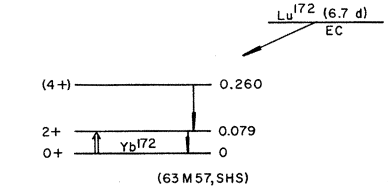
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{68}Er^{171}$	7.8 h (134C56); 7.5 h (24K48, 11K51)	☢	β^- (24K48);	β^-	1.49, 1.05 spect, scint spect (134C56); 1.52 (6%), 1.40, 1.11 (94%), no 0.67 β^- (lim 5%) scint spect, β-γ coinc (17J57); 1.49 (~6%), 1.05 (~72%), 0.67 (~22%) spect, β-γ coinc (24K48);	Q_{β^-} 1.47 (64K54)
		A	n-capt (71H36, 23N35); chem, genet (24K48); chem, mass spect (37N56); parent Tm^{171} (24K48); others (1P38a, 37B46)	γ	0.00506, 0.01240 ($L_I/L_{II}/L_{III}$ = 1/1/2), 0.11163 (†27, K/L 7), 0.11669 (†~3, K/L 0.8), 0.12403 (†12, K/L 1.0), 0.2106 (†~1), 0.2849, 0.2960 (†42), 0.3084 (†100) cryst spect, spect conv (158H57); 0.1116 (†27), 0.1167 (†2), 0.1240 (†10), 0.177 (†<0.1), 0.211 (†~1, delay coinc with 0.296 γ and 0.308 γ, prompt coinc with 0.285 γ), 0.235 (†~0.2), 0.285 (†~1), 0.296 (†27), 0.308 (†84), 0.372 (†~0.1), 0.56 (†<0.1), 0.62 (†~0.1), 0.69 (†0.6), 0.74 (†<0.1), 0.80 (†1.0), 0.88 (†~0.2), 0.91 (†0.7) spect conv, scint spect, γ-γ coinc (134C56); 0.113 (K/L ~10), 0.118 (K/L ~0.5), 0.126 (K/L ~2), 0.176, 0.295 (K/L ~10), 0.308 (K/L ~10), 0.420, no 0.8 γ spect conv, β-γ coinc (11K51); 0.088 (weak), 0.120 (coinc with 1.11 β^-, 1.40 β^-, 0.21 γ, and 0.30 γ), 0.207, 0.300 (coinc with 1.11 β^-), 0.42 scint spect, β-γ, γ-γ coinc (17J57); 0.425 level of Tm^{171}: $t_{1/2}$ 2.5 x 10^{-6} s delay coinc (10D48, 134C56, 17J57, 96K56); others (10D48, 96K56, 24K48)	
Er^{172}	50 h genet (37N56)	☢	[β^-] (37N56);			
		B	chem, genet (37N56); parent Tm^{172} (37N56)			
$_{69}Tm^{165}$	29 h (105M54); 25 h (29H53a)	☢	[EC], no β^+ (29H53a);	γ	0.0472 ($L_I/L_{II}/L_{III}$ ~1.4/<1.2/1.1), 0.0545, 0.0605, 0.0773 ($K/L_I+L_{II}/L_{III}$ = 0.4/1.0/1.0), 0.1137 (K/L_I 5.5), 0.2193 (K/L_I 4.3), 0.2433 (K/L_I 6.5), 0.2965, 0.2978 (K/L_I 4.4), 0.3473, 0.3569 spect conv (63M57); 0.205, 0.81, 1.16, 1.38 scint spect (29H53a)	
		A	chem, excit (29H53a); chem, mass spect (105M54); parent Er^{165} (29H53a, 22N54)			
Tm^{166}	7.7 h (2W49a, 105M54)	☢	EC 99+%, β^+ ~0.5% (2W49a);	β^+	2.1 spect (2W49a);	
		A	chem, excit (2W49a); chem, mass spect (105M54); daughter Yb^{166} (6F51, 22N55, 126G57)	γ	0.0807 ($K/L_I+L_{II}/L_{III}$ = 0.2/1.0/1.0), 0.1546, 0.1847 ($K/L_I+L_{II}/L_{III}$ = 5/1.5/1.0), 0.1948, 0.2154 spect conv (63M57); 0.080, 0.180, 0.69, 0.78 scint spect (126G57); see also gammas of Er^{166} and Ho^{166}; others (22N55)	
Tm^{167}	9.6 d (2W49a, 22N55); others (29H54c)	☢	EC, no β^+ (2W49a);	γ	0.0571 ($L_I/L_{II}/L_{III}$ = 1.2/0.9/1.0), 0.208 (with Er^{167m}, $K/L_I+L_{II}/L_{III}$ = 1.0/0.8/0.5) spect conv (63M...), 0.049 (†100), 0.115 (†2), 0.202 (†29), 0.52 (†9), 0.72 (†18) scint spect (22N55); see also gammas of Er^{167m}	see Er^{167m}
		A	chem, excit (2W49a); chem, mass spect (105M54, 22N55); parent Er^{167m} (63M57)			
Tm^{168}	85 d (2W49a); 87 d (29H54c)	☢	EC, β^- (?) ~2% (2W49a);	γ	0.0799 ($K/L_I+L_{II}/L_{III}$ = 0.25/1.0/1.0), 0.0999, 0.1846, 0.1987, 0.247, 0.448, 0.72, 0.82 spect conv, scint spect, γ-γ coinc (57J57, 63M57, 63M57a); 1.28 level of Er^{168}: $t_{1/2}$ 1.2 x 10^{-7} s delay coinc (57J57)	
		B	chem, excit (2W49a)			

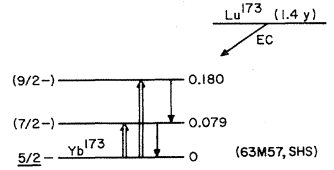
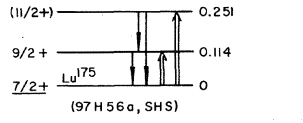
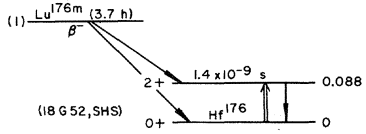
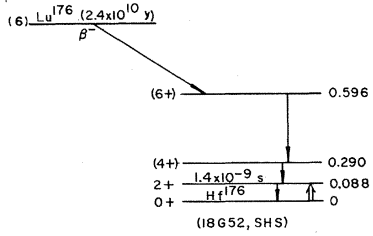
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{69}Tm^{169}$	t_α >5 x 10^{16} y sp act (37P54)	%	100 (7L50, 98C57);	γ	Coulomb excitation (in Tm^{169}): 0.10977, 0.11816 cryst spect (137C58); others (96H56, 97H55);	see Yb^{169}
		I	1/2 atomic spect (87M50);		0.316 level of Tm^{169}: $t_{1/2}$ 6.6 x 10^{-7} s delay coinc (27F50);	
		μ	-0.21 atomic spect (83L55a, 83L55)		$t_{1/2}$ 6.4 x 10^{-7} s delay coinc (63M56);	
					0.379 level of Tm^{169}: $t_{1/2}$ 4.5 x 10^{-8} s delay coinc (63M56);	
					see also gammas of Yb^{169} and Er^{169}	
Tm^{170}	129 d (24K49b); 120 d (42C50); 127 d (37B46a)	☢	β⁻ (37B46a); EC (K) 0.15% (56D56); no EC (lim 0.3%), no β^+ (lim 0.01%) (14G52);	β⁻	0.968 (76%), 0.884 (24%) spect (14G52); 0.970 (~90%), 0.886 (~10%) spect (36F49); 0.970 (78%), 0.886 (22%) spect (38P54); 0.957 (78%), 0.882 (22%) spect (39N56); 0.950 (76%), 0.867 (24%) scint spect, β-γ coinc (115B56e); 0.970, 0.88 spect, β-γ coinc (44R52); 0.990 spect (16A50); others (14G49, 22G49a, 97S50, 9S49a, 60W57, 180B57b, 56B58);	Q_{β^-} 0.969 (64K54); see Lu^{170} 
		A	n-capt (23N36, 71H36); chem (24K48a); others (2S47)	γ	0.08426 cryst spect (158H56b); 0.08423 cryst spect (56D56); 0.0841 (3%, e_K/γ 1.6, K/L 0.4) spect conv, β-γ coinc (14G52); 0.084 (e_K/γ 1.69) scint spect (115B56e); 0.084 (3.4%, e_K/γ 1.34) scint spect (164H57); 0.085 (K/L 0.16, $L_I/L_{II}/L_{III}$ = <0.1/0.83/1.00) spect conv (63M52); 0.085 (e_K/γ 1.7) scint spect (52M52a, 52M57b); 0.084 (e/γ 4, K/L 0.15) spect, spect conv, β-γ coinc (36F49); 0.084 γ: $t_{1/2}$ 1.57 x 10^{-9} s delay coinc (14G52); $t_{1/2}$ 1.6 x 10^{-9} s delay coinc (52M52a, 60W56); others (8B50, 22G50a, 1N50a, 10C49a, 52R52, 16A50, 42C50, 9S49a, 7S51, 38P54, 68G56, 84L54, 7S52); see also gammas of Lu^{170}		
Tm^{171}	680 d (24K49b)	☢	β⁻ (24K48);	β⁻	0.097 (98%), ~0.03 (~2%) spect, scint spect, β-γ coinc (119S57a); 0.103 spect (115B55c); 0.10 spect (24K48a);	Q_{β^-} 0.097 (119S57a) 
		A	chem, genet (24K48); chem, mass spect (37N56); daughter Er^{171} (24K48)	γ	0.0667 spect conv (119S57a); no γ (115B55c); 0.425 level of Tm^{171}: $t_{1/2}$ 2.5 x 10^{-6} s delay coinc (10D48, 134C56, 17J57, 116K56); see also gammas of Er^{171} and 8.5 d Lu^{171}	
$Tm^{>171}$	19m (65B50)	E	excit (65B50)			
Tm^{172}	63.6 h (37N56); 2-3 d (6F51)	☢	β⁻ (6F51);	β⁻	1.5 abs (37N56);	see Lu^{172}
		A	chem (6F51); chem, n-capt, mass spect (37N56); daughter Er^{172} (37N56)	γ	0.076, 0.18 (weak), 0.40 (weak), 1.09, 1.49, 1.79 scint spect (37N56); see also gammas of Lu^{172} (6.7 d)	

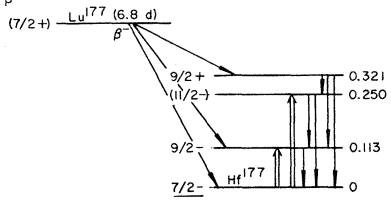
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{70}Yb^{166}$	54 h (22N55); 62 h (6F51)	☢ EC (6F51);	γ	0.112, 0.140 scint spect (126G57)	
		A chem, genet (6F51); chem, mass spect (105M54, 22N55); parent Tm^{166} (6F51, 22N55, 126G57)			
Yb^{167}	74 m (22N55)	☢ β^+ (22N55);	β^+	2.4 spect (22N55)	
		D chem (22N55)			
Yb^{167}	19 m (29H54c)	☢ EC, no β^+ (29H54c);	γ	0.118, 0.18 (?), 0.33 (?) scint spect (29H54c)	
		D chem, excit (29H54c)			
$\underline{Yb^{168}}$		% 0.140 (1B50); 0.135 (98C57)			
Yb^{169}	31.8 d (49W49); 30.6 d (10C56a); 33 d (37B46a, 75M51a, 29H54c)	☢ EC (37B46a);	γ	0.00842, 0.02075 ($L_I/L_{II}/L_{III}$ = 20/2.5/1), 0.06312 (†65, e_L/γ 0.15, $L_I/L_{II}/L_{III}$ = 1.0/0.2/0.3), 0.09360 (†4.4, e_K/γ 2.4, K/L_I 5.7), 0.10978 (†22, e_K/γ 2.1, K/L_I 6.0) 0.11820 (†2.6, e_K/γ 0.66), 0.13053 (†15, e_K/γ 0.54, $K/L_{II}/L_{III}$ = 6/3.4/3.0), 0.17724 (†31, e_K/γ 0.51, K/L_I 5.7), 0.19797 (†51, e_K/γ 0.40, K/L_I 5.7), 0.2404 (†1), 0.2610 (†8), 0.3077 (†18, e_K/γ 0.04, K/L 4) cryst spect, spect conv (158H56a);	
		A n-capt (37B46a); chem, excit (24K48a); mass spect (105M54); others (34A45); daughter Lu^{169} (126G57)		0.00817, 0.02073, 0.0450, 0.06302 (e_L/γ 0.19, $L_I/L_{II}/L_{III}$ = 1.0/0.3/0.4), 0.09357 (e_L/γ 0.34, $L_I/L_{II}/L_{III}$ = 10/1.8/1.0), 0.1098 (e_K/γ 1.27, K/L 4.2, $L_I/L_{II}/L_{III}$ = 1.7/0.3/0.1), 0.1182 (L_{II}/L_{III} 1.1), 0.1307 (e_K/γ 0.47, K/L 0.9, $L_I/L_{II}/L_{III}$ = 0.28/1.3/1.0), 0.1777 (e_K/γ 0.49, L_I/L_{III} ~10), 0.1986 (e_K/γ 0.45, L_I/L_{III} ~10), 0.262, 0.308 (e_K/γ 0.059) spect conv, scint spect (63M56);	
				0.0084, 0.0206, 0.0632 ($L_I/L_{II}/L_{III}$ = 1.0/0.4/0.6), 0.0936 ($K/L_I/L_{II}/L_{III}$ = 21/10/1.8/1.0), 0.1099 ($K/L_I/L_{II}/L_{III}$ = 6/1.7/0.3/0.1), 0.1183 (K/L 0.9), 0.1307 ($K/L_I+L_{II}/L_{III}$ = 1.7/1.1/1.0), 0.1777 (K/L 5.6), 0.1986 (K/L 6.6), 0.261, 0.308 (K/L 3.5) spect conv, scint spect (10C56a, 10C50e);	
				γ_1 0.023 (†20), γ_2 0.064 (†25, coinc with γ_3, γ_4, γ_6, γ_7, γ_9, and γ_{12}), γ_3 0.094 (†3.4), γ_4 0.110 (†14, coinc with γ_7, γ_9, and γ_{11}), γ_5 ~0.12 (coinc with γ_9), γ_6 0.133 (†9, coinc with γ_7, γ_8, and γ_{10}), γ_7 0.178 (†15), γ_8 ~0.194, γ_9 0.198 (†21), γ_{10} ~0.24, γ_{11} ~0.26, γ_{12} 0.308 (†6) scint spect, γ-γ coinc (17J55b);	
				0.316 level of Tm^{169}: $t_{1/2}$ 6.6×10^{-7} s delay coinc (27F50); $t_{1/2}$ 6.4×10^{-7} s delay coinc (63M56); $t_{1/2}$ 6.7×10^{-7} s delay coinc (75M51a);	
				0.379 level of Tm^{169}: $t_{1/2}$ 4.5×10^{-8} s delay coinc (63M56);	
				0.473 level of Tm^{169}: $t_{1/2}$ $<5 \times 10^{-8}$ s delay coinc (44N58);	
				others (10D48, 14S51a, 96K56, 115B56d, 112C57, 116K56, 126G57); see also gammas of Tm^{169} and Er^{169}	
$\underline{Yb^{170}}$		% 3.03 (1B50); 3.14 (98C57)	γ	Coulomb excitation (in Yb^{170}) (97H55); 0.084 level of Yb^{170}: $t_{1/2}$ 1.57×10^{-9} s delay coinc (14G52); see also gammas of Tm^{170} and Lu^{170}	see Tm^{170}

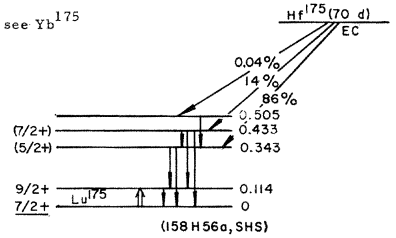
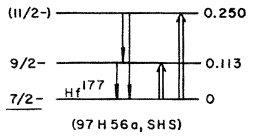
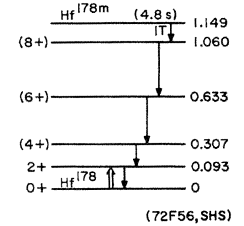
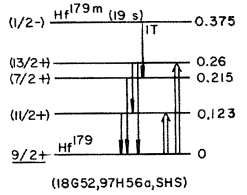
(158H56a, 63M56, SHS)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{70}Yb^{171m}$	short (63M57a)	☢	IT (63M57);	γ	0.0758 (L_{II}/L_{III} 0.9) spect conv (63M57);	
		D	chem (63M57a); daughter Lu^{171} (8.5 d) (63M57, 63M57a)		see also gammas of Lu^{171} (8.5 d)	
Yb^{171}		%	14.31 (1B50); 14.4 (98C57);	γ	Coulomb excitation (in Yb^{171}): 0.06672, 0.07588 cryst spect (137C58); 0.067, 0.076 spect, p, p' and d, d' (31E57a); others (97H55); see also gammas of Lu^{171}	see Tm^{171}
		I	1/2 atomic spect (87M50); 1/2 paramag res (133C56);			
		μ	+0.45 atomic spect (87M50); 0.43 paramag res (133C56); +0.49 atomic spect (117K55)			
Yb^{172}		%	21.82 (1B50); 21.9 (98C57)	γ	Coulomb excitation (in Yb^{172}): 0.07870 cryst spect (137C58); others (97H55)	
Yb^{173}		%	16.13 (1B50); 16.2 (98C57);	γ	Coulomb excitation (in Yb^{173}): 0.079, 0.180 spect, p, p' and d, d' (31E57a); 0.07870 cryst spect (137C58); others (97H55); see also gammas of Lu^{173}	
		I	5/2 atomic spect (87M50, 117K54); 5/2 paramag res (133C56);			
		μ	-0.67 atomic spect (117K55); -0.65 atomic spect (87M50); 0.60 paramag res (133C56);			
		q	+2.4 atomic spect (117K56); +3.9 atomic spect (87M50)			
Yb^{174}		%	31.84 (1B50); 31.6 (98C57)	γ	Coulomb excitation (in Yb^{174}): 0.07646 cryst spect (137C58); others (97H55)	
Yb^{175}	101 h (34A45, 10C56a); 102 h (31I47f); 99 h (37B46a)	☢	β^- (34A45);	β^-	0.468 (80%), 0.35 (5%), 0.07 (15%) spect, scint spect, β-γ coinc (115M55); 0.471 (†80), 0.37 (†20) spect (10C56a); 0.463 (87%), ~0.35 (3%), 0.072 (10%) spect, β-γ coinc (60W55b); others (37B46a, 34A45);	Q_{β^-} 0.468 (115M55); see Hf^{175} and Lu^{175}
		A	n-capt (37B46a, 34A45); mass spect (31I47f); chem (24K49b);			
		μ	-0.15 (assuming I = 7/2) nucl alignment (7G57a)	γ	0.11381 (†31, e_K/γ 1.6, $K/L_I/L_{II}/L_{III}$ = 12/3.0/0.8/1.0), 0.13765 (†2.2, e_K/γ 1.0), 0.14485 (†5.9, e_K/γ 0.11), 0.2513 (†3.8), 0.2826 (†62, e_K/γ 0.030, K/L 8), 0.3961 (†100, e_K/γ 0.067, K/L 8) cryst spect, spect conv (158H56a); 0.3953 cryst spect (76R55); 0.1136 (†30, e_K/γ 1.7, $L_I/L_{II}/L_{III}$ = 3/1/1, coinc with 0.144 γ and 0.35 β^-), 0.1376, 0.144 γ (coinc with 0.138 γ and 0.251 γ), 0.251, 0.2824 (†43, e_K/γ 0.038, K/L+M ≥5, coinc with 0.07 β^-), 0.3960 (†100, e_K/γ 0.05, K/L+M 5.8, coinc with 0.07 β^-) spect conv, scint spect, β-γ, γ-γ coinc (115M55); 0.1141 (K/L 2.9, $L_I/L_{II}/L_{III}$ = 4/1.5/1.0), 0.1378 (K/L ~2), 0.145, 0.2829, 0.397 (K/L 5.4) spect conv (10C56a); 0.1130 (†25, e_K/γ 2.2, K/L+M ~2.5), 0.281 (†50, K/L >4), 0.3951 (†100, K/L ~5.9) spect conv, scint spect, β-γ coinc (60W55b); 0.283 γ and 0.396 γ: $t_{1/2}$ 3.4 x 10^{-9} s delay coinc (23V57); others (10C50e, 80A55, 54M55c); see also gammas of Lu^{175} and Hf^{175}	
Yb^{176}		%	12.73 (1B50); 12.6 (98C57);	γ	Coulomb excitation (in Yb^{176}): 0.08213 (?) cryst spect (137C58); others (97H55)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{70}Yb^{177}$	1.9 h (10C56a, 34A45); 2.4 h (37B46a)	☢ A	β^- (37B46a); n-capt (82M35, 71H36); chem (24K49b); chem, genet (228B58); parent Lu^{177} (228B58); others (1P38a, 3I47f)	β^-	1.30 (88%) spect (60W55b); 0.16 (4%) scint spect, β-γ coinc (115M56a); 1.3 abs (37B46a); 1.2 cl ch (34A45);	
				γ	0.119 (†18, K/L+M ~3), 0.146 (†100, e_K/γ 0.63, K/L+M 3.5) spect conv, scint spect, β-γ coinc (60W55b); 0.118 (†13, 0.140 (†<10), 0.147 (†100, e_K/γ <0.4, coinc with 0.140 γ and 1.09 γ), 0.95 (†6, coinc with 0.140 γ), 1.09 (†30), 1.12 (†4), 1.24 (†27) scint spect, β-γ, γ-γ coinc (115M56a); 0.148 (†100, coinc with 1.08 γ), 1.08 (†~5), 1.23 (†~5) scint spect, β-γ, γ-γ coinc (10C56a); 0.147 γ: $t_{1/2}$ 1.2 x 10^{-7} s delay coinc (60W55b); $t_{1/2}$ 1.3 x 10^{-7} s delay coinc (52M49)	
Yb^m	6 s (38M49a, 31K51)	☢ E	IT (38M49a); n-capt (38M49a)	γ	0.212, 0.104 (?) scint spect (31K51); 0.20 abs (38M49a); Yb K-x (38M49)	
Yb^m	50 s (38M49a); others (38M49)	☢ E	IT (38M49a); n-capt (38M49a)	γ	~0.025, Yb L-x abs (38M49a)	
Yb^m	0.15 s (31K52)	E	n-capt (31K51)	γ	0.455 scint spect (31K52)	
$_{71}Lu^{169}$	~2 d (126G57, 22N55)	☢ B	[EC] (126G57); chem (22N55); chem, genet (126G57); parent Yb^{169} (126G57)			
Lu^{170}	1.7 d (2W51)	☢ A	EC (2W51); chem, excit (2W51); chem, mass spect (105M56)	γ	0.0842 ($K/L_I+L_{II}/L_{III}$ = 0.24/0.94/1.0), 0.1935 ($K/L_I+L_{II}/L_{III}$ ~7/2/1) spect conv (63M57); see also gammas of Tm^{170}	
Lu^{171}	8.5 d (2W51); 8.1 d (63M57)	☢ B	EC (2W51); chem, excit (2W51); parent Yb^{171m} (63M57, 63M57a); daughter Hf^{171} (2W51)	γ	0.0556, 0.0667 ($L_I/L_{II}/L_{III}$ ~0.6/1.1/1.0), 0.0758 (with Yb^{171m}, $K/L_I+L_{II}/L_{III}$ ~0.09/0.9/1.0) spect conv (63M57); see also gammas of Yb^{171m}	
Lu^{171}	~600 d (2W51)	☢ D	EC (2W51); chem, excit (2W51)	γ	~1 abs (2W51)	
Lu^{172}	6.70 d (2W51)	☢ B	EC (2W51); chem, excit (2W51); daughter Hf^{172} (2W51)	γ	0.0787 (L_I+L_{II}/L_{III} 0.93), 0.0906 ($K/L_I+L_{II}/L_{III}$ = 0.6/1.1/1.0), 0.1128 ($K/L_I+L_{II}/L_{III}$ ~1.8/1.4/1.0), 0.1815 ($K/L_I+L_{II}/L_{III}$ ~4.8/1.4/1.0), 0.2038 ($K/L_I+L_{II}/L_{III}$ = 5/2/1), 0.2705, 0.3246, 0.373 spect conv (63M57)	
Lu^{172}	4.0 h (2W51)	☢ B	β^+, EC (?) (2W51); chem, excit (2W51)	β^+	1.2 abs (2W51)	

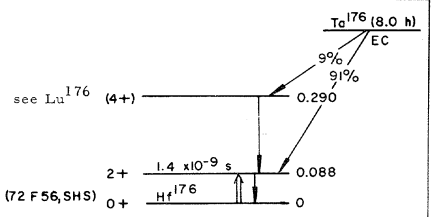
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{71}Lu^{173}$	1.4 y (2W51, 63M57)	☢ EC (2W51);	γ	0.0788 ($L_I/L_{II}/L_{III}$ ~6.3/1/1), 0.1009 ($K/L_I/L_{II}/L_{III}$ ~21/8/1/1), 0.1715, 0.273 spect conv (63M57);	
		B chem, excit (2W51);		metastable state in Lu^{173}: 0.124 γ ($t_{1/2}$ >1 x 10^{-6} s) delay coinc (104W57a);	
		daughter Hf^{173} (2W51)		metastable state in Lu^{173}: 0.140 γ ($t_{1/2}$ ~10^{-7}s) delay coinc (104W57a);	
				see also gammas of Hf^{173}	
Lu^{174}	165 d (2W51)	☢ EC ~80%, β^- ~20% (2W51);	β^-	0.6 abs (2W51);	
		A chem, excit (2W51)	γ	0.0766 (L_I+L_{II}/L_{III} ~1) spect conv (63M57);	
				0.265 scint spect (126G57);	
				0.133 level of Lu^{174}:	
				0.133 (e_K/γ ~0.5, $t_{1/2}$ 7.5 x 10^{-5} s) scint spect, Lu^{175} (γ,n) (157H57)	
Lu^{175}	t_a >1 x 10^{17} y sp act (37P54)	% 97.40 (60H50); 97.41 (98C57);	γ	Coulomb excitation (in Lu^{175}): 0.114, 0.136 (†100), 0.250 (†50) scint spect (97H55, 97H56a); 0.114 (K/L 4.3), 0.139 (K/L 5.5), 0.253 spect conv (116B57a); 0.11379 cryst spect (137C58); 0.14 (†100), 0.25 (†90) scint spect (78G56); others (96H56, 102M55);	see Yb^{175} and Hf^{175} 
		I 7/2 atomic spect (87M50);			
		μ +2.0 atomic spect (206S57); +2.9 atomic spect (67K56);			
		q +5.6 atomic spect (206S57); +5.9 atomic spect (87M50, 67K56); others (61W53, 111K55, 88M57)		0.396 level of Lu^{175}: $t_{1/2}$ 3.4 x 10^{-9} s delay coinc (23V57);	
				see also gammas of Hf^{175} and Yb^{175}	
Lu^{176m}	3.71 h (228B58); 3.67 h (34A45); 3.7 h (37B46a)	☢ β^-, no IT (17S52);	β^-	1.1, 1.2 (17S52); 1.3 cl ch (34A45); 1.2 abs (9F43);	Q_{β^-} 1.2 (SHS); see Ta^{176} and Lu^{176} 
		A n-capt (77M35a, 82M35); chem, excit (2W48); others (2W51, 77M35a, 71H36, 2S47, 31A50a, 11D47a, 65B50)	γ	0.0889 ($K/L_{II}/L_{III}$ = 0.24/0.71/1.0) spect conv (63M52);	
				0.089 (e_K/γ 1.3) scint spect, β-γ coinc (52M52c, 52M57b);	
				0.089 (e/γ large, K/L 0.1) scint spect (17S52);	
				0.088 γ: $t_{1/2}$ 1.35 x 10^{-9} s delay coinc (52M52c);	
				see also gammas of Hf^{176} and Ta^{176}	
Lu^{176}	2.4 x 10^{10} y sp act (23A54); 4.6 x 10^{10} y sp act (42D54a); 2.1 x 10^{10} y sp act (106G57a); 7.5 x 10^{10} y sp act (3L39a)	☢ β^-, no EC (lim 10%) (23A54); no EC (106G57a); EC (K) 3% (42D54a);	β^-	0.43 ion ch (42D54a); 0.40 abs (9F47a, 9F43);	Q_{β^-} 1.03 (SHS) 
		A chem (52H38); mass spect (8M39);	γ	0.089 (†0.6), 0.203 (†3.3), 0.306 (†3.7) scint spect (23A54, 23A53); 0.206, 0.311 scint spect (106G57a); ~0.09 (coinc with 0.19 γ and 0.31 γ), 0.19 (†3.3, coinc with 0.31 γ), 0.31 γ (†3.3) scint spect, ion ch, γ-γ coinc (42D54a);	
		% 2.60 (60H50); 2.59 (98C57);			
		I 6 (5 and 7 not excluded) atomic spect (206S57); ≥7 atomic spect (87M50);			
		μ +2.8 (assuming I = 6) atomic spect (206S57);		see also gammas of Lu^{176m}, Hf^{176}, and Ta^{176};	
		q +8.0 atomic spect (206S57); others (61W53)		Coulomb excitation (in Lu^{176}) (97H55, 116B57a)	

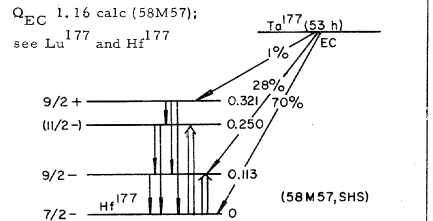
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{71}Lu^{177}$	6.75 d (228B58); 6.8 d (37B46a, 2W48); 7.0 d (30D49); 6.6 d (9F43, 34A45)	☢	β^- (37B46a);	β^-	0.18 (7%), 0.38 (3%), 0.497 (90%) spect, β-γ coinc (163M55); 0.17 (18%), 0.37 (17%), 0.495 (65%) spect (30D49); 0.475 spect (31A50a);	Q_{β^-} 0.496 (SHS)  (27 0 57, 163 M 55, SHS)
		A	n-capt (71H36); mass spect (3147f); chem, excit (2W48); daughter Yb^{177} (228B58); others (2S47, 130B56)	γ	0.07164 (†2, e/γ ~0), 0.11297 (†100, e_K/γ 0.75, $K/L_I/L_{II}/L_{III}$ = 1.3/0.2/1.2/1.0), 0.20836 (†220, e_K/γ 0.044, K/L_I 6.3), 0.2500 (†3, e_K/γ 0.3, K/L_I 3, coinc with 0.072 γ), 0.3214 (†3, e_K/γ 0.2) cryst spect, spect conv, scint spect, γ-γ coinc (163M55); 0.11308, 0.20786 cryst spect (76R55); 0.113 (coinc with 0.208 γ) γ-γ coinc (156H55, 54W53a, 154S57); 0.112 (e_K/γ 0.81), 0.206 (e_K/γ 0.04), 0.318 (~5%) scint spect, γ-γ coinc (52M52d); 0.072 (e_K/γ 1.0) scint spect, γ-γ coinc (27O57); others (30D49, 31A50a, 10C49a); see also gammas of Hf^{177}, Ta^{177}, and Yb^{177}; 0.147 level of Lu^{177}: $t_{1/2}$ 1.2 x 10^{-7} s delay coinc (60W55b)	
$Lu^{178,9}$	18.7 m (156S57); 22 m (65B50)	D	chem (65B50)	γ	0.342 (†100), 0.445 (†10) scint spect (156S57)	
$_{72}Hf^{170}$	112 m (2W51)	☢	β^+ (2W51);	β^+	2.4 spect (2W51);	Q_{EC} 3.4 (64K54)
		D	chem (2W51)	γ	no γ (2W51)	
Hf^{171}	16.0 h (2W51); 12 h (22N55)	☢	EC (2W51);	γ	0.18 scint spect (22N55); 1.4 abs (2W51); others (47W54d)	
		B	chem, genet, excit (2W51); parent (8.5 d) Lu^{171} (2W51)			
Hf^{172}	~5 y (2W51)	☢	EC (2W51);	γ	~0.28, 0.8 abs, spect conv (2W51)	
		B	chem, genet (2W51); parent (6.7 d) Lu^{172} (2W51)			
Hf^{173}	23.6 h (2W51); 44 h (22N55); 28 h (47W54d)	☢	EC (2W51);	γ	0.1239 ($K/L_I/L_{II}/L_{III}$ ~32/4/1/1), 0.1353 ($K/L_I/L_{II}/L_{III}$ ~7/1/1/1), 0.1400 ($K/L_I/L_{II}/L_{III}$ ~50/7/1/1), 0.1623 (K/L_I ~7), 0.297 ($K/L_I/L_{II}/L_{III}$ ~45/6/1/1), 0.307, 0.312 (K/L_I ~7), 0.358 spect conv (63M57, 104W57a); 0.121 (†100), 0.299 (†75), 0.63 (weak, ?), 1.02 (weak, ?), scint spect (47W54d); 0.12, 0.28 scint spect (22N55); 0.124 γ: $t_{1/2}$ >1 x 10^{-6} s delay coinc (104W57a); 0.140 γ: $t_{1/2}$ ~10^{-7} s delay coinc (104W57a)	
		B	chem, excit, genet (2W51); parent Lu^{173} (2W51)			
Hf^{174}		%	0.163 (64W56); 0.18 (75H49); 0.20 (28R53)			

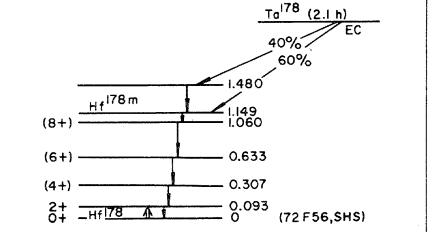
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{72}Hf^{175}$	70 d (2W49b)	☢ EC (2W49b); A chem, excit (2W49b); n-capt, sep isotopes (82B51); mass spect (12H51a)	γ	0.08936 (†40, e_K/γ 2.2, $K/L_I+L_{II}/L_{III}$ = 5/1.0/0.05), 0.11381 (†3.6, e_K/γ ~2, L_I+L_{II}/L_{III} ~6), 0.1613 (†0.3, e_K/γ 0.5, K/L 2.5), 0.2296 (†7.3, e_K/γ 0.11, K/L 2.2), 0.3189, 0.3434 (†1000, e_K/γ 0.11, K/L 5.5, coinc with 0.161 γ), 0.4330 (†16, e_K/γ 0.061, K/L 6.4) cryst spect, spect conv, conv-γ coinc (158H56a); 0.0893 (†40, $L_I/L_{II}/L_{III}$ = 1.0/0.1/0.1), 0.1136, 0.2293 (†~10, K/L ~2), 0.3186, 0.343 (†1000, $L_I/L_{II}/L_{III}$ = 10/0/0, K/L+M 5.0), 0.432 (†~20) spect conv, scint spect (115M55); 0.0891 (†31, e_K/γ ~4, K/L 6.0), 0.1134 (†6), 0.228 (K/L+M 2.0), 0.318, 0.342 (†1000, K/L+M 4.9), 0.430, no 1.5 γ spect, spect conv (215B55); others (44A56, 82B52, 2W49b, 117B53b); see also gammas of Yb^{175} and Lu^{175}	see Yb^{175} 
Hf^{176}		% 5.21 (64W56); 5.23 (28R53); 5.15 (75H49)	γ	Coulomb excitation (in Hf^{176}): 0.08835 cryst spect (137C58); 0.087 scint spect (97H55, 102M55); 0.090 spect conv (96H56); 0.088 level of Hf^{176}: $t_{1/2}$ 1.35 x 10^{-9} s delay coinc (52M52c); see also gammas of Lu^{176}, Lu^{176m}, and Ta^{176}	see Lu^{176} and Ta^{176}
Hf^{177}		% 18.56 (64W56); 18.39 (75H49); 18.6 (28R53); I 7/2 atomic spect (198S56b, 198S56a); μ +0.61 atomic spect (198S56b, 198S56a); q +3 atomic spect (198S56b, 198S56a); others (87M50)	γ	Coulomb excitation (in Hf^{177}): 0.1129 cryst spect (137C58); 0.112, 0.138 (†10), 0.250 (†26) scint spect (97H56a, 97H55); 0.112, 0.235 scint spect (102M55); 0.114 spect conv (96H56); ~0.14 (†10), ~0.25 (†43) scint spect (78G56); others (121S55); see also gammas of Lu^{177} and Ta^{177}	see Lu^{177} 
Hf^{178m}	4.8 s (72F56)	☢ IT (72F56); B chem, genet (72F56); daughter (2.1 h) Ta^{178} (72F56)	γ	0.0888, 0.0932, 0.2137, 0.326, 0.427 spect conv (72F56); see gammas of Ta^{178}	see Ta^{178} 
Hf^{178}		% 27.1 (64W56, 75H49); 27.2 (28R53); μ ~0 atomic spect (87M50)	γ	Coulomb excitation (in Hf^{178}): 0.09314 cryst spect (137C58); 0.090 scint spect (97H55); 0.091 scint spect (102M55); others (121S55, 96H56); see also gammas of Ta^{178}	see Ta^{178}
Hf^{179m}	19 s (9F44b, 38M51b)	☢ IT (9F46); A n-capt (9F44b); n-capt, sep isotopes (82B51, 38M51b); others (38M51)	γ	0.160, 0.217 scint spect, spect conv (82B51); ~0.150, 0.215 scint spect, conv-γ coinc (38M51b); 0.150 (e/γ very large, K/L 0.9) spect conv (15H48a)	Q_{IT} 0.375 (18G52) 
Hf^{179}		% 13.75 (64W56); 13.78 (75H49); 13.7 (28R53); I 9/2 atomic spect (198S56a); μ -0.47 atomic spect (198S56a); q +3 atomic spect (198S56a); others (87M50)	γ	Coulomb excitation (in Hf^{179}): 0.1227 cryst spect (137C58); 0.119, 0.141 (†100), 0.260 (†44) scint spect (97H56a, 97H55); 0.122, 0.25 scint spect (102M55); 0.123 spect conv (96H56); ~0.12 (†100), ~0.26 (†50) scint spect (78G56); others (65P56, 121S55)	

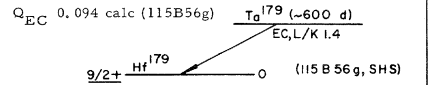
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{72}Hf^{180m}$	5.5 h (82B51)	☢	IT (82B51);	γ	0.0576, 0.0933, 0.216 (coinc with 0.443 γ), 0.332 (coinc with 0.443 γ), 0.443 (80%), 0.501 (20%) spect conv, scint spect, γ-γ coinc (17S56, 63M54a); 0.057, 0.093, 0.214, 0.330, 0.442 spect conv, γ-conv coinc (82B51); 0.0576 (e_L/γ 0.2), 0.44 (85%), 0.50 (15%) scint spect, spect conv (113G57);	Q_{IT} 1.14 (17S56, SHS)
		A	chem, n-capt, sep isotopes (82B51); genet energy levels (63M54a)		0.216 γ: $t_{1/2}$ 9 x 10^{-11} s (14S57a); see also gammas of Ta^{180} (8.2 h)	
$\underline{Hf^{180}}$		%	35.22 (64W56); 35.44 (75H49); 35.1 (28R53);	γ	Coulomb excitation (in Hf^{180}): 0.09329 cryst spect (137C58); 0.093 scint spect (97H55); 0.092 scint spect (102M55); others (121S55, 96H56); 0.093 level of Hf^{180}: $t_{1/2}$ 1.4 x 10^{-9} s delay coinc (14S55); 0.309 level of Hf^{180}: $t_{1/2}$ 9 x 10^{-11} s delay coinc (14S57a); see also gammas of Ta^{180} and Hf^{180m}	
		μ	~0 atomic spect (87M50)			
Hf^{181}	44.6 d (109W57); 46 d (142M53); 45 d (10C50f); 47 d (43B48a)	☢	β^- (71H38);	β^-	0.408 spect (29F52); 0.420 spect (82B51); 0.404 spect (71C49); 0.460 spect (43B48a); 0.405 spect (44A56, 117B53b);	Q_{β^-} 1.024 (SHS): see W^{181} and Ta^{181}
		A	chem, n-capt (71H38); mass spect (12H51a); sep isotopes, n-capt (82B51); others (2S47, 24N47);	γ	0.0039, 0.13302 (†7, e_K/γ 0.49, $L_I/L_{II}/L_{III}$ = 0.26/1.3/1.0), 0.13625 (†1, e_K/γ 1.2, L_I+L_{II}/L_{III} 5.9), 0.13686 (†0.3, e_K/γ 0.9), 0.3459 (†2.3, e_K/γ 0.04, K/L 4), 0.4760 (†~0.3, e_K/γ 0.06, K/L 4.3), 0.4820 (†14, e_K/γ 0.027, K/L 4.7, coinc with 0.13686 γ), 0.6155 (†0.04, e_K/γ 0.12) cryst spect, spect conv, conv-γ coinc (56B56a); 0.133 (K/L ~1, coinc with 0.345 γ and 0.481 γ), 0.136 (K/L ~0.2, coinc with 0.345γ), 0.345, 0.481 (not coinc with 0.345γ), 0.612 spect conv, conv-conv coinc (10C50f); 0.130 (e/γ 0.90, K/L+M 0.6), 0.134 (e/γ ~3, K/L+M ~8), 0.340 (e/γ ~0.1), 0.474 (e/γ 0.030, K/L+M 4.0) spect conv (29F52); 0.132 (e_K/γ 0.48), 0.135 (e_K/γ 1.9), 0.345 (e_K/γ 0.08), 0.480 (e_K/γ 0.034) scint spect, γ-γ coinc (52M54); 0.133 (e_K/γ 0.50, K/L 0.9, L_I+L_{II}/L_{III} 1.5), 0.136 (e_K/γ 1.2, K/L 7), 0.346 e_K/γ 0.038, K/L 3.3), 0.482 (e_K/γ 0.023, K/L 4.1) spect conv, scint spect, γ-γ coinc (223S57); ~0.34 γ and ~0.48 γ: $t_{1/2}$ 1.06 x 10^{-8} s delay coinc (60W52); $t_{1/2}$ 1.04 x 10^{-8} s delay coinc (28E53); $t_{1/2}$ 1.1 x 10^{-8} s delay coinc (63B50); 0.133 γ: $t_{1/2}$ 1.88 x 10^{-5} s delay coinc (142M53); $t_{1/2}$ 2.2 x 10^{-5} s delay coinc (10D48, 63B50); $t_{1/2}$ 2.0 x 10^{-5} s delay coinc (4B48); others (52M52e, 12H51a, 71C49, 13J49a, 43B48a, 10C47, 24N47, 3V48, 26M49a, 49W49a, 20D50a, 32P50, 27F50a, 35F50, 4B49, 14L49, 52M54a, 105W49, 116S53, 116S53a, 135B53, 78D55, 121S57c, 159H55, 63G56, 44A56, 130B55, 117B53b, 65L57d, 113G57, 82B51, 42A57); see also gammas of Ta^{181} and W^{181}	
		μ	of 0.482 level of Ta^{181} (assuming I = 5/2): +3.1 ang corr attenuation (55K57a); +3.3 ang corr attenuation (63D56a, 159H55a, 159H55); +2.7 ang corr attenuation (65L57d); see also Ta^{181}			

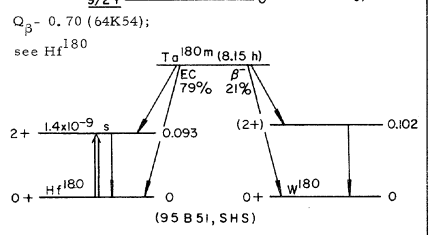
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{72}Hf^{183}$	64 m (107G56)	☢	β^- (107G56);	β^-	1.4 abs (107G56);	
		D	chem (107G56)	γ	(107G56)	
$_{73}Ta^{176}$	8.0 h (2W50e)	☢	EC (2W50e); no β^+ (lim 0.2%) (72F56);	γ	0.0883 (†42, L_I+L_{II}/L_{III} 1.3), 0.2021 (†24) spect conv, scint spect (72F56); see also gammas of Lu^{176}, Hf^{176}, and Lu^{176m}	
		A	chem, excit (2W48, 2W50e); genet energy levels (72F56); daughter W^{176} (2W50e)			
Ta^{177}	53 h (2W50e)	☢	EC (2W50e); β^+ ~2 x 10^{-3}% (58M57);	γ	0.113, 0.208, 0.321, 0.425, 0.510, 0.63, 0.75, 0.96, 1.07 spect conv, scint spect, γ-γ coinc (58M57); 0.113 (L_I+L_{II}/L_{III} 1.8), 0.208 spect conv, scint spect (72F56); see also gammas of Lu^{177} and Hf^{177}	
		A	chem, excit (2W48, 2W50e); genet energy levels (58M57, 72F56); daughter W^{177} (2W50e)			
Ta^{178}	2.1 h (2W50e)	☢	EC ~97%, β^+ ~3% (2W50e);	β^+	~1 abs (2W50e);	
		B	chem, excit (2W50e); parent Hf^{178m} (72F56)	γ	γ_1 0.0888 († of $\gamma_1+\gamma_2$: 17, e/γ ~0.5, coinc with γ_2, γ_3, $\gamma_4+\gamma_5$, and γ_6) γ_2 0.0932 (L_I+L_{II}/L_{III} 1.6), γ_3 0.2137 (†21, $K/L_I/L_{II}/L_{III}$ = 3.5/0.4/1.0/0.6, coinc with $\gamma_4+\gamma_5$, and γ_6), γ_4 0.326 († of $\gamma_4+\gamma_5$ 27), γ_5 0.332, γ_6 0.427 (†18, coinc with $\gamma_4+\gamma_5$) spect conv, scint spect, γ-γ coinc (72F56); see also gammas of Hf^{178}, Ta^{178} (9.35 m), and Hf^{178m}	
Ta^{178}	9.35 m (2W50e)	☢	EC 98%, β^+ ~2% (72F56); no β^+ (lim 1%) (115B56f); EC ~94%, β^+ ~6% (2W50e);	β^+	1.06 spect (2W50e); 0.88 spect (72F56);	
				γ	0.931, 1.35 spect conv, scint spect (72F56); no 1.5 γ (lim 1.4%) (115B56f);	
		B	chem, genet (2W50e); daughter W^{178} (2W50e, 72F56)		see also gammas of Ta^{178} (2.1 h) and Hf^{178}	
Ta^{179}	~600 d (2W50e)	☢	EC (2W50e); EC (L/K 1.4) (115B56g);	γ	no γ (115B56g); others (2W50e)	
		D	chem, excit (2W50e)			
Ta^{180m}	8.15 h (95B51); 8.00 h (2W50e); 8.2 h (17O38)	☢	EC ~79%, β^- ~21%, no β^+ (lim 0.005%) (95B51);	β^-	0.71 (~50%), ~0.61 (~50%) spect (95B51); 0.7 spect (2W50e); abs (83M51);	
		A	chem, excit (17O38); others (1P37, 27M49, 55S51, 96B49)	γ	γ_1 0.093 (K/L 0.15), γ_2 0.102 ($\gamma_1+\gamma_2$: e/γ ~5), γ_3 0.2, γ_4 0.4 (γ_3 and γ_4 very weak) spect conv, scint spect, β-γ, x-γ coinc (95B51); γ_1: $t_{1/2}$ 1.4 x 10^{-9} s delay coinc (14S55); see also gammas of Hf^{180m} and Hf^{180}	
Ta^{180}	>10^{12} y sp act (41E55)	%	0.0123 (64W56)			
Ta	5 x 10^{-3} s (86L57)	E	excit (86L57)	γ	~0.5 scint spect (86L57)	

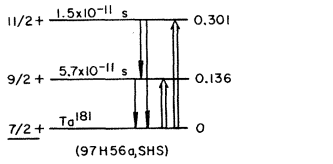
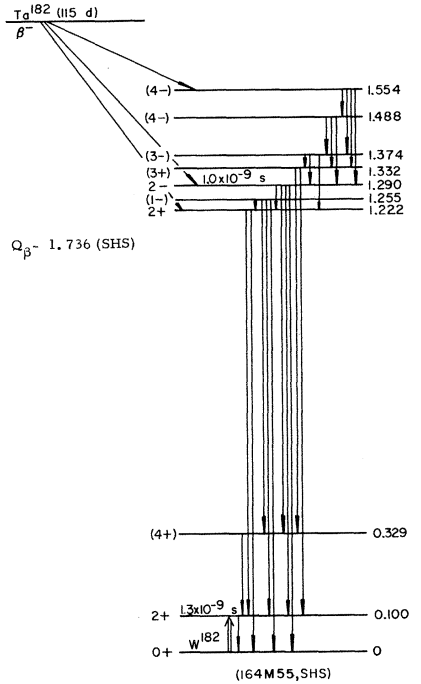


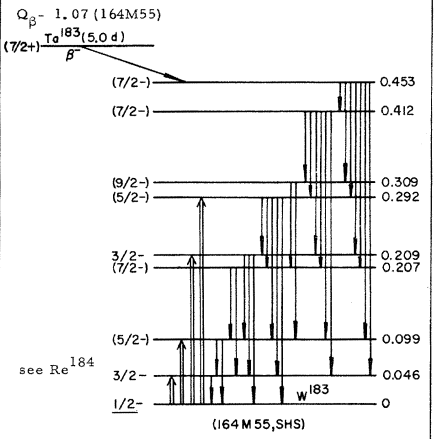


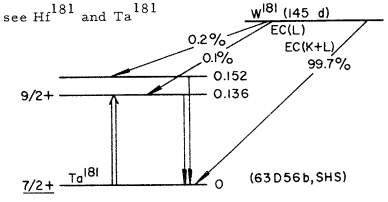






Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{73}Ta^{181}$		% 99.9877 (64W56, 64W55); 100 (24W48); I 7/2 atomic spect (87M50); μ (of ground state): +2.1 atomic spect (67K56, 87M50); μ (of 0.482 level of Ta^{181}, assuming I = 5/2): +3.0 ang corr attenuation (55K57a, 81R54); +3.3 ang corr attenuation (63D56a, 159H55a, 159H55); +2.7 ang corr attenuation (65L57d); q +6 atomic spect (87M50, 216B52); +3 atomic spect (88M57, 111K55); others (61W53)	γ Coulomb excitation (in Ta^{181}): 0.1361, 0.1652 cryst spect (137C58); 0.136 (coinc with 0.167 γ), 0.167 (†100), 0.303 (†36) scint spect, γ-γ coinc (97H56a, 97H55, 27T54b, 27T54); 0.136 (e_K/γ 1.5, $t_{1/2}$ 5.7×10^{-11} s), 0.166, 0.303 ($t_{1/2}$ 1.5×10^{-11} s) scint spect (52M58, 52M57b); 0.137, 0.165 (†100), 0.302 (†66) scint spect (45D56); 0.137, 0.166 (†100), 0.303 (†69) scint spect (92W57); 0.137, 0.166 (†100, coinc with 0.137 γ), 0.303 (†60) scint spect, γ-γ coinc (61G54); 0.139, 0.167 (†100), 0.309 (†80) scint spect (42E54); 0.137 (K/L 6.3), 0.165 (K/L 7.1), 0.302 spect conv (116B57a); ~0.17 (†100), ~0.30 (†57) scint spect (78G56); others (102M53, 96H53, 102M55, 116B55, 122B54, 141M55b, 96H53a, 41A56, 41A56a, 96H56, 121S55, 52M55, 52M56a); 0.482 level of Ta^{181}: $t_{1/2}$ 1.06×10^{-8} s delay coinc (60W52); 0.615 level of Ta^{181}: $t_{1/2}$ 1.88×10^{-5} s delay coinc (142M53); $t_{1/2}$ 1.81×10^{-5} s scint spect, Ta^{181} (γ,γ) (91D57); others (95B53, 135B53, 18V56); see also gammas of Hf^{181} and W^{181}	
Ta^m	0.33 s (24C49, 45G50, 31K51)	☢ IT (45G50); E n-excit (24C49, 24C52)	γ Ta L-x (45G50, 31K51)	
Ta^{182m}	16.5 m (15H48a); 16.2 m (2S47)	☢ IT (15H48a); IT ~95%, β^- ~5% (2W50e); A chem, n-capt (2S47, 15H48a)	β^- 0.6 abs (2W50e); γ 0.180 (K/L 0.25) spect conv (15H48a); 0.180 (e_K/γ 0.8) scint spect (14S51)	
Ta^{182}	115.1 d (109W57); 111 d (21E52, 38S51); 117 d (2S47, 11Z43)	☢ β^- (76H40); A chem, n-capt (37F36, 17O38); others (76H40, 2S47, 1M48, 17O38, 11Z43, 31S50, 31T51)	β^- 0.514 (†100), 0.44 (†64), 0.36 (†28) spect (87D57); 0.525, others β's, spect (7J49); 0.51, other β's, spect (164M55); 0.53 spect (86B49a); others (11R47, 7J47, 24N47); γ 0.03336 (weak), 0.04271 (weak), 0.06571 (†8, $L_I/L_{II}/L_{III}$ = 7/1/0.6), 0.06774 (†85, $L_I/L_{II}/L_{III}$ = 2.4/1/1), 0.08467 (†5, $L_I/L_{II}/L_{III}$ = 3/1/0.8), 0.10009 (†40, $K/L_I/L_{II}/L_{III}$ = 1.0/0.09/1.0/1.0), 0.11366 (†8, $K/L_I/L_{II}$ = 4.8/1.0/0.18), 0.11640 (†1.7), 0.15241 (†35), 0.15637 (†12), 0.17936 (†16, $K/L_I/L_{III}$ = 8/3.4/1), 0.19831 (†8, $K/L_{II}/L_{III}$ = 2.2/1.0/0.6), 0.22205 (†35, K/L_I 6), 0.22927 (†20, $K/L_{II}/L_{III}$ = 3.2/1.0/0.6), 0.26409 (†22, $K/L_{II}/L_{III}$ = 2.8/1.0/0.5), 0.927, 0.960, 1.003 (K/L 7.0), 1.122 (†100, K/L 6.7), 1.155 (†7), 1.189 (†45, K/L 6.5), 1.222 (†95, K/L 6.0), 1.231 (†50), 1.289 (K/L 6.6), 1.375, 1.437, 1.454 cryst spect, spect conv (164M55, 164M54, 100M52); 1.122 (†100), 1.189, 1.222, 1.254 (†4), 1.273 (†3), 1.289 (†2), no 1.437 γ, no 1.375 γ, no 1.454 γ spect (128B56a); 0.1524 (†14), 0.1564 (†5.9), 0.1794 (†6.9), 0.1983 (†3.5), 0.2221 (†19), 0.2293 (†8), 0.264 (†7), 1.122 (†100), 1.155 (†9), 1.189 (†60) cryst spect (232S57); 0.046, 0.058, 0.065, 0.067, 0.075, 0.077, 0.084, 0.100, 0.113, 0.134, 0.143, 0.152, 0.178, 0.198, 0.221, 0.228, 0.245, 0.262 spect conv (10C50e); 1.121, 1.189, 1.219 spect, spect conv (10C51e); 0.224, 0.232, 0.260, 0.268, 0.280, 0.320, 0.342, 0.362, 0.392, 0.412, 0.421, 0.526, 0.565, 0.607, 0.624, 0.728, 0.763, 0.780, 0.892, 0.935, 0.993, 1.133, 1.215, 1.231 spect (18O50); ~0.0677 (coinc with 1.122 γ and 1.222 γ), ~0.152 γ (coinc with 1.222 γ) scint spect, γ-γ coinc (106W56); 0.100 (coinc with 1.122 γ and 1.189 γ) scint spect, γ-γ coinc (63M54b); 0.100 γ: $t_{1/2}$ 1.3×10^{-9} s delay coinc (14S54b, 14S55); 1.29 level of W^{182}: $t_{1/2}$ 1.0×10^{-9} s delay coinc (14S54b, 63M54b); others (35F54, 25P53, 86B49a, 4G49, 11R47, 10C49b, 98S48, 4B49, 52W51, 73F57) see also gammas of Re^{182} and W^{182}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{73}Ta^{183}$	5.0 d (66P55); 5.2 d (164M55); 6.0 d (83M51)	☢ β^- (65B50, 66P55);	β^-	0.62 (>95%) spect (164M55); 0.6 (~70%), ~0.15 (~30%) abs (66P55); 0.6 abs (83M51);	Q_{β^-} 1.07 (164M55)
		A chem, excit (65B50); n-capt, chem, genet energy levels (164M55)	γ	0.04097 (†22, L_I/L_{III} 14), 0.04648 (†220, $L_I/L_{II}/L_{III}$ = 7.1/1.0/0.5), 0.05259 (†240, $L_I/L_{II}/L_{III}$ = 6.9/1.6/1.0), 0.08292 (†11), 0.08470 (†70), 0.09907 (†220, $K/L_{II}/L_{III}$ = 1.0/1.1/1.0), 0.10194 (†10), 0.10249 (†4, K/L_I 0.6), 0.10314 (†3), 0.10793 (†350, K/L_I 6.3), 0.10973 (†17), 0.12038 (†3), 0.14225 (†15), 0.14412 (†85, K/L_I 5.5), 0.16053 (†110), 0.16136 (†310), 0.16233 (†170), 0.19264 (†9), 0.20327 (†9), 0.20506 (†35, K/L_I 4.6), 0.20881 (†26), 0.20987 (†170), 0.24426 (†340), 0.24605 (†1000), 0.29171 (†200, K/L 3), 0.31303 (†300, K/L_I 6.3), 0.3540 (†400, K/L_I 5.6), 0.3656 (†35), 0.4066 (†40) cryst spect, spect conv (34D53, 164M55); 0.1441 (†110), 0.1605 (†120), 0.1614 (†340), 0.1623 (†170), 0.2088 (†18), 0.2099 (†160), 0.2443 (†300), 0.2461 (†1000), 0.2917 (†150), 0.3130 (†250), 0.3540 (†390) cryst spect (232S57); others (63M53a, 66P55); see also gammas of W^{183} and Re^{183}	
Ta^{184}	8.7 h (65B55a)	☢ β^- (65B55a);	β^-	1.26 (~70%), 0.15 (~30%) abs, scint spect (65B55a);	see Re^{184}
		B chem, sep isotopes (65B55a)	γ	0.110 (†30), 0.16 (†10), 0.21 (†10), 0.24 (†60), 0.30 (†35), 0.41 (†100), 0.78 (†17), 0.89 (†90), 1.18 (†50) scint spect (65B55a); see also gammas of Re^{184} (50 d) and W^{184}	
Ta^{185}	50 m (66P55); 48 m (83M51, 65B50)	☢ β^- (23D50);	β^-	1.7 (~70%), ~0.15 (~30%) abs, scint spect (66P55); 1.6, 0.15 (conv ?) abs (83M51); 1.7 abs (23D50);	Q_{β^-} 1.7 (64K54)
		B chem, excit (65B50); excit, sep isotopes (23D50); not parent W^{185m} (66P55)	γ	0.125 (†28), 0.175 (†71), 0.235 (†18) scint spect (66P55)	
Ta^{186}	10.5 m (66P55)	☢ β^- (66P55);	β^-	2.2 (coinc with γ), abs, scint spect, β-γ coinc (66P55);	
		C sep isotopes, cross bomb (66P55)	γ	0.125 (†25), 0.20 (†100), 0.30 (†25), 0.41 (†20), 0.51 (†45), 0.61 (†45), 0.73 (†65), 0.94 (†15), ~1.2 (?, †≤10) scint spect (66P55); see also gammas of Re^{186} and W^{186}	
$_{74}W^{176}$	80 m (2W50e)	☢ EC 99+%, β^+ ~0.5% (2W50e);	β^+	~2 abs (2W50e);	
		B chem, genet (2W50e); parent Ta^{176} (2W50e)	γ	~1.3 abs (2W50e)	
W^{177}	130 m (2W50e)	☢ EC (2W50e);	γ	~0.5, 1.2 abs (2W50e)	
		B chem, genet (2W50e); parent Ta^{177} (2W50e); daughter Re^{177} (79H57)			
W	long sp act (37P56)	☢ α (37P56)	α	3.0 range emuls (37P56)	
		F (37P56)			
W^{178}	21.5 d (2W50e); 22.0 d (115B56f)	☢ EC (2W50e, 72F56);	γ	no 0.27 γ (lim <0.6%) (115B56f); ~0.3 (weak) abs (2W50e)	
		B chem, genet (2W50e); parent 9.4 m Ta^{178} (2W50e, 72F56)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{74}W^{179}$	30 m (2W50e); 40 m (86R56)	☢	EC (2W50e);	γ	0.030 (86R56)	
		D	chem, excit (2W50e)			
W^{179}	5.2 m (2W50e); ~7 m (86R56); no 5 m act observed (224S55)	☢	EC or IT (2W50e);	γ	0.22 (?) (86R56)	
		D	chem, excit (2W50e)			
W^{180m}	5.5×10^{-3} s (224S55); 5×10^{-3} s (86L57)	E	excit (224S55); others (18V56)	γ	0.22 (?), ~0.35 scint spect (224S56)	
W^{180}		%	0.135 (9W46)			
W^{181}	145 d (115B56f); 140 d (2W47)	☢	EC (2W47); EC (L/K 1.5), no β^+ (115B56f, 115B55d);	γ	0.1365 (K/L ~8), 0.1525 (K/L ~8), no 0.030 γ, no 0.60 γ, no 0.80 γ scint spect, spect conv (10C53d); 0.136, 0.152 (e_K/γ 1.0) scint spect, x-γ coinc (63D56b, 63D56); no γ (115B56f, 115B55d); 0.366 level of W^{181}: 0.366 (e_K/γ 0.30, $t_{1/2}$ 1.44×10^{-5} s) scint spect, W^{182} (γ, n) (192B57); 0.368 (e_K/γ 0.41, $t_{1/2}$ 1.47×10^{-5} s) scint spect, W^{182} (γ, n) (18V56, 18V56a); see also gammas of Hf^{181}, Ta^{181}, and Re^{181}	see Hf^{181} and Ta^{181} 
		A	chem, excit (2W47); chem, n-capt (37L51); others (96B49, 38M51c)			
W^{182}		%	26.4 (9W46);	γ	Coulomb excitation (in W^{182}): 0.10007 cryst spect (137C57); 0.100 spect conv (96H56, 96H53); 0.100 ($t_{1/2}$ 1.3×10^{-9} s) scint spect (52M58); others (116B55a, 121S55, 61G57, 102M54); 0.100 level of W^{182}: $t_{1/2}$ 1.3×10^{-9} s delay coinc (14S54b, 14S55); 1.290 level of W^{182}: $t_{1/2}$ 1.0×10^{-9} s delay coinc (14S54b, 63M54b); see also gammas of Ta^{182} and Re^{182}	see Ta^{182}
		I	(87M50)			
W^{183m}	5.5 s (38M49, 24C52a)	☢	IT (38M49);	γ	0.105 (†25), 0.155 (†10) scint spect (66P55); 0.12, 0.17 scint spect (24C52a)	
		B	sep isotopes, n-capt (38M49)			
W^{183}		%	14.4 (9W46);	γ	Coulomb excitation (in W^{183}): 0.04650, 0.05261 cryst spect (137C57); 0.099, 0.162, 0.292 scint spect (52M58, 121S55); 0.046 spect conv (96H56); 0.103 scint spect (102M54); see also gammas of Ta^{183} and Re^{183}	see Ta^{183}
		I	1/2 atomic spect (87M50);			
		μ	+0.115 nucl induct (162S55)			
W^{184}		%	30.6 (9W46);	γ	Coulomb excitation (in W^{184}): 0.11113 cryst spect (137C57); 0.112 spect conv (96H56, 96H53a); 0.112 ($t_{1/2}$ 1.0×10^{-9} s) scint spect (52M58); others (116B55a, 121S55, 61G57, 102M54); 0.111 level of W^{184}: $t_{1/2}$ 1.3×10^{-9} s delay coinc (108G58); see also gammas of Ta^{184} and Re^{184} (50 d)	see Re^{184}
		I	(87M50)			

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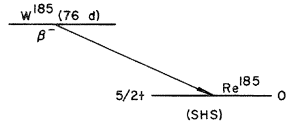
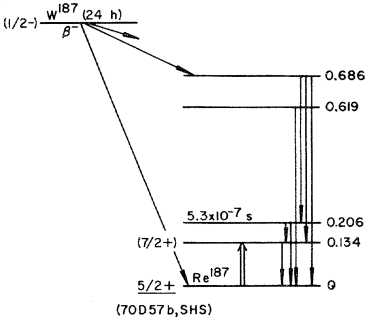
$_{74}W^{185m}$	1.62 m (66P55); 1.85 m (23D50)	☢ IT (23D50); B excit, sep isotopes (23D50, 66P55); not daughter Ta^{185} (66P55)	γ	0.130 (†50, coinc with 0.165 γ), 0.165 (†50) scint spect, γ-γ coinc (66P55); others (23D50)	
W^{185}	75.8 d (45P57); 73.2 d (9S48a); 75 d (5F40a, 82K55); 70 d (64T57)	☢ β^- (64M40); A chem, excit, n-capt (64M40); others (2S47)	β^-	0.430 spect (111W57); 0.428 spect (68S48); 0.426 spect (115B55d); 0.425 spect (54M56); 0.440 spect (70D57b); average energy of β^-: 0.144 calorimeter (227S56); others (71A55a, 20P48, 9S48a, 23S45a);	Q_{β^-} 0.430 (SHS); see Re^{185} and Os^{185} 
			γ	no γ (56L53, 70D57b, 111W57); 0.0556 (2.4%, e_L/γ ~3), no 0.13 γ scint spect, ion ch (115B55d); ~0.058 (e/γ ~3) scint spect (211B56a); 0.134 spect conv (10C49); others (23S45a, 65C47a, 4B49, 82K55, 165M54, 28E53)	
W^{186}	$t_{\beta\beta}$ >6 x 10^{15} y sp act (59F52)	% I 28.4 (9W46); (87M50)	γ	Coulomb excitation (in W^{186}): 0.12248 cryst spect (137C57); 0.123 spect conv (96H56); 0.124 ($t_{1/2}$ 1.0 x 10^{-9} s) scint spect (52M58); others (116B55a, 96H53a, 121S55, 61G57, 102M54); see also gammas of Ta^{186} and Re^{186}	see Re^{186}
W^{187}	24.0 h (109W57); 23.9 h (21E53); 24.1 h (5F40a); 24.0 h (64M40, 10C53e)	☢ β^- (64M40); A chem, n-capt (12A35); chem, n-capt, excit (64M40); others (77M35b, 2S47, 10C49, 6O48)	β^-	1.33 (20%), 0.63 (70%), 0.34 (~10%) spect (70D57b); 1.33 (30%), 0.63 (70%) spect (20P48); 1.30 (20%), 0.62 (80%) spect (10C53e); others (15H48b, 23S45a, 43M46);	Q_{β^-} 1.32 (SHS); see Re^{187} 
			γ	0.07200, 0.13425, 0.4795, 0.6189, 0.6861 cryst spect (100M52); 0.0721, 0.1062, 0.1138, 0.1343 (K/L 5.5, L_I/L_{III} ~60), 0.2063, 0.2392, 0.246, 0.480 (K/L 4.2), 0.514, 0.619 (K/L 4), 0.626, 0.686 (K/L 5), 0.774, 0.866 spect conv (10C53e); 0.072, 0.136 (†45, K/L 5.0), 0.206 (K/L 4.5), 0.226 (†2), 0.241 (†4), 0.249 (†2), 0.482 (†100, K/L 4.0), 0.510 (†12), 0.552 (†40), 0.621 (†30, K/L 3.8), 0.627 (†15), 0.686 (†190), 0.775 (†20), 0.866 (†12) spect, spect conv (70D57b); 0.133 ($e_K/\gamma \leq 3.2$, K/L ~5) scint spect (52M52b); 0.48 (coinc with 0.072 γ, 0.134 γ, and 0.206 γ), 0.134 γ (coinc with 0.072 γ), 0.69 (not coinc with γ) γ-γ coinc (90G53); 0.13 (coinc with 0.48 γ, 0.55 γ, and 0.78 γ), 0.618 (not coinc with γ) γ-γ coinc (14S53); 0.69 (29%) scint spect (10M57); 0.206 level of Re^{187}: $t_{1/2}$ 5.3 x 10^{-7} s delay coinc (4B49, 10D48); others (28E53, 15H48b, 86B49b, 6V41a, 72C42, 20P48, 9J51); see also gammas of Re^{187}	
W^{188}	69.5 d (45P57); 65 d genet (37L51)	☢ β^- (37L51); B chem, genet (37L51); parent Re^{188} (37L51, 37L51a)			

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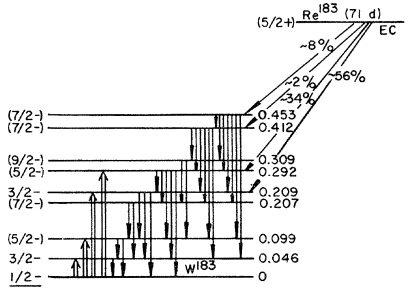
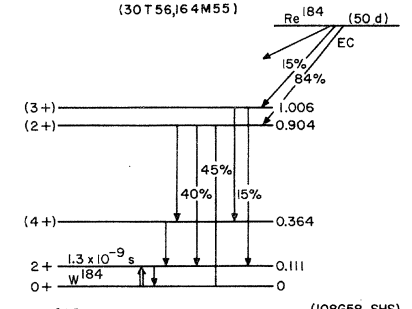
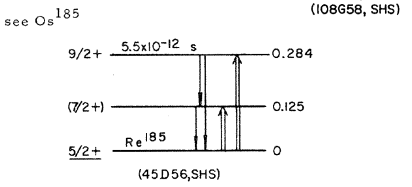
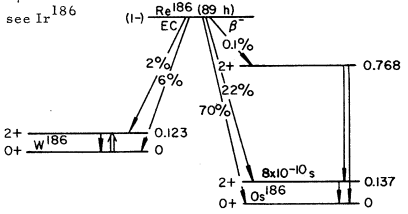
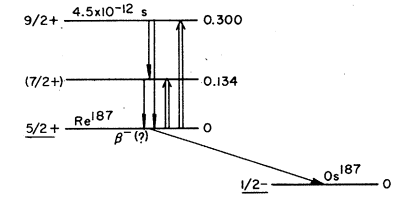
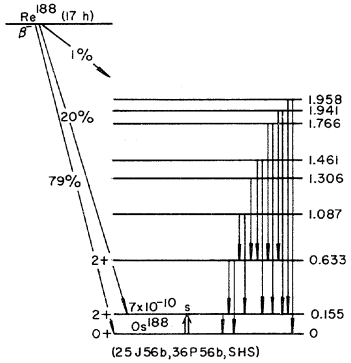
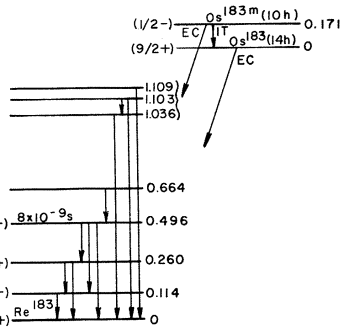
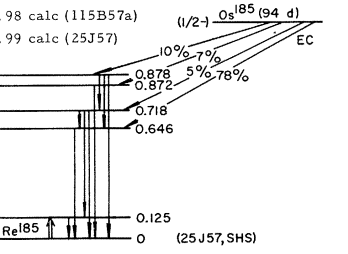
$_{75}Re^{177}$	17 m (79H57)	☢ β^+ (79H57); B chem, genet (79H57); parent W^{177} (79H57)			
Re^{178}	15 m (79H57)	☢ β^+ (79H57); D chem, cross bomb (79H57)	β^+	3.1 scint spect (79H57)	
Re^{180}	2.4 m (34F55)	☢ β^+, EC (34F55); C excit (34F55)	β^+ γ	1.1 abs (34F55); 0.11, 0.88 (γ/β^+ 5) scint spect (34F55); see also gammas of Ta^{180m}	
Re^{180}	18 m (79F58)	☢ [EC] (79F58); D chem, excit, sep isotopes (79F58)	γ	0.227, 0.282 (79F58)	
Re^{180}	20 h (79H57)	☢ β^+ (79H57); D chem, decay charac, cross bomb (79H57)	β^+	1.9 scint spect (79H57)	
Re^{181}	20 h (108G57); 19 h (79F58)	☢ EC (108G57); B chem, excit (108G57)	γ	0.04738, 0.1226, 0.2523, 0.3323, 0.3420, 0.3610, 0.3655 (K/L_I 5.7), 0.4419, 0.470, 0.487, 0.489, 0.557, 0.638, 0,82, 0.895, 0.954 spect conv, scint spect, γ-γ coinc (108G57, 108G57b); 0.367 (79F58); see also gammas of W^{181}	
Re^{182}	12.7 h (2W50g); 14 h (31D50)	☢ EC (2W50g); A chem, excit (2W50g); chem, sep isotopes (31D50); chem, genet energy levels (108G57a); daughter Os^{182} (93S50, 79F58)	γ	0.06571 (L_I/L_{II} 11), 0.06774 ($L_I/L_{II}/L_{III}$ = 2.0/0.9/1.0), 0.08467 ($L_I/L_{II}/L_{III}$ = 3.5/1.5/1.0), 0.1001 ($L_I/L_{II}/L_{III}$ = 0.25/1.1/1.0), 0.1137, 0.1164, 0.1524, 0.2293, 1.122, 1.189, 1.222, 1.231 (energies of some gammas taken from 164M55) spect conv, scint spect (108G57b); 0.110, 0.127, 0.222, 0.250, 0.346 spect conv, spect (2W50g); see also gammas of 64 h Re^{182}, Ta^{182}, and W^{182}	see Ta^{182}
Re^{182}	64.0 h (2W50g); 67 h (31D50); 60 h (108G57b)	☢ EC (2W50g); A chem, excit (2W50g); chem, sep isotopes (31D50); chem, genet energy levels (108G57a)	γ	0.01986, 0.03910, 0.05296, 0.06051, 0.06571 (L_I/L_{II} 6.5), 0.06774 (L_{II}/L_{III} 0.9), 0.08467 ($K/L_I/L_{II}/L_{III}$ = 5/1/0.3/0.2), 0.10009 (K/L 0.12), 0.10713 ($K/L_I/L_{II}/L_{III}$ = 5/1/1.5/1), 0.10857 (K/L_I 4.1), 0.11136 ($K/L_I/L_{II}$ = 5/1/0.17), 0.11640, 0.12094, 0.13076 ($K/L_I/L_{II}/L_{III}$ = 5.5/1/0.4/0.2), 0.1338, 0.1477 (K/L_I 2.7), 0.1488 (K/L_I 5.0), 0.1494, 0.1524, 0.1564, 0.1601, 0.1692 ($K/L_I/L_{II}$ = 5.9/1/0.08), 0.1728 (K/L_I 5.8), 0.1794 ($K/L_I/L_{II}/L_{III}$ = 4.3/1/0.5/0.2), 0.1816, 0.1895, 0.1913, 0.1983, 0.2082, 0.2093, 0.2144, 0.2157, 0.2221, 0.2261, 0.2293, 0.2474, 0.2564 (K/L_I ~6.5), 0.2641, 0.2763, 0.2814, 0.2865, 0.2999, 0.3005, 0.3390, 0.3510, 1.077, 1.122, 1.158, 1.189, 1.222, 1.231 (energies of some gammas taken from 164M55 and 128B56a) spect conv (108G57b); 0.110, 0.127, 0.222, 0.250, 0.346 spect conv, spect (2W50g); see also gammas of Ta^{182}, W^{182}, and 13 h Re^{182}	see Ta^{182}

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{75}Re^{183}$	71 d (108G58); 68 d (79F58); 155 d (33T51); 120 d (93S50)	☢	EC (2W50g);	γ	0.0410, 0.0465 ($L_I/L_{II}/L_{III}$ = 12/2.1/1), 0.0526 ($L_I/L_{II}/L_{III}$ = 8.6/1.6/1), 0.0829, 0.0847, 0.0991 (L_{II}/L_{III} 1.1), 0.1079, 0.1097 († of 0.1079 γ + 0.1097 γ: 6.3), 0.1423, 0.1441, 0.1605, 0.1614, 0.1623 (†13, $L_I/L_{II}/L_{III}$ = 8/1.8/1.1), 0.1926, 0.2051, 0.2088 (†1.4), 0.2099, 0.2443, 0.2453, 0.2461 (†~0.8), 0.2917, 0.3130, 0.3540, 0.3656, 0.4066 (energies of gammas except 0.2453 γ taken from 164M55) spect conv, scint spect (30T56, 108G58); 0.081, 0.252 spect conv (2W50g); 0.496 level of Re^{183}: $t_{1/2}$ 8 x 10^{-9} s delay coinc (30N57a); see also gammas of Ta^{183}, W^{183}, and Os^{183}	
		A	chem, excit (2W50g); chem, genet energy levels (30T56); daughter Os^{183} (93S50)			
Re^{184}	50 d (2W50g, 33T51)	☢	EC (2W50g);	γ	0.09733 (weak), 0.11120 (14%, L_{II}/L_{III} 1.6, coinc with 0.2528 γ, 0.793 γ, and 0.895 γ), 0.21 (?), 0.23 (~0.4%, coinc with 0.895 γ), 0.2411 (?), 0.25 (~0.8%, coinc with 0.793 γ and 0.904 γ), 0.2528 (~0.6%, e_K/γ ~0.08, coinc with 0.54 γ and 0.642 γ), 0.33 (~0.3%, coinc with 0.793 γ and 0.904 γ), 0.54 (~0.3%), 0.642 (~0.5%, e_K/γ ~0.008), 0.788 (weak), 0.793 (40%, e_K/γ 0.009, K/L_I 9), 0.895 (15%, e_K/γ 0.006), 0.904 (45%) spect conv, scint spect, γ-γ coinc (108G58); others (33T51, 29C40, 2W50g, 30T56); see also gammas of Ta^{184} and W^{184}; 0.111 γ: $t_{1/2}$ 1.3 x 10^{-9} s delay coinc (108G58)	
		A	chem, excit (5F40a); chem, excit (2W50g); chem, genet energy levels (108G58)			
Re^{184}	2.2 d (2W50g)	☢	EC or IT (2W50g);	γ	0.043, 0.159 spect, spect conv (2W50g)	see Os^{185}
		D	chem, excit (2W50g)			
Re^{185}		%	37.07 (24W48);	γ	Coulomb excitation (in Re^{185}): 0.1253 cryst spect (137C58); 0.128, 0.159, 0.287 ($t_{1/2}$ 5.5 x 10^{-12} s) scint spect (52M58); 0.126 (coinc with 0.160 γ), 0.160 (†100), 0.286 (†24) scint spect, γ-γ coinc (92W57); 0.125 (K/L 2.2) spect conv (116B57a); 0.125 spect conv (96H56); 0.125, 0.158 (†100), 0.28 (†12) scint spect (45D56); 0.128 (e_K/γ 2.4) scint spect (121S56, 52M57b); 0.130, 0.29 scint spect (102M55); ~0.16 (†100), ~0.29 (†23) scint spect (78G56, 65P56); see also gammas of Os^{185}	
		I	5/2 atomic spect (87M50); 5/2 microwave (51J54);			
		μ	+3.144 nucl induct (67K56, 61W53);			
		q	+2.8 atomic spect (87M50); others (231S57)			

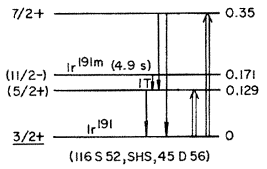
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{75}Re^{186}$	88.9 h (19P56); 92.8 h (24G47); 91 h (10C48); 90 h (99S39)	☢ β^- 92%, EC 8%, no β^+ (lim 2×10^{-4}%) (19P56); β^- 97%, EC 3% (25J56a, 25J53a); β^- 95%, EC 5%, no β^+ (lim 10^{-5}%) (44M51); A n-capt (8K35); n-capt, excit (99S39); chem, n-capt, excit (5F40a); mass spect (43H47); others (29C40, 12P48, 8Y40, 2S47, 66C50)	β^- 1.072 (†77), 0.934 (†23) spect, β-γ coinc (19P56); 1.064 (†76), 0.927 (†24) spect, β-γ coinc (25J56a); 1.07 (†80), 0.93 (†20) spect (44M51); 1.070 (†73), 0.942 (†27) spect (82S51a); 1.090 (†67), 0.95 (†30), 0.64 (†3) spect (22G49a); others (10L49, 86B49a, 1N56, 20R53, 44A56, 148M53, 92K54a, 19P55, 145H54); γ with β^-: γ_1 0.13722 cryst spect (76R55); 0.1372 (†100, e_K/γ 0.36, K/L 0.65), 0.627 (†0.7), 0.764 (†0.35) spect conv, scint spect (19P56); 0.1372 (10%, e_K/γ 0.45, K/L 0.62), 0.631 (0.02%, coinc with 0.137 γ), 0.768 (0.02%, not coinc with 0.137 γ) spect, spect conv, scint spect, γ-γ coinc (25J56a); 0.137 (e_K/γ ~0.35, K/L 0.6), 0.627, 0.764 spect, spect conv, β-γ, γ-γ coinc (44M51); 0.137 (L_{II}/L_{III} 1.24) spect conv (116S53, 116S53a); 0.137 γ: $t_{1/2}$ 8×10^{-10} s delay coinc (52M51a); with EC: γ_2 0.1227 (K/L 0.72) spect conv (19P56); 0.1229 (0.6%, K/L 0.43) spect conv (25J56a); 0.123 (~2%, γ_1/γ_2 9) (44M51); 0.122 (3%, e_K/γ 0.45, K/L 0.6) spect, spect conv, β-conv, γ-γ coinc (82S51a); others (22G49a, 10C48, 86B49a, 44A56, 145H54, 31A53, 65L57b, 10M57); see also gammas of Ta^{186}, W^{186}, and Ir^{186}	Q_{β^-} 1.068 (64K54); see Ir^{186}  (19P56, SHS)
Re^m	1 h (79H57)	D chem (79H57)		
Re^{187}	~5 x 10^{10} y yield (160H54); <10^{11} y sp act (169S54); >10^{16} y sp act (42D54); others (25N48, 63S48)	☢ β^- (25N48); no β^- (42D54, 42D55); A chem (25N48); % 62.93 (24W48); I 5/2 atomic spect (87M50); 5/2 microwave (51J54); μ +3.176 nucl induct (67K56, 61W53); q +2.6 atomic spect (87M50); others (23IS57)	β^- <0.008 abs (169S54); <0.001 ion ch (42D54, 42D55); ~0.034 range emuls (109G53); others (25N48); γ Coulomb excitation (in Re^{187}): 0.1342 cryst spect (137C58); 0.135 (coinc with 0.168 γ), 0.168 (†40), 0.303 (†10) scint spect (92W57); 0.135, 0.163 (†54), 0.30 (†10) scint spect (45D56); 0.134 (e_K/γ 2.1), 0.167, 0.301 ($t_{1/2}$ 4.5×10^{-12} s) scint spect (121S56, 52M58, 52M57b); 0.135 (K/L 4.6) spect conv (116B57a); 0.135 spect conv (96H56); 0.139, 0.32 scint spect (102M55); ~0.17 (†46), ~0.30 (†10) scint spect (78G56); 0.206 level of Re^{187}: $t_{1/2}$ 5.3×10^{-7} s delay coinc (4B49, 10D48); see also gammas of W^{187}	see W^{187}  (45 D56, SHS)

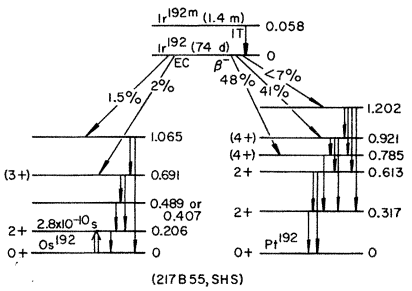
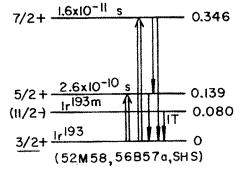
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{75}Re^{188m}$	18.7 m (9F53a); 22 m (63M53b); 17 m (65B50)	☢ IT (63M52b); A n-capt, sep isotopes (63M52b); chem, genet (147H52); parent Re^{188} (147H52)	γ	0.0635, 0.105 spect conv, scint spect (63M53b); 0.06 (e/γ ~2) abs (9F53a)	
Re^{188}	16.7 h (9F53a, 44A56, 16D54); 16.9 h (37L51); 18.9 h (24G47); 18 h (1P37)	☢ β^- (99S39); A chem, n-capt (12A35); n-capt, excit (99S39); chem, n-capt, excit (5F40a); mass spect (43H47); daughter W^{188} (37L51, 37L51a); others (8K35, 8Y40, 2S47, 66C50, 6O48)	β^-	2.12 (79%), 1.96 (20%), <1.9 (~1%) spect (25J56b, 25J56a, 25J53a); 2.15 (78%), 2.00 (21%), others (~1%) spect, β-γ coinc, scint spect (36P56b); 2.07 (coinc with 0.155 γ) spect, β-γ coinc (44R52a); 2.10 spect (86B49a); others (24G47, 26M48b, 99S39);	Q_{β^-} 2.12 (25J56b)  (25J56b, 36P56b, SHS)
			γ	0.1551 cryst spect (158H57a); 0.1549 cryst spect (76R55); 0.1550 (9%, e_K/γ 0.40, K/L 0.79, $L_I/L_{II}/L_{III}$ = 0.3/1.4/1.0, coinc all γ's except 0.633 γ and 1.959 γ), 0.454 (0.04%), 0.478 (0.6%, e_K/γ 0.06), 0.633 (1.0%, coinc with 0.828 γ, 1.133γ and 1.308 γ), 0.673 (0.09%), 0.828 (0.33%), 0.931 (0.41%), 1.133 (0.07%), 1.308 (0.05%, complex), 1.610 (0.07%), 1.783 (0.02%), 1.803 (0.03%), 1.959 (0.01%, not coinc with other γ) spect, spect conv, γ-γ coinc (148M53, 25J56a); 0.155 (†630, e_K/γ 0.33, K/L 0.70), 0.478 (†67, coinc with 0.633 γ, 0.828 γ, and 1.132 γ), 0.633 († 0.633 γ + 0.66 γ: 100, coinc with 0.828 γ and 1.132 γ), 0.66, 0.828 (†35), 0.931 (†43), 1.132 (†8), 1.307 (†14), 1.610 (†13), 1.78 (†6), 1.805 (†3), 1.96 (†3) spect conv, γ-γ, β-γ coinc (36P56b, 36P56a); 0.155 (16%) scint spect (10M57); 0.155 γ: $t_{1/2}$ 7×10^{-10} s delay coinc (14S55); others (44R52a, 86B49a, 43M46, 26M48b, 10C48); see also gammas of Os^{188} and Ir^{188}	
Re^{189}	150 d (37L51); 250-300 d (33T51)	☢ β^- (37L51, 33T51); D chem (37L51, 33T51); others (222S56a)	β^- γ	0.2 abs (37L51, 33T51); 1.0 abs (33T51)	
Re	9.8 m (25A53d)	☢ β^- (25A53d); D chem (25A53d)	β^-	1.8 abs (25A53d)	
Re^{190}	2.8 m (25A55b)	☢ β^- (25A55b); C chem, genet energy levels (25A55b)	β^- γ	1.7 abs (25A55b); 0.191 (†~100), 0.392 (†~100), 0.57 (†~100), 0.83 (†~30) scint spect (25A55b); see also gammas of Os^{190m} and Ir^{190}	see Os^{190m}
Re	≥5 y (37L51)	☢ β^- (37L51); E chem (37L51)	β^-	0.75 abs (37L51)	
$_{76}Os^{181}$	23 m (79F58)	☢ [EC] (79F58); B chem, excit, sep isotopes (79F58)	γ	0.166, 0.174 (79F58)	
Os^{182}	21.9 h (79F58); 24.0 h (93S50); 21 h (30N57a)	☢ EC, no β^+ (93S50); A chem, genet (93S50); parent Re^{182} (13 h) (93S50, 79F58)	γ	0.510 (e_K/γ ~0.03), 0.1802, 0.0555, 0.0276 (?) spect conv, scint spect, γ-γ coinc (30N57a); 0.509 (79F58)	

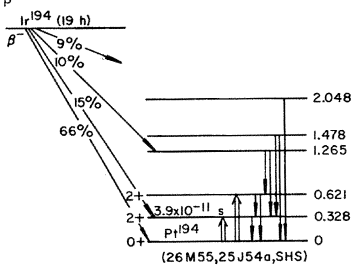
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{76}Os^{183m}$	10 h (30N57a, 79F58)	☢	IT, EC (30N57a);	γ	with IT: 0.1707 ($L_I/L_{II}/L_{III}$ = 1.0/0.5/1.6) spect conv, scint spect, γ-γ coinc (30N57a); with EC: 1.109, 1.103, 1.036, 0.0673 spect conv, scint spect, γ-γ coinc (30N57a); 0.486, 0.846, 1.11 (79F58)	 (30N57a)
		B	chem, excit, sep isotopes (79F58)			
Os^{183}	13.5 h (30N57a); 15.4 h (79F58); 12.0 h (93S50)	☢	EC (93S50);	γ	0.1144, 0.1454, 0.1679, 0.1971, 0.2362, 0.2598, 0.3818 (e_K/γ 0.011, coinc with 0.114 γ and 0.168 γ), 0.4772, 0.4961, 0.808, 0.852, 0.888, 0.890 spect conv, scint spect, γ-γ coinc (30N57a); 0.1146, 0.1455, 0.1687, 0.382 (79F58); 0.382 γ: $t_{1/2}$ 8 x 10^{-9} s delay coinc (30N57a)	
		A	chem, genet (93S50); parent Re^{183} (93S50)			
Os^{184}		%	0.018 (6N37a)			
Os^{185}	93.6 d (25J57); 93 d (79F58); 97 d (50K48, 33T51); 95 d (24G47)	☢	EC (L/K 0.38) (25J57); EC (L/K ~0.35) (69M51a); EC to 0.878 level: L/K 1.1 (115B57a); no β^+ (lim 10^{-7}%) (174M58);	γ	0.0716 ($L_I/L_{II}/L_{III}$ = 1.0/0.5/0.5), 0.1255 (†0.8), 0.1626 (†0.8, e_K/γ 0.41, K/L 4.1, coinc with 0.718 γ), 0.2334 (†1.5, e_K/γ 0.10, K/L 3), 0.592 (†1.3, e_K/γ 0.016), 0.646 (†100, e_K/γ 0.011, K/L 3.7), 0.718 (†5.1, e_K/γ 7 x 10^{-3}, K/L 2.1), 0.872 (†9, e_K/γ 0.01, K/L 7.7), 0.879 (†9, e_K/γ 6 x 10^{-3}, K/L 3.5) spect, spect conv, scint spect, γ-γ coinc (25J57); 0.125 (coinc with 0.590 γ), 0.160 (coinc with 0.718 γ), 0.233 (coinc with 0.646 γ), 0.590 (†<10), 0.647 (†100, e_K/γ 0.011, K/L 5), 0.718 (†<10), 0.875 (†10, e_K/γ ~5 x 10^{-3}) spect conv, scint spect, γ-γ coinc (54M57); 0.0725, 0.125, 0.162, 0.234, 0.647 (†100), 0.875 (†16) spect conv, scint spect (64P55, 69M51b); 0.075, 0.120, 0.158, 0.233, 0.593, 0.643, 0.870, 0.878 spect conv, scint spect (174M58); 0.070, 0.65 (†100), 0.88 (†13) scint spect, γ-γ coinc (115B57a); others (2B50b, 116S52, 79F58, 10C53b); see also gammas of Re^{185}	Q_{EC} 0.98 calc (115B57a) Q_{EC} 0.99 calc (25J57) 
		A	chem, cross bomb (24G47, 50K48); chem, genet energy levels (64P55, 54M57); others (66C50, 93S50, 2B50b)			
Os^{186}		%	1.59 (6N37a)	γ	0.137 level of Os^{186}: $t_{1/2}$ 8 x 10^{-10} s delay coinc (52M51a); see also gammas of Re^{186}	see Re^{186}
Os^{187m}	39 h (110G56); 35 h (66C50)	F	chem (66C50); not daughter Ir^{187} (17S58)	γ	K-x (110G56)	
Os^{187}	t_{EC} >10^{15} y sp act (42D54, 42D55)	%	1.64 (6N37a);			
		I	1/2 atomic spect (88M55);			
		μ	+0.12 atomic spect (88M55)			
Os^{188}		%	13.3 (6N37a)	γ	Coulomb excitation (in Os^{188}): 0.155 ($t_{1/2}$ 6 x 10^{-10} s) scint spect (52M58); 0.155 scint spect (97H54, 122B57b); 0.155 level of Os^{188}: $t_{1/2}$ 7 x 10^{-10} s delay coinc (14S55); see also gammas of Re^{188}	see Re^{188}

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{76}Os$	26 d (110G56)	E	chem (110G56)	γ	K-x (110G56)	
Os^{189m}	5.7 h (17S58); 6 h (66C50); 7 h (110G56)	☢	IT (17S58);	γ	0.03087 ($L_I/L_{II}/L_{III}$ = 0.18/0.02/1.00) spect conv (30N57a); 0.03000 (e/γ ~5 x 10^3, L_I+L_{II}/L_{III} <0.2), no K-x spect conv, scint spect (17S58); K-x (110G56)	
		B	chem (66C50, 110G56); chem, genet (17S58); daughter Ir^{189} (17S58)			
Os^{189}		%	16.1 (6N37a);	γ	Coulomb excitation (in Os^{189}) (97H54)	
		I	3/2 atomic spect (88M52a, 88M51a); 3/2 nucl induct (85L54);			
		μ	+0.6507 nucl induct (85L54);			
		q	+0.6 atomic spect (88M52a, 88M51a, 88M57)			
Os^{190m}	9.5 m (66C50); 10 m (25A55c)	☢	IT (17S57, 25A55c);	γ	0.039 (e/γ >200, L_I+L_{II}/L_{III} ~2), 0.187, 0.359, 0.500, 0.614 spect conv, scint spect (17S58, 17S57); 0.186 (†75), 0.356 (†90), 0.510 (†100), 0.62 (†92), all γ's coinc with each other scint spect, γ-γ coinc (25A55c); 0.186 γ: $t_{1/2}$ 3.5 x 10^{-10} s delay coinc (14S57a); 0.359 γ: $t_{1/2}$ ~4 x 10^{-11} s delay coinc (14S57a); see also gammas of Re^{190}, Os^{190}, and Ir^{190}	Q_{IT} 1.70 (17S58)
		B	chem, genet (66C50, 25A55c); daughter Ir^{190} (3.2 h) (66C50, 25A55c)			
Os^{190}		%	26.4 (6N37a)	γ	Coulomb excitation (in Os^{190}): 0.190, 0.38 (coinc with 0.190 γ), 0.57 scint spect, γ-γ coinc (122B57b); 0.186 ($t_{1/2}$ 3.5 x 10^{-10} s) scint spect (52M58); others (97H54, 52M57); see also gammas of Os^{190m}, Re^{190}, and Ir^{190}	
Os^{191m}	14 h (116S52)	☢	IT, no β^- (lim 5%) (116S52);	γ	0.0742 ($L_I/L_{II}/L_{III}$ = 0.42/0.24/1.00) spect conv (116S53a, 116S53, 116S52); 0.0742 ($L_I/L_{II}/L_{III}$ = 0.55/0.16/1.00) spect conv (63M55); others (67H53)	
		A	chem, genet (116S52); parent Os^{191} (116S52)			
Os^{191}	16.0 d (66C50); 16.1 d (9S48a); 15.0 d (50K48)	☢	β^- (13S41b);	β^-	0.143 spect (38K51b, 38K52); 0.142 spect (9S48a); others (50K48, 13S41b, 37W47, 26M48b, 2B50b);	Q_{β^-} 0.313 (38K51b); see Ir^{191m} and Pt^{191}
		A	n-capt (12Z40); chem, n-capt (13S41b); chem, excit (23F48a, 116S52); daughter Os^{191m} (116S52); parent Ir^{191m} (21N54a, 24C56); others (2S47, 6O48)	γ	with Ir^{191m}: 0.0417 (L_{II}/L_{III} 0.80, e/γ large), 0.1291 ($K/L_I/L_{II}/L_{III}$ = 100/30/11/6, coinc with 0.0417 γ) spect conv, conv-conv coinc (116S52, 116S53, 116S53a); 0.042 (L/M 1.8), 0.128 (e_K/γ ~0.5, K/L 2.1) spect conv (38K51b, 38K51c, 38K52); 0.129 (e_K/γ 2.1, not coinc with β^-) scint spect, β-γ coinc (52M54); 0.124 (e_K/γ 3.2) scint spect (17J52a); others (2B50b, 9S48a, 10C47, 10C53b, 60W54); see also gammas of Ir^{191m}, Ir^{191}, and Pt^{191}	
Os^{192}	$t_{\beta\beta}$ >10^{14} y sp act (59F52)	%	41.0 (6N37a)	γ	Coulomb excitation (in Os^{192}): 0.206, 0.29 (coinc with 0.206 γ), 0.50 scint spect, γ-γ coinc (122B57b); 0.206 ($t_{1/2}$ 2.8 x 10^{-10} s) scint spect (52M58); others (97H54, 52M57); see also gammas of Ir^{192}	see Ir^{192}

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{76}Os^{193}$	30.6 h (66C50); 31.5 h (45N56); 31.9 h (24G47); 32 h (13S41b); 30 h (12Z40)	☢ β^- (13S41b); A n-capt (8K35, 12Z40); chem, n-capt (13S41b); chem, excit (23F48a, 116S52)	β^-: 1.14 (40%), 1.06 (33%), 1.00 (5%), 0.86 (12%), 0.68 (10%) spect (45N56); 1.10, 1.03, 0.96, 0.82, 0.6 scint spect, β-conv coinc (60W54); 1.10 spect (2B50b); others (52M50b, 66C50, 26M48b); γ: 0.251, 0.281, 0.321, 0.362, 0.388, 0.460, 0.558 spect, spect conv (45N56); 0.073 (L_I/L_{II} ~1), 0.106, 0.139 (K/L ~5), 0.251, 0.281 (K/L ~10), 0.321 (K/L ~8), 0.404, 0.460, 0.558, no 0.215 γ spect conv (10C53b); no 0.106 γ, no 0.404 γ scint spect, spect conv (60W54); 0.073 γ: $t_{1/2}$ 5.7×10^{-9} s delay coinc (52M50b); $t_{1/2}$ 6.0×10^{-9} s delay coinc (60W54); others (165S53, 2B50b, 24G47, 26M48b); see also gammas of Ir^{193}	Q_{β^-} 1.14 (45N56); see Ir^{193} Os^{193} (31h) β^- 0.460 0.281 2.6×10^{-10} s 0.139 5/2+ 5.7×10^{-9} s 0.073 Ir^{193} 3/2+ 0 (45N56, 60W54, SHS)
Os^{194}	~700 d (37L51)	☢ [β^-] (37L50a); B chem, genet (37L50a); parent Ir^{194} (37L50a, 37L51)		
Os^{195}	6.5 m (202B57)	☢ β^- (202B57); D chem, genet (202B57); parent Ir^{195} (202B57)	β^-: 2 abs (202B57)	
$_{77}Ir^{185}$	15 h (43D58)	☢ EC (43D58); B chem, excit (43D58)	γ: 0.0374, 0.0599, 0.0973, 0.1008, 0.1044, 0.2544, other γ's, spect conv, scint spect (43D58)	
Ir^{186}	15 h (17S58); 16 h (43D58); 14 h (119S55)	☢ EC, β^+ (<10%) (17S58); B chem, excit, genet energy levels (17S58); chem, excit (43D58); daughter Pt^{186} (119S55)	γ: 0.1372, 0.2969, 0.4348, 0.631, 0.769, 0.775, 0.923 (?) spect conv, scint spect (43D58); 0.137, 0.297 (K/L 2.2, coinc with 0.137 γ and 0.434 γ), 0.434 (K/L 3.0, coinc with 0.137 γ), 0.625, 0.773, 0.923 scint spect, spect conv, γ-γ coinc (17S58); 0.14 (↑100), 0.30 (↑110), 0.44 (↑80) scint spect (119S55); see also gammas of Re^{186}	Ir^{186} (14 h) EC, β^+ see Re^{186} (6+) 0.878 (4+) 0.444 2+ 8×10^{-10} s 0.137 0+ Os^{186} 0 (17S58, SHS)
Ir^{187}	13 h (43D58)	☢ EC (43D58); B chem, excit (43D58)	γ: 0.0255, 0.0652, 0.0742, 0.0750, 0.0905, 0.1131, 0.1776, 0.1875, 0.3140, 0.401, 0.427, 0.442 (?), 0.914 (?), 0.979 spect conv, scint spect (43D58)	
Ir^{188}	41.5 h (66C50); 41 h (119S55); 40 h (21N54)	☢ EC 99+%, β^+ ~0.3% (66C50); B chem, excit, sep isotopes (66C50); daughter Pt^{188} (21N54, 119S55)	β^+: 2.0 spect (66C50); γ: 0.1550 ($K/L_{II}/L_{III}$ ~1.1/1.0/0.8), 0.3230, 0.479, 0.634, 0.825, 0.830, 1.212, 1.33, 1.45, 1.6, 1.71, 1.94, 2.05, 2.18 spect conv, scint spect (43D58); 0.156 spect conv (21N54); 0.150 (↑90), 0.48 (↑60), 0.63 (↑100) scint spect (119S55); see also gammas of Re^{188}	see Re^{188}
Ir^{189}	11 d (119S55); 12.6 d (66C50)	☢ EC (119S55); B chem, genet (119S55); daughter Pt^{189} (119S55); parent Os^{189m} (17S58)	γ: 0.0308, 0.0362, 0.0590, 0.0695 ($L_I/L_{II}/L_{III}$ ~1/1/1), 0.0952, 0.2450 scint spect, spect conv (43D58); with Ir^{189} or Ir^{190}: 0.1358, 0.147, 0.150, 0.164, 0.186, 0.189, 0.206, 0.2166, 0.2193, 0.2336, 0.276 spect conv (43D58); ~0.14 (?), 0.25 scint spect (119S55); with Os^{189m}: 0.0300 spect conv (17S58); see gammas of Os^{189m}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{77}Ir^{190}$	3.2 h (66C50)	☢ EC ~90%, β^+ ~10% (25A55c); B chem, excit, sep isotopes (66C50); chem, cross bomb (25A55c); parent Os^{190m} (66C50, 25A55c)	β^+ 2.0 scint spect (25A55c); 1.7 spect (66C50); γ 0.186 (†100), 0.36 (†100), ~0.56 (†115, complex), 0.62 (†100), all gammas in coinc with each other, scint spect, γ-γ coinc (25A55c); see also gammas of Re^{190} and Os^{190m}	see Os^{190m}
Ir^{190}	11 d (25A55c); 10.7 d (24G47)	☢ EC (25A55c); B chem, excit (24G47, 25A55c)	γ 0.186 (†75, coinc with 0.356 γ and 0.401 γ), 0.356 (†~30), 0.401 (†~55), 0.557 (†145, complex), 0.604, 0.80 (†17), 1.33 (†2) spect conv, scint spect, γ-γ coinc (20N54a, 25A55c); 0.1867 ($K/L_{II}/L_{III}$ 1.5/1.0/1.0), 0.361, 0.371, 0.407, ~0.52, 0.558, 0.568, ~0.61 spect conv, scint spect (43D58); see also gammas of Ir^{189}, Re^{190}, and Os^{190m}	
Ir^{191m}	4.9 s (34F55, 24C56); 5.6 s (21N54a); 7 s (63M54c)	☢ IT (21N54a); A chem, genet (21N54a, 24C56); daughter Os^{191} (21N54a, 24C56)	γ 0.0417 (L_{II}/L_{III} 0.80, e/γ large), 0.1291 ($K/L_I/L_{II}/L_{III}$ = 100/30/11/6, coinc with 0.0417 γ) spect conv, conv-conv coinc (116S52, 116S53, 116S53a); 0.14 (e_K/γ 2.7) scint spect (34F55); others (21N54a, 63M54c, 65B54); see also gammas of Os^{191} and Au^{191}	Q_{IT} 0.171 (SHS) 
Ir^{191}		% 38.5 (37S36a); I 3/2 atomic spect (88M52a, 120S53a); μ +0.16 atomic spect (88M52a); +0.2 atomic spect (120S53a); +1.5 atomic spect (120S53a); +1.2 atomic spect (88M52a); others (87M50, 99B50, 94B49) q	γ Coulomb excitation (in Ir^{191}): 0.133, 0.216 (†11), 0.356 (†10) scint spect (45D56); 0.129 (K/L 3.9), 0.083 spect conv (116B57a); 0.129 spect conv (96H56); 0.129 (e_K/γ 2.9) scint spect (52M57b, 52M58); 0.083 level of Ir^{191}: $t_{1/2}$ 3.9×10^{-9} s delay coinc (14S55); see also gammas of Os^{191} and Pt^{191}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{77}Ir^{192m}$	1.42 m (15H48a, 115M54); 1.45 m (84W53); 1.5 m (12M37)	☢ IT 99.9%, β^- ~0.1% (84W53); γ A n-capt (12M37); resonance neutron activation (18G47a); others (2S47)	γ 0.0580 (L_{II}/L_{III} 1.1, e_L/γ >870) spect conv, scint spect (115M54); 0.056 ($e/\gamma \geq 1000$) spect conv (84W53); no gamma continuum (115M54, 84W53); others (42C50, 15H48a, 38M51)	Q_{IT} 0.058 (115M54)
Ir^{192}	74.37 d (51K51); 74.5 d (38S51); 74.7 d (66C50)	☢ β^- 95.5%, EC 4.5% (117B56); β^- 96.5%, EC 3.5%, no β^+ (lim 10^{-4}%) (217B55); A n-capt (12A36); mass spect (37R46); chem (2W48a); others (12M37, 24J38, 2S47, 25C52, 41M51)	β^- 0.67 spect (2L47, 217B55, 25J54a); 0.66 spect (88S51a); others (37W47, 26M48a, 24G47, 117B52); γ with β^-: 0.13633 (†1.9, e_K/γ 1.0, $K/L_I+L_{II}/L_{III}$ = 1.0/0.63/0.44), 0.2959 (†360, e_K/γ 0.065, $K/L_I+L_{II}/L_{III}$ = 1.0/0.4/0.1), 0.3085 (†350, e_K/γ 0.069, $K/L_I+L_{II}/L_{III}$ = 1.0/0.41/0.12), 0.3165 (†1000, $K/L_I+L_{II}/L_{III}$ = 1.0/0.33/0.11, coinc with 0.468 γ), 0.4166 (†16, e_K/γ 0.019), 0.4680 (†640, e_K/γ 0.022, $K/L_I+L_{II}/L_{III}$ = 1.0/0.24/0.05), 0.5884 (†71, e_K/γ 0.011, K/L_I+L_{II} 3.5, coinc with 0.613 γ), 0.605 (†140, e_K/γ 0.016, K/L_I+L_{II} 5.1), 0.613 (†84, e_K/γ 0.011, K/L_I+L_{II} 4.8), 0.79 (†1), 0.885 (†5, e_K/γ 0.007) cryst spect, spect conv, scint spect, γ-γ coinc (217B55, 100M52); 0.2960, 0.3087, 0.3165, 0.4680 cryst spect (76R55); 0.1363 ($L_I/L_{II}/L_{III}$ = 0.26/0.54/0.44), 0.2959 ($K/L_I/L_{II}/L_{III}$ = 1.0/0.14/0.19/0.09), 0.3085 ($K/L_I/L_{II}/L_{III}$ = 1.0/0.15/0.17/0.10), 0.3165 ($K/L_I/L_{II}/L_{III}$ = 1.0/0.15/0.21/0.10), 0.468 ($K/L_I/L_{II}/L_{III}$ = 1.0/0.17/0.12/0.05), 0.605 ($K/L_I/L_{II}/L_{III}$ = 1.0/0.14/0.05/0.02) spect conv (70K57a); 0.1362 (†34), 0.1740 (†10), 0.2815 (†13), 0.2958 (†340), 0.3084 (†360), 0.3165 (†1000), 0.440 (†6), 0.4678 (†740), 0.5887 (†83), 0.6045 (†130), 0.6127 (†100), 0.745 (†0.6), 0.783 (†0.6), 0.885 (†12), 1.157 (†1) spect (25J54a); with EC: 0.20131 (†4.6, e_K/γ 0.30, $K/L_I+L_{II}/L_{III}$ = 1.0/0.40/0.23), 0.20575 (†39, e_K/γ 0.16, $K/L_I+L_{II}/L_{III}$ = 1.0/0.48/0.25), 0.28335 (†6, e_K/γ 0.04), 0.3747 (†19), 0.4848 (†39, e_K/γ 0.022), 1.06 (†0.5) cryst spect, spect conv (217B55); 0.2012 (†10), 0.2054 (†45), 0.374 (†6), 0.484 (†70), 1.065 (†2) spect (25J54a); 0.2013 ($K/L_I/L_{II}/L_{III}$ = 1.0/0.16/0.22/0.14), 0.2058 ($K/L_I/L_{II}/L_{III}$ = 1.0/0.12/0.27/0.17) spect conv (70K57a); others (76L54b, 111G55, 18P54, 62T55, 117B52, 50R52, 10C51f, 103S51, 2L47, 20D50, 4B49, 67H48b, 52W51, 98S48, 56G49, 88S51a, 6W50a, 105K56, 129K56, 225S57, 16D56, 112G55, 70P56, 76D56, 232S57, 16D56i, 168M57); see also gammas of Au^{192} and Os^{192}	Q_{β^-} 1.45 (217B55); see Os^{192} 
Ir^{193m}	11.9 d (56B57a)	☢ IT (56B57a); γ B chem, n-capt (56B57a)	γ 0.0802 ($L_I/L_{II}/L_{III}$ = 5.5/1/23) spect conv (56B57a)	Q_{IT} 0.080 (56B57a); see Os^{193}
Ir^{193}		% 61.5 (37S36a); γ I 3/2 atomic spect (88M52a, 87M50); μ +0.17 atomic spect (88M52a); +0.2 atomic spect (120S53a); q +1.5 atomic spect (120S53a); +1.0 atomic spect (88M52a)	Coulomb excitation (in Ir^{193}): 0.140 (e_K/γ 2.2, $t_{1/2}$ 2.6 x 10^{-10} s), 0.217, 0.357 ($t_{1/2}$ 1.6 x 10^{-11} s) scint spect (52M58, 52M57b); 0.143, 0.230 (†32), 0.37 (†100) scint spect (45D56); 0.139 spect conv (96H56); 0.140, 0.073 spect conv (116B57a); 0.073 level of Ir^{193}: $t_{1/2}$ 5.7 x 10^{-9} s delay coinc (52M50b); see also gammas of Os^{193}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{77}Ir^{194}$	19.0 h (24G47); 19.5 h (53W41); 19 h (12A35, 12M37)	☢ β^- (12M37); A n-capt (12A35); mass spect (37R46); chem (2W48a); daughter Os^{194} (37L50a, 37L51); others (1P37, 2S47, 24J38, 25C52)	β^- γ	2.24 (66%), 1.91 (15%), 0.98 (10%), 0.43 (~8%) spect (25J54a); 1.88 (coinc with 0.328 γ), 0.94 (coinc with 0.937 γ), 0.74 (coinc with 1.149 γ) scint spect, β-γ coinc (26M55); 2.18 spect (53W41); 2.2 spect (24A36); others (26M48a, 24G47); 0.3291 cryst spect (76R55); 0.2930 (†5), 0.3281 (†27), 0.62 (†1.7), 0.643 (†6), 0.937 (†2.9), 1.149 (†2.9), 1.180 (†1.7), 1.216 (†0.4), 1.339 (†0.3), 1.466 (†0.8), 1.478 (†0.2), 1.507 (†0.3), 1.618 (†0.3), 1.662 (†0.2), 1.802 (†0.3), 2.048 (†0.05) spect (25J54a); 0.295, 0.325 (†27, coinc with 0.295 γ, 0.93 γ, 1.14 γ, and 1.45 γ), 0.63 (†0.63 γ + 0.64 γ: 2.7), 0.64 (coinc with 0.295 γ, 0.325 γ, 0.63 γ, and 0.93 γ), 0.93 (†2.1), 1.14 (†2.3), 1.45 (†0.5), 1.77 (†0.24), 2.00 (†0.05) scint spect (26M55); others (65B54a, 58K53, 81W52, 10C51f, 23W50, 4B49, 26M48a, 42C50, 37L51); see also gammas of Pt^{194} and Au^{194}	Q_{β^-} 2.21 (SHS) 
Ir^{195}	2.3 h (65B54a); 2.7 h (25C52)	☢ β^- (25C52); D chem, excit (25C52, 65B54a); daughter Os^{195} (202B57)	β^- γ	2.1, 1.3 abs, β-γ coinc (65B54a); ~1 abs (25C52); 0.42, 0.66, 0.88, >1.0 scint spect (65B54a); see also gammas of Pt^{195} and Au^{195}	see Pt^{195} and Au^{195}; Q_{β^-} 2.1 (64K54)
Ir^{196}	9.7 d (65B54a)	☢ β^- (65B54a); D chem, cross bomb (65B54a)	β^- γ	0.08 abs (65B54a); 0.58, 0.76, ~1 scint spect (65B54a); see also gammas of Pt^{196} and Au^{196} (5.6 d)	see Au^{196}
Ir^{197}	7 m (25C52, 65B54a)	☢ β^- (65B54a); D chem, excit (25C52); chem, cross bomb (65B54a)	β^- γ	1.6, <1.6 abs, β-γ coinc (65B54a); 1.8 scint spect (65B54a)	
Ir^{198}	50 s (65B54a)	☢ β^- (65B54a); C excit, cross bomb (65B54a)	β^- γ	3.6 abs (65B54a); 0.78 (coinc with 3.6 β^-) scint spect, β-γ coinc (65B54a); see also gammas of Pt^{198}	Q_{β^-} 4.4 (64K54)
$_{78}Pt^{186}$	2.5 h (119S55)	☢ [EC] (119S55); D chem, genet (119S55); parent Ir^{186} (119S55); daughter Au^{186} (119S55)			
Pt^{188}	10.0 d (119S55); 10.3 d (21N54)	☢ EC (21N54); B chem, genet (21N54, 119S55); parent Ir^{188} (21N54, 119S55); daughter Au^{188} (119S55)	γ	0.20 (†100), 0.28 (†10), ~0.40 (†30) scint spect (119S55); others (21N54)	
Pt^{189}	11 h (119S55)	☢ [EC] (119S55); B chem, excit (119S55); parent Ir^{189} (119S55); daughter Au^{189} (119S55)	γ	0.14, ~0.55 (?), 0.70 (?) scint spect (119S55)	

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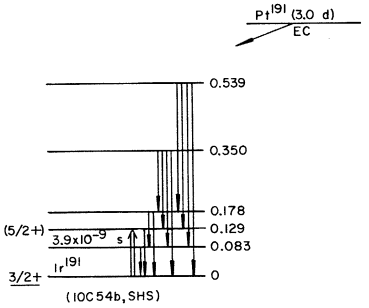
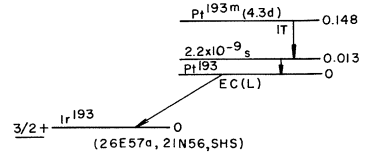
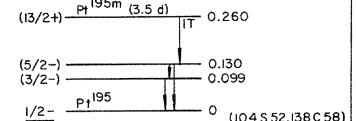
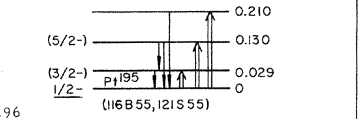
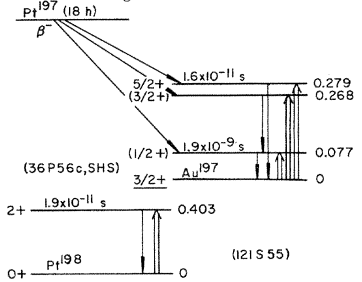
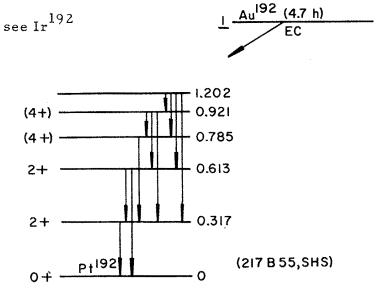
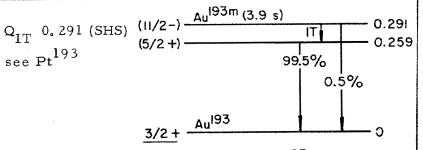
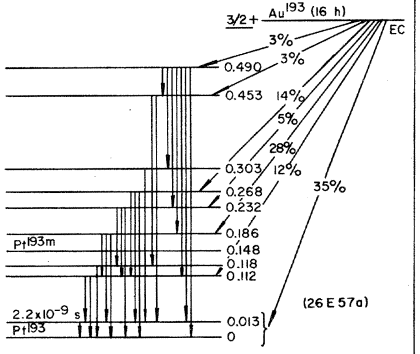
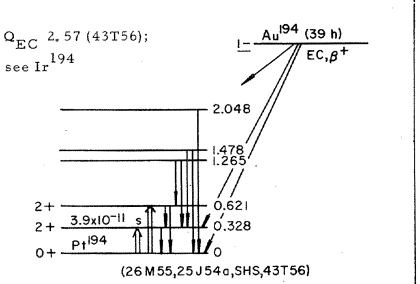
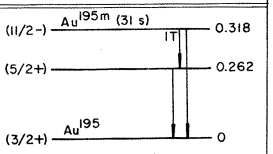
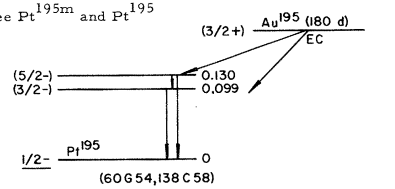
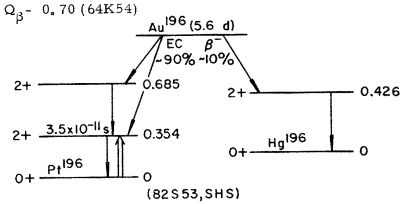
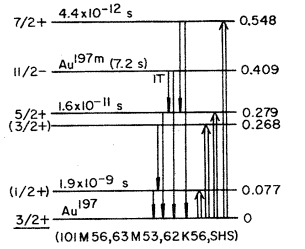
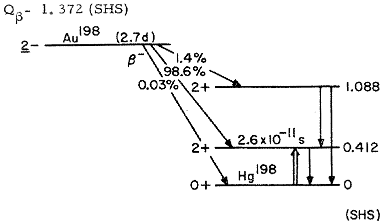
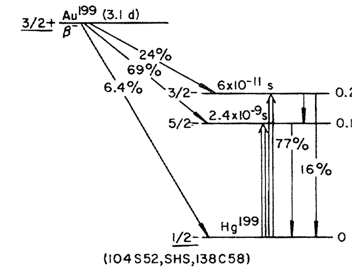
$_{78}Pt^{190}$	5.9×10^{11} y sp act (171M57); 9.6×10^{11} y sp act (37P56, 37P54)	☢	α (37P54);	α	3.30 ion ch (171M57); 3.3 range emuls (37P56, 37P54)	
		A	decay charac (37P56); chem, sep isotopes (171M57);			
		%	0.0127 (64W56); 0.012 (28L49a)			
Pt^{191}	3.00 d (2W49c); 2.90 d (10C54b); 3.0 d (119S55); 3.2 d (116S53b)	☢	EC (2W48a);	γ	0.0825 ($L_I/L_{II}/L_{III}$ = 1.0/1.8/1.6), 0.0965 (K/L_I 4.5, L_I/L_{II} 5), 0.1294 (K/L_I 3.3, L_I/L_{II} 3) spect conv (60G54);	
		A	chem, excit (2W48a); genet energy levels (60G54); daughter Au^{191} (119S55)		0.0737 (?), 0.0826, 0.0964 (K/L_I ~2), 0.1296 (K/L_I ~3, L_I+L_{II}/L_{III} ~8), 0.1723 (K/L_I ~5), 0.1784, 0.2197, 0.2684, 0.351 (K/L ~9), 0.360 (K/L ~7), 0.409 (K/L >10), 0.456 (K/L ~9), 0.539 (K/L ~7), 0.550, 0.623 spect conv, γ-γ coinc (10C54b); 0.042, 0.047, 0.082, 0.097, 0.129, 0.172, 0.179, 0.188, 0.219, 0.221, 0.223, 0.267, 0.268, 0.271, 0.352, 0.361, 0.410, 0.447, 0.458, 0.496, 0.540, 0.543, 0.571, 0.585, 0.590, 0.626 spect conv (7T55); 0.13 (†~50), 0.18 (†40), 0.27 (†20), 0.36 (†100), 0.41 (†80), 0.45 (†20), 0.53 (†170) scint spect (119S55); 0.083 γ: $t_{1/2}$ 3.9×10^{-9} s delay coinc (14S55); others (36P56c, 116S53b, 2W49c); see also gammas of Os^{191}, Ir^{191}, and Ir^{191m}	
Pt^{192}	~10^{15} y sp act (37P56)	☢	α (37P56);	α	2.6 range emuls (37P56)	
		E	decay charac (37P56);			
		%	0.78 (3I47g, 64W56)			
Pt^{193m}	4.3 d (2W49c); 3.4 d (10C54b); 3.5 d (114B55); 4.5 d (116S53b)	☢	IT (116S52a);	γ	0.1355 ($K/L_I/L_{III}$ = 1/1.4/2.8), 0.0127 (coinc with 0.1355 γ) spect conv, conv-conv coinc (26E57a); 0.1355 ($K/L_I/L_{III}$ = 1/4/6) spect conv (10C54b); 0.1354 ($K/L_I/L_{III}$ = 1/2/4) spect conv (114B55); 0.135 ($K/L_I/L_{III}$ = 1/1.2/2.4) spect conv (116S53b); 0.0127 γ: $t_{1/2}$ 2.2×10^{-9} s delay coinc (26E57a); others (2W49c, 36P56c); see also gammas of Au^{193}	Q_{IT} 0.148 (26E57a); see Au^{193} 
		B	chem, excit (2W48a); daughter Au^{193} (2W49c); daughter Au^{193m} (0.03%) (114B55)			
Pt^{193}	no act observed lim $t_{1/2}$ >74 d, <1 h (116S53b)	☢	EC (L/K >1000), no β^-, no β^+, no EC (K) (21N56);	EC	Ir L-x, no γ (21N56)	
		B	n-capt, chem (21N56)			
Pt^{194}		%	32.9 (64W56); 32.8 (3I47g);	γ	Coulomb excitation (in Pt^{194}): 0.328 scint spect (97H54); 0.330 ($t_{1/2}$ 3.9×10^{-11} s), 0.292 (coinc with 0.330 γ) scint spect (52M57, 121S55, 52M55); others (102M55, 61G57); see also gammas of Ir^{194} and Au^{194}	see Ir^{194} and Au^{194}
		μ	~0 atomic spect (87M50)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{78}Pt^{195m}$	3.5 d (15H48a); 3.8 d (104S52); 4.4 d (79H52); 3.3 d (12M37)	☢	IT (104S52);	γ	0.0311 (L_I/M 6.4), 0.0991 ($K/L_I/L_{III}$ = 23/13/1), 0.1299 ($K/L_I/L_{III}$ = 1.0/5.0/8.5), 0.031 γ coinc with 0.099 γ, spect conv, γ-γ coinc (10C54b, 10C52a); 0.029 (e/γ >7.5), 0.097 (e/γ 9.0, K/L 5.7), 0.126, 0.129 (e/γ very large, K/L 0.26) spect, spect conv, γ-conv coinc (104S52); 0.031 (coinc with 0.099 γ), 0.099 (not coinc with 0.130 γ), 0.130 scint spect, γ-γ coinc (36P56c); 0.126 (K/L 0.23) spect conv (15H48a); see also gammas of Au^{195} and Pt^{195}	Q_{IT} 0.260 (SHS) see Pt^{195} and Au^{195} 
		A	chem (12M37); chem, genet (104S52); genet energy levels (10C54b, 116B55); daughter Au^{195} (?) (104S52); others (26M48e, 1P37, 2S47, 34H51, 9K41b, 25C52)			
Pt^{195}		%	33.8 (64W56); 33.7 (3I47g);	γ	Coulomb excitation (in Pt^{195}): 0.029, 0.097, 0.210 (K/L 6) spect conv (116B55); 0.029, 0.098, 0.128 scint spect (97H54); 0.100, 0.130, 0.210, 0.240 scint spect (121S55); 0.210 spect conv (96H56); scint spect (102M55, 102M53); see also gammas of Pt^{195m} and Au^{195}	see Pt^{195m} and Au^{195} 
		I	1/2 atomic spect (87M50);			
		μ	+0.6004 nucl induct (67K56,61W53);			
Pt^{196}		%	25.2 (64W56); 25.4 (3I47g);	γ	Coulomb excitation (in Pt^{196}): 0.358 ($t_{1/2}$ 3.5×10^{-11} s) scint spect (121S55, 52M55); 0.36 scint spect (102M55); others (61G57); see also gammas of Au^{196} (5.6 d)	see Au^{196}
		μ	~0 atomic spect (87M50)			
Pt^{197m}	78 m (15H48a); 80 m (28S41); 88 m (25C52)	☢	IT (15H48a);	γ	0.337 (e/γ very large, K/L 1.3) spect conv (15H48a); 0.346 spect conv (67L56)	
		B	chem (28S41); chem, excit, cross bomb (25C52); others (60M48)			
Pt^{197}	18 h (12M37); 17.4 h (10C52a)	☢	β^- (12M37);	β^-	0.670 spect (105S52, 34H51); 0.670, 0.479, 0.468 scint spect, β-γ coinc (36P56c); others (9K41b, 28S41);	Q_{β^-} 0.75 (64K54); see Au^{197} and Hg^{197}  Q_{β^-} 1.7 (67L56)
		A	chem (10C36); chem, excit (12M37); others (2S47, 79H52, 10C36, 9K42, 2W48a, 25C52, 25W48)	γ	0.077, 0.191 (K/L 6.0) spect conv (10C52a); 0.077, 0.191 spect, spect conv (105S52); 0.077 (†30, coinc with 0.67 β^- and 0.191 γ), 0.191 (†3.9, e_K/γ ~2.5, coinc with 0.479 β^-), 0.279 (†1, coinc with 0.468 β^-, not coinc with γ) scint spect, β-γ, γ-γ coinc (36P56c); 0.077 γ: $t_{1/2}$ 1.9×10^{-9} s delay coinc (14S55); others (4B49); see also gammas of Au^{197m}, Au^{197}, Hg^{197m}, and Hg^{197}	
Pt^{198}	$t_{\beta\beta} > 10^{15}$ y sp act (59F52)	%	7.19 (64W56); 7.23 (3I47g)	γ	Coulomb excitation (in Pt^{198}): 0.403 ($t_{1/2}$ 1.9×10^{-11} s) scint spect (121S55); 0.43 scint spect (102M55)	
Pt^{199}	31 m (12M37); 30 m (67L56)	☢	β^- (12M37);	β^-	0.8 (coinc with γ_7, γ_8, and γ_9), 1.1 (coinc with γ_2 and γ_6), 1.3 (coinc with γ_3 and γ_4), 1.7 (not coinc with γ) abs, β-γ coinc (67L56); 1.8 abs (9K41b, 28S41);	
		A	n-capt (77M35b, 12A35); chem, n-capt, excit (28S41); others (2S47, 50H51, 10C36)	γ	γ_1 0.074 (coinc with γ_2, γ_3, γ_5, and γ_7), γ_2 0.197 (coinc with γ_3, γ_4, γ_5, and γ_6), γ_3 0.246 (coinc with γ_5), γ_4 0.318 (coinc with γ_5), γ_5 0.475, γ_6 0.54, γ_7 0.72, γ_8 0.79, γ_9 0.96 scint spect, spect conv, γ-γ coinc (67L56)	

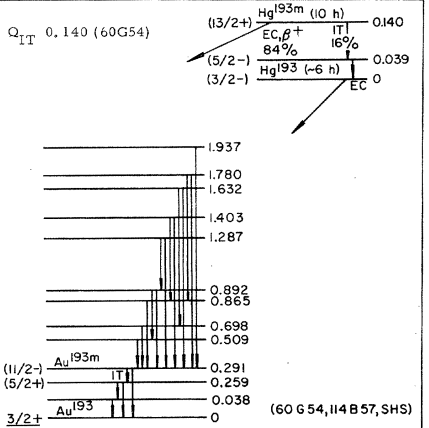
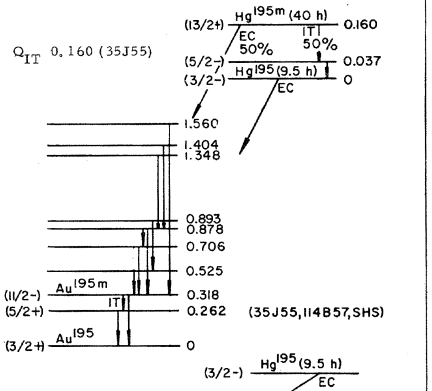
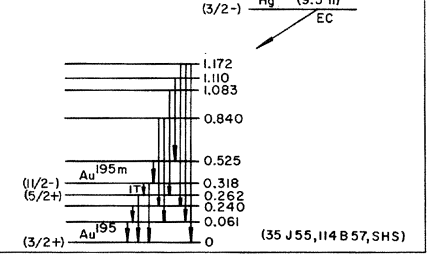
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{78}Pt^{200}$	11.5 h (87R57)	☢	β⁻ (87R57);			
		B	n-capt, chem, genet (87R57); parent Au^{200} (87R57); others (107W56)			
Pt	82 d activity not observed (107W56, 10C50g)					
183-$_{79}Au^{187}$	4.3 m (42R53)	☢	EC, β^+, α ~0.01% (3T49, 42R53);	α	5.07 ion ch (42R53)	
		D	chem, excit (3T49)			
Au^{186}	~15 m (119S55)	☢	[EC] (119S55);			
		D	chem, genet (119S55); parent Pt^{186} (119S55)			
Au^{188}	4.5 m (136C57); ~10 m (119S55)	☢	[EC] (119S55);			
		D	chem, genet (119S55); chem, excit (136C57); parent Pt^{188} (119S55)			
Au^{189}	42 m (119S55)	☢	EC (119S55);	γ	0.135 (↑10), 0.29 (↑100), others >0.80 (?) scint spect (119S55)	
		B	chem, genet, cross bomb (119S55); parent Pt^{189}, daughter Hg^{189} (119S55, 136C57)			
191-$_{Au}^{193}$	2.0 s (95H53)	E	excit (95H53)	γ	no γ scint spect (95H53)	
Au^{191}	3.0 h (119S55); ~4 h (60G54); others (90M52, 2W48, 2W49c);	☢	EC (119S55);	γ	0.0482 ($L_I/L_{II}/L_{III}$ = 1/1.5/1.0), 0.0531 (L_I/L_{II} 7.5), 0.0642 (L_I/L_{II} 0.83), 0.0911 (L_{II}/L_{III} 0.89), 0.1115 (K/L_I 1), 0.116 (K/L_I 2), 0.123 (K/L_{III} 0.33), 0.130 ($K/L_I/L_{II}$ = 6/4.5/0.7), 0.133 ($K/L_I/L_{II}$ = 8/1.7/1.0), 0.159, 0.161, 0.215, 0.249 (K/L_{II} 2.5), 0.405 spect conv, scint spect (161H57);	
		B	chem, genet (119S55, 60G54); parent Pt^{191} (119S55); daughter Hg^{191} (119S55, 60G54);			
	18 h activity not observed (119S55)	I	3/2 atomic beam (43E57a);		0.0480, 0.0910 (L_{II}/L_{III} 1.2), 0.130, 0.1587 spect conv (60G54);	
		μ	~+0.14 atomic beam (43E57a)		0.14 (↑10), 0.30 (↑60), 0.39 (↑5), 0.48 (↑4), 0.60 (↑10) scint spect (119S55)	
Au^{192}	4.7 h (2W49c); 4.1 h (33F52); 4.8 h (28E53)	☢	EC, β^+ ~1% (2W49c);	β^+	~1.9 abs (2W49c);	see Ir^{192}
		A	chem, excit (2W49c); chem, genet (33F52, 60G54); genet energy levels (60G54); daughter Hg^{192} (33F52, 60G54);	γ	0.2958, 0.3168 spect conv (60G54); 0.1365, 0.1577, 0.1734, 0.2054, 0.2818, 0.2957, 0.3081, 0.3160, 0.401, 0.416, 0.436, 0.467, 0.588, 0.612, 0.783, 1.158 spect conv (26E53); 0.0451 ($L_I/L_{II}/L_{III}$ = 8/2.0/7), 0.0968 (K/L_I+L_{II}/L_{III} = 3.5/1/1), 0.1047 ($K/L_I/L_{II}$ = 6/2/0.5), 0.137 ($K/L_I/L_{II}$ = 6/8/2.5), 0.157 (L_I/L_{II} 8), 0.167 (K/L_I+L_{II}/L_{III} = 3/1.5/1.0), 0.205 (K/L_I 3), 0.282 (K/L_{II} 0.4), 0.295 ($K/L_I/L_{II}/L_{III}$ = 4/1/1.3/0.75), 0.308 (K/L_I 2.3), 0.316 ($K/L_I/L_{II}/L_{III}$ = 7/1.2/1.4/1.0), 0.401, 0.415, 0.437, 0.466 spect conv, scint spect (161H57); see also gammas of Ir^{192}	

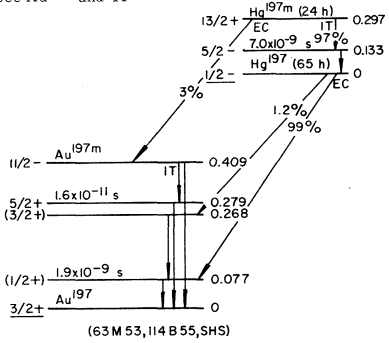
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{79}Au^{193m}$	3.9 s (34F55); 3.8 s (114B55)	☢	IT (34F55, 114B55, 60G54);	γ	0.0319 (L_{II}/L_{III} 0.65), 0.2181 ($K/L_{II}/L_{III}$ = 1.6/1.0/1.0), 0.2579 (K/L 5.4), 0.2906 spect conv (60G54); 0.0324 (coinc with 0.257 γ), 0.2573, 0.290 spect conv, γ-conv coinc (114B55); 0.255 (e_K/γ 0.4) scint spect (34F55); see also gammas of Hg^{193m}	Q_{IT} 0.291 (SHS); see Pt^{193} 
		B	genet (114B55); daughter Hg^{193m} (60G54, 114B55); parent Pt^{193m} (0.03%) (114B55)			
Au^{193}	15.8 h (2W49c); 15.3 h (33F52); 17.5 h (26E57a)	☢	EC, no β^+ (lim 0.08%) (26E57a);	γ	0.1124, 0.1735, 0.1862 spect conv (60G54); 0.0127 (coinc with 0.1735 γ and 0.1355 γ), 0.0374, 0.0737, 0.0998 ($L_I/L_{II}/L_{III}$ = 0.55/1.0/0.8), 0.1124 ($K/L_I/L_{II}$ = 8.8/1.7/0.4, coinc with 0.1194 γ and 0.1557 γ), 0.1140 ($K/L_I/L_{III}$ = 1.2/0.4/0.1), 0.1179 (K/L_I 5), 0.1194 (K/L_I 3.5), 0.1557 (0.35%, e_K/γ 1.8, K/L_I 5.7), 0.1735 (2.0%, e_K/γ 1.6, $K/L_I/L_{II}/L_{III}$ = 3.3/0.48/0.09/0.05), 0.1861 (8.9%, e_K/γ 1.1, $K/L_I/L_{II}/L_{III}$ = 10/1.6/0.3/0.2), 0.1875 (L_I/L_{III} 2.1), 0.2318 (0.55%, e_K/γ 0.14, $K/L_{II}/L_{III}$ = 3/2.2/1.0), 0.2556 (4.6%, e_K/γ 0.48, $K/L_I/L_{II}$ = 2.2/0.38/0.05), 0.2584 (K/L_{III} 0.9), 0.268 (4.4%, e_K/γ 0.17, $K/L_I/L_{II}/L_{III}$ = 5/1.0/0.6/0.4), 0.290 (0.2%, e_K/γ 0.15), 0.304, 0.318 (1.3%, e_K/γ 0.027), 0.335, 0.378 (1.4%, e_K/γ 0.052), 0.425 (0.25%, e_K/γ 0.072, K/L 1.1), 0.440 (3.1%, e_K/γ 0.081, K/L 5.2), 0.477 (0.5%, e_K/γ 0.094, K/L 5.2), 0.490 (0.55%, e_K/γ 0.025, K/L 1.8) spect, spect conv, scint spect, conv-conv coinc (26E57a); 0.1355 (with Pt^{193m}) (26E57a); 0.0127 γ: $t_{1/2}$ 2.2 x 10^{-9} s delay coinc (26E57a); see also gammas of Pt^{193m}	
		B	chem, genet (2W49c); daughter Hg^{193} (60G54, 33F52); daughter Hg^{193m} (60G54); parent Pt^{193} (2W49c);			
		I	3/2 atomic beam (43E57a);			
		μ	~+0.14 atomic beam (43E57a)			
Au^{194}	39.5 h (2W49c); 39 h (82S49)	☢	EC ~97%, β^+ ~3% (2W49c);	β^+	1.21 (†1.7), 1.55 (†1.3) spect, β-γ coinc (43T56); 1.8 abs (2W49c);	Q_{EC} 2.57 (43T56); see Ir^{194} 
		A	chem, excit (2W49c); genet energy levels (43T56); daughter Hg^{194} (114B55a);	γ	γ_1 0.2913 (†26, e_K/γ 0.062), γ_2 0.3267 (†100, e_K/γ 0.056), γ_3 0.64 (†20), γ_4 0.94 (†9), γ_5 1.12 (†6), γ_6 1.16 (†6, e/γ 0.003), γ_7 1.23 (†<2), γ_8 1.27 (†~2, e/γ 0.004), γ_9 1.34 (†2, e/γ 0.007), γ_{10} 1.47 (†8, e/γ 0.01), γ_{11} ~1.50 (†~1), γ_{12} 1.59 (†6, e/γ 0.003), γ_{13} 1.89 (†7, e/γ 0.0014), γ_{14} 2.05 (†5, e/γ 0.0018), γ_{15} 2.15 (†~1, e/γ 0.013), γ_{16} ~2.30 (†0.6), (γ_1 coinc with γ_2, γ_3, γ_4, γ_6, γ_{10}, and γ_{12}), (γ_2 coinc with γ_1, γ_3, γ_4, γ_6, γ_{10}, γ_{12}, and γ_{13}), (γ_3 coinc with $\gamma_1 + \gamma_2$, γ_4, γ_6, γ_9, γ_{11}, and γ_{12}), (γ_4 coinc with $\gamma_1 + \gamma_2$, γ_3, and γ_4), (γ_1 not coinc with β^+) spect conv, scint spect, β-γ, γ-γ coinc (43T56); 0.095, 0.154, 0.185, 0.201, 0.290, 0.327, 0.525, 0.543, 0.590, 0.618, 0.642, 0.664, 0.699, 0.732, 0.895, 0.944, 1.046, 1.102, 1.149, 1.176, 1.216, 1.266, 1.301, 1.341, 1.423, 1.479, 1.593, 1.713, 1.831, 1.885, 1.923, 2.04, 2.08, 2.16, 2.31, 2.36 spect conv (13A57a); others (82S49, 114B55a); see also gammas of Ir^{194} and Pt^{194}	
		I	1 atomic beam (65R57);			
		μ	±0.068 atomic beam (165H57)			

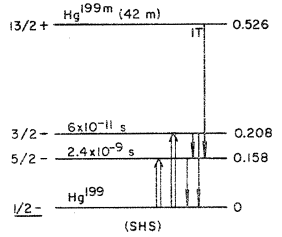
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{79}Au^{195m}$	30.6 s (34F55); 30 s (34H52a)	☢ IT (34H52a); B chem, genet (34H52a); excit (34F55); daughter Hg^{195m} (34H52a, 33J55); not daughter Hg^{195} (34H53, 60G54)	γ 0.0565 (e/γ very large, L_{II}/L_{III} 1.1), 0.2615 (e/γ 0.25, K/L 5.3), 0.318 spect conv, scint spect (35J55, 34H53); 0.0565 (L_{II}/L_{III} 1), 0.2616 (K/L_I 5.5) spect conv (60G54)	Q_{IT} 0.318 (35J55)  (34H53)
Au^{195}	180 d (82S49); 185 d (2W49c)	☢ EC (2W49c); EC to 0.130 level: L/K 0.6 (115B54); A chem, genet (2W49c); daughter Hg^{195m} (74B54); daughter Hg^{195} (60G54); parent Pt^{195m} (?) (104S42)	γ 0.0308 (M_I/M_{II} 9.4), 0.0985 ($L_I/L_{II}/L_{III}$ = 104/10/3), 0.1294 (L_I+L_{II}/L_{III} 1.4) spect conv (138C58); 0.0308, 0.0988 ($L_I/L_{II}/L_{III}$ = 70/10/3) spect conv (60G54); 0.031 (†1, coinc with 0.099 γ), 0.099 (†12, not coinc with 0.130 γ), 0.130 (†2) scint spect, γ-γ coinc (36P56); ~0.03 (†1.2, e/γ 32), ~0.10 (†12) ion ch (115B54); 0.029, 0.097 (K/L 5.8), 0.126 spect, spect conv, γ-conv coinc (104S52); others (34H51, 82S49, 114B55a, 74B54); see also gammas of Pt^{195} and Pt^{195m}	Q_{EC} 0.27 calc (115B54); see Pt^{195m} and Pt^{195}  (60G54, 138C58)
Au^{196}	14.0 h (2W49c); 13 h (12M37)	☢ EC or IT (2W49c); B chem, excit (12M37)		
Au^{196}	5.55 d (2W49c); 5.60 d (82S49); others (25W48, 9K41b)	☢ EC ~95%, β^- ~5% (82S49); EC ~80%, β^- ~20% (2W49c); EC ~88%, β^- ~12% (43T56a); A chem, excit (12M37)	β^- 0.27 spect (106S52); 0.30 spect (82S49); 0.34 abs (2W49c); γ with EC: 0.331 (†28, e_K/γ 0.059, K/L+M 2.0), 0.354 (†100, e_K/γ 0.042, K/L+M 1.9, coinc with 0.331 γ) spect, spect conv, γ-conv, conv-conv coinc (43T56a); 0.332, 0.354 spect conv (106S52); 0.330 (K/L 1.7), 0.358 (K/L 1.7), no 0.688 γ (lim 1%) spect conv, scint spect (82S53, 82S49); others (114B55a, 62K57, 13A57a); with β^-: 0.426 (e_L/γ 0.007) spect conv, β-conv coinc (106S52); others (114B55a, 82S49, 36P56); see also gammas of Pt^{196} and Tl^{196}	Q_{β^-} 0.70 (64K54)  (82S53, SHS)
Au^{197m}	7.2 s (34F55); 7.4 s (40F47); 7.5 s (37W45a)	☢ IT (37W45a); A excit (37W45a); daughter Hg^{197m} (3%) (40F50, 104S52)	γ 0.1302 ($e_K/\gamma \leq 2$, $K/L_I/L_{II}/L_{III}$ = 10/<2/~54/21), 0.2793 (e_K/γ 0.27, K/L ≥6), spect conv, scint spect (63M53); 0.130 (e/γ 0.8, K/L 0.12, L_{II}/L_{III} 1.3), 0.277 (e/γ 0.29, K/L 5.3) 0.407 (weak, $e_K/\gamma \geq 1.5$, K/L+M 2.3), 0.130 γ coinc with 0.277 γ spect conv, scint spect, γ-conv coinc (35J55); others (34H48a, 24C52, 37W45a, 34F55, 62K56); see also gammas of Pt^{197}, Au^{197}, and Hg^{197m}	Q_{IT} 0.409 (SHS) see Pt^{197}  (101M56, 63M53, 62K56, SHS)
$\underline{Au^{197}}$	$t_a > 3 \times 10^{16}$ y sp act (37P54)	% 100 (1D35a); I 3/2 atomic spect (87M50); μ +0.136 atomic spect (63K52); +0.14 atomic spect (120S53); 0.13 atomic beam (59W53); q +0.56 atomic spect (120S53); others (87M50, 61W53, 67K56)	γ Coulomb excitation (in Au^{197}): 0.1913 (K/L 4.2), 0.270 (K/L 6), 0.280 (K/L 6.3), 0.548 (K/L 3.6) spect conv (101M56); 0.077, 0.191, 0.279 (K/L 5.5) spect conv (116B55); 0.191, 0.273 (†2.6, coinc with 0.277 γ), 0.277 ($t_{1/2}$ 1.6×10^{-11} s), 0.55 (†100, $t_{1/2}$ 4.4×10^{-12} s), 0.077 scint spect, γ-γ coinc (121S55, 52M58); others (84C54, 102M53, 121S56, 61G54, 41A56, 96H56, 97H54, 31E57, 41A56a); 0.077 level of Au^{197}: $t_{1/2}$ 1.9×10^{-9} s delay coinc (14S55, 14S53a); see also gammas of Au^{197m}, Pt^{197}, Hg^{197m}, and Hg^{197}	

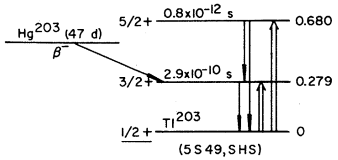
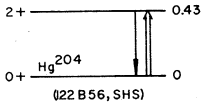
Isotope Z A	Half-life	Type of Decay; Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{79}Au^{198}$	2.697 d (55L53); 2.699 d (8B54); 2.697 d (36J56); 2.686 d (22T55); 2.694 d (122S56); others (57S49, 38S51, 33D46, 50H51, 2S47, 28S41, 1P37, 109W57)	decay: β^- (12M37); no EC (lim 0.1%) (117B56); no EC (lim 0.2%) (38M52a); no EC (25R49, 118B53); no β^+ (lim 0.003%) (41M51); A chem, n-capt (12A35, 12M37); I 2 atomic beam (85C56); μ ±0.50 atomic beam (85C56)	β^- β_1 0.960 spect (average of 10L49, 4E54, 118B53, 19P56); β_2 0.290 (coinc with 0.68 γ) spect, β-γ coinc (48B51a); β_3 1.37 (0.025%) spect (4E54); average energy of β^-: 0.32 calorimeter (227S56); others (9S48, 2L49a, 82S49, 107S49, 4E51, 6W52a, 38P54, 4E55, 4E51, 6W52a, 60W57, 56R57, 40F57a, 56B57c, 230B57, 209S58, 96G58, 91L58, 176B58, 56B58, 133H58); γ γ_1 0.41177 cryst spect (100M52, 34D48); 0.4117 spect conv (12H52, 29L51); γ_1 (e_K/γ 0.0281, K/L 2.9) spect conv (47W58); γ_1 (L_{II}/L_{III} 2.5) spect conv (63M52a, 116S53); γ_1 ($L_I/L_{II}/L_{III}$ = 1.9/2.2/1.0) electrostatic analyzer (86C56); γ_2 0.675 (not complex), γ_3 1.087 (not complex) spect (131K58); 0.6711 (†0.9), 0.6789 (†0.3) cryst spect (68H57); 0.6765 (e_K/γ 0.022, K/L 5.7) spect, spect conv (4E54, 4E51); γ_2 coinc with γ_1 and β_2^- scint spect, β-γ, γ-γ coinc (48B51a, 69C51a, 69C51); γ_2 (e_K/γ 0.019) spect, spect conv (16V56); γ_3 1.089 (e_K/γ 0.0045, K/L 6.3) spect, spect conv (4E54, 4E51); γ_3 (e_K/γ 0.0046) spect, spect conv (16V56); γ_1 (†100), γ_2 (†1.1), γ_3 (†0.24) spect, spect conv, scint spect (average of 4E54, 16V56, 57H51b, 69C51a, 69C51, 16D56, 94M54, 16D55a); γ_1: $t_{1/2}$ 2.6 x 10^{-11} s delay coinc (14S57, 14S57a); others (48B51a, 18P50a, 2L48, 2L49a, 9S49b, 31A50a, 12H50, 38T49, 4F44, 130B56, 72C42, 7S47g, 15J48, 25R48, 86S53, 123S53, 123S53a, 16D41, 9K41c, 50S52a, 13A57a, 7S49e, 82S49, 107S49, 29F52, 86C56, 50S52, 119B55); see also gammas of Hg^{198}, Tl^{198m}, and Tl^{198}	Q_{β^-} 1.372 (SHS) 
Au^{199}	3.14 d (109W57); 3.15 d (8B55); 3.2 d (104S52); 3.3 d (12M37); others (28S41)	decay: β^- (9K41b); A chem, genet (12M37); daughter Pt^{199} (12M37, 86B49a, 37M49, 67H50); I 3/2 atomic beam (86C56); μ ±0.24 atomic beam (86C56)	β^- 0.460 (6.4%), 0.302 (69.3%), 0.251 (24.3%) spect (56H55); 0.460, 0.297 (coinc with 0.158 γ), 0.250 (coinc with 0.207 γ) spect, β-γ coinc (8B52a); ~0.47 (not coinc with γ) β-γ coinc (1I53); others (108S51, 104S52, 86B49a, 37M49, 26M48e, 9K41b, 89R57); γ 0.0497, 0.1583 (†45), 0.2080 (†10, e_K/γ 0.71, $K/L_I/L_{II}/L_{III}$ = 6.2/1.0/0.20/0.06) scint spect, spect conv (138C58); γ_1 0.050 (†0.84, e_L/γ 6), γ_2 0.159 (†100, e_K/γ 0.19, K/L 0.6), γ_3 0.209 (†24, e_K/γ 0.54, K/L 5.4) spect, spect conv, γ-γ coinc (108S51); γ_1 0.050, γ_2 0.158 (e_K/γ 0.24, K/L 0.73, coinc with γ_1, not coinc with γ_3), γ_3 0.208 (e_K/γ ~0.62, K/L ~5.6) spect, spect conv, scint spect, conv-conv coinc (7S51, 7S52); γ_1 (coinc with γ_2), γ_3 (not coinc with γ_1 or γ_2) scint spect, γ-γ coinc (1I53); γ_2 (L_{II}/L_{III} 1.6) spect conv (63M52a, 116S53, 116S53a); γ_2: $t_{1/2}$ 2.4 x 10^{-9} s delay coinc (14G51a, 8B52a); γ_3: $t_{1/2}$ ~7 x 10^{-11} s delay coinc (14G55); others (104S52, 86B49a, 37M49, 26M48e, 67H50, 67H50a, 10C50g, 4B49, 34H51, 10C52a); see also gammas of Hg^{199}, Hg^{199m}, and Tl^{199}	Q_{β^-} 0.460 (SHS); see Hg^{199} and Tl^{199} 

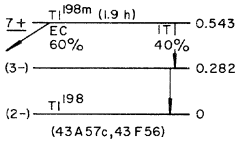
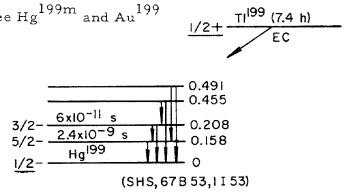
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{79}Au^{200}$	48 m (65B52a, 3M42)	☢ β^- (28S41); B chem (28S41); chem, sep isotopes, excit (65B52a); daughter Pt^{200} (87R57)	β^- 2.18 (76%), 0.6 (24%) abs (88R57a); 2.2 abs (65B52a); ~2.5 abs (28S41); γ 0.367 (24%), 1.23 (24%), 1.36 (<1%) scint spect (88R57a, 87R57); 1.13, 0.39 scint spect (65B52a); see also gammas of Hg^{200} and Tl^{200}	Q_{β^-} 2.2 (SHS)
Au^{201}	26 m (65B52a)	☢ β^- (65B52a); B chem, excit, sep isotopes (65B50, 65B52a)	β^- 1.5 abs (65B52a); γ 0.55 scint spect (65B52a)	Q_{β^-} 1.5 (64K54)
$Au^{202,}$ Au^{204}	~25 s (65B52a)	☢ β^- or IT (65B52a); E excit (65B52a)		
Au^{203}	55 s (65B52a)	☢ β^- (65B52a); B chem, excit, sep isotopes (65B52a)	β^- 1.9 abs (65B52a); γ 0.69 scint spect (65B52a)	Q_{β^-} 1.9 (64K54)
$_{80}Hg^{189}$	23 m genet (136C57); 20 m (119S55); ~25 m (60G54)	☢ [EC] (119S55); B excit (60G54); chem, genet (119S55, 136C57); parent Au^{189} (119S55, 136C57)	γ 0.0286 ($L_I/L_{II}/L_{III}$ = 3/1/1) spect conv (60G54)	
$Hg^{<191}$	90 m (60G54)	E excit (60G54)		
$Hg^{<191}$	~3 h (60G54)	E excit (60G54)		
$Hg^{<195}$	0.7 m (42R53)	☢ α (42R53); E chem (3T49)	α 5.60 ion ch (42R53)	
Hg^{191}	57 m (60G54); 55 m (119S55); no 12 h Hg^{191} observed (119S55)	☢ [EC] (119S55); B excit (60G54); chem, genet (119S55); parent Au^{191} (119S55, 60G54)	γ 0.2526 (K/L_I 4), 0.2741 spect conv (60G54)	
Hg^{192}	5.7 h (33F52); 6.3 h (17V55)	☢ EC, β^+ (33F52); B chem, excit (33F52, 60G54); parent Au^{192} (33F52, 60G54)	β^+ 1.18 spect (33F52); γ 0.0313 ($L_I/L_{II}/L_{III}$ = 4.7/1.0/1.0), 0.1143 (K/L_I 5), 0.1423 (K/L_I 3), 0.1460 (K/L_I 5), 0.1574 (K/L_I 3.5), 0.275 spect conv (60G54); others (33F52)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{80}Hg^{193m}$	10.0 h (33F52); 11 h (17V55)	☢ EC 84%, IT 16% (60G54); β^+ (weak) (114B56); B chem, excit (33F52, 60G54); parent Hg^{193} (60G54, 62G53); parent Au^{193m} (60G54, 114B55); no 27 h Hg^{193} (60G54)	β^+ 2.22, 1.17, ~0.42 spect (114B57); γ with EC of Hg^{193m}: 0.500, 0.510, 0.535, 0.537, 0.574 (K/L_I 4.6), 0.601 (K/L_I 5.7), 0.675, 0.701, 0.762, 0.861, 0.871, 0.879 (K/L_I 8.1), 0.914 (K/L_I 5.4), 0.933 (K/L_I 6.4), 0.997 (K/L_I 4.8), 1.113, 1.175, 1.243, 1.328, 1.343, 1.489, 1.646 spect conv (114B56, 114B57); with EC of Hg^{193m} and/or Hg^{193}: 0.032, 0.038, 0.157, 0.186, 0.218, 0.220, 0.258, 0.291, 0.300, 0.345, 0.360, 0.364, 0.381, 0.382, 0.394, 0.407, 0.499, 0.534, 0.571, 0.860, 0.920, 1.120, 1.170, 1.240, 1.320, 1.490, 1.630 spect conv, γ-conv coinc (114B55a); with IT: 0.0392, 0.1012 (L_I/L_{III} 0.27) spect conv (60G54, 62G53); see also gammas of Au^{193m}	
Hg^{193}	~6 h (60G54, 62G53)	☢ EC (60G54); B genet (60G54); daughter Hg^{193m} (60G54, 114B55)	γ 0.0379 ($L_I/L_{II}/L_{III}$ = 3.0/8.5/4.0), 0.1865 spect conv (60G54); 0.570, 0.860, 0.920 spect conv (114B55, 114B57); see also gammas of Hg^{193m}	
Hg^{194}	0.4 s (95H53)	E excit (95H53)	γ 0.048, 0.134 scint spect (95H53)	
Hg^{194}	~130 d (114B55a)	☢ [EC] (114B55a); D chem, genet (114B55a); parent Au^{194} (114B55a)	γ no γ spect conv, scint spect (114B55a)	
Hg^{195m}	40.0 h (35J55, 34H53, 114B54); 42 h (74B54)	☢ EC 50%, IT 50% (35J55, 114B54); EC 52%, IT 48% (60G54); A chem, excit (33F52); chem, excit, genet (60G54); parent Au^{195m} (34H52a, 33J55); parent Hg^{195} (60G54); not daughter Tl^{195} (20K55)	γ with IT: 0.0371 (e/γ very large, L_I/L_{II} ~10), 0.1227 (e/γ ≥24, K/L 0.22, $L_I/L_{II}/L_{III}$ = 10/3/19) spect conv, scint spect (34H53, 35J55); 0.0368 (L_I/L_{II} 5), 0.1226 (K/L 0.2, $L_I/L_{II}/L_{III}$ = 10/2/20) spect conv (60G54); with EC: 0.470 (†34, coinc with 0.559 γ), 0.559 (†229, e_K/γ 0.016, K/L 5.4), ~1.03 (†14) spect conv, scint spect, γ-conv coinc (35J55, 34H53, 114B54, 114B57); 0.255, 0.58 (weak), 0.81 (weak), 1.17 (very weak) scint spect, γ-γ coinc (74B54); with EC of Hg^{195m} and/or Hg^{195}: 0.172, 0.201, 0.207, 0.368, 0.388, 0.439, 0.526 (K/L_I 5.3), 0.561 (K/L_I 5), 0.585 (K/L_I 5), 0.600 (K/L_I 4.5), 0.780 (K/L_I 4.8), 0.810, 0.821, 0.920, 0.930, 0.955, 1.010, 1.110 (K/L_I 4.2), 1.120, 1.172, 1.180, 1.242, 1.255 (0.388 γ coinc with 0.368 γ and 0.207 γ), (0.179 γ coinc with 0.920 γ) spect conv, γ-γ coinc (114B56, 114B55a); others (34H52a, 30D51); see also gammas of Au^{195m} and Tl^{195}	
Hg^{195}	9.5 h (35J55, 114B54, 34H53)	☢ EC (35J55); A chem, genet, excit (60G54); daughter Hg^{195m} (60G54); daughter Tl^{195} (20K55); not parent Au^{195m} (34H53, 60G54)	γ 0.0612 ($L_I/L_{II}/L_{III}$ = 1.2/1.1/1.0), 0.1798 (K/L >4), no 0.262 γ (lim 10%) spect conv (60G54); γ_1 0.0614 (e/γ very large, $L_I/L_{II}/L_{III}$ = 1.1/1.0/1.0, coinc with γ_2, γ_4, γ_5, and γ_7), γ_2 0.179 (e_K/γ 0.9, coinc with γ_3, γ_4, and γ_6), γ_3 0.39 (†4.5), γ_4 0.600 (†31, e_K/γ ~0.02, K/L ~5), γ_5 0.779 (e_K/γ 0.013, K/L+M 4.5), γ_6 0.95, γ_7 1.15 (†22) spect conv, scint spect, γ-conv coinc (35J55, 34H53, 114B54, 34H52a, 114B57); others (30D51, 114B55a); see also gammas of Hg^{195m}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{80}Hg^{196}$		%	0.146 (6N50a);			
		I	0 atomic spect (120B54)			
Hg^{197m}	24 h (74B54); 23 h (23F43, 34H51); 25 h (12M37)	☢	IT 97%, EC 3% (104S52, 35J55);	γ	with IT: 0.133 (e_K/γ 0.5, K/L 0.42), 0.164 (e_K/γ 4.6, K/L 0.43) spect conv, γ-γ coinc (40F50, 34H51); 0.134 (K/L <0.1), 0.165 (K/L ~0.25) spect conv (10C52b); 0.134 ($L_I/L_{II}/L_{III}$ = 0.04/1.1/1.0), 0.165 ($L_I/L_{II}/L_{III}$ = 1.0/<0.1/1.5) spect conv (63M53); 0.133 γ: $t_{1/2}$ 7.0 x 10^{-9} s delay coinc (52M50c); $t_{1/2}$ 8 x 10^{-9} s delay coinc (20D50, 87C55); with EC (with Au^{197m}): 0.1302, 0.2793 spect conv (63M53); 0.130, 0.277, 0.407 spect conv (35J55); others (2H42a, 6V41b, 34H48a, 40F47, 40F50a, 121B54, 121B56, 87C55, 74B54, 63G56, 87C57, 40F50, 34H51); see also gammas of Au^{197m}, Au^{197}, and Tl^{197}	Q_{IT} 0.297 (40F50, 34H51); see Au^{197} and Tl^{197} 
Hg^{197}	65 h (34H51); 66 h (10C52b); 64 h (23F43); others (28S41, 9K40, 9K41c)	☢	EC (23F43);	γ	0.0776 (e/γ 2.5, $L_I/L_{II}/L_{III}$ = 10/4.6/3.4, coinc with 0.1918 γ), 0.1918 (e_K/γ 0.9, K/L 6.1) spect conv, γ-conv coinc (35J55, 34H53); 0.0774 ($L_I/L_{II}/L_{III}$ = 10/4.5/3.4), 0.191 (K/L 6) spect conv (63M53); 0.078 (L_I/M 4), 0.191 (K/L ~9) spect conv (10C52b); others (34H51, 40F50, 2H42a, 40F47, 34H48a); see also gammas of Hg^{197m}, Pt^{197}, and Au^{197m}	
		A	chem, excit, cross bomb (16W41, 23F43); daughter Hg^{197m} (34H53); daughter 2.8 h Tl^{197} (20K55);			
		I	1/2 atomic spect (120B54);			
		μ	+0.52 atomic spect (120B54)			
Hg^{198}		%	10.02 (6N50a);	γ	Coulomb excitation (in Hg^{198}): 0.412 scint spect (45D56, 122B56); 0.412 level of Hg^{198}: $t_{1/2}$ 2.6 x 10^{-11} s delay coinc (14S57, 14S57a); $t_{1/2}$ 2.1 x 10^{-11} s nucl res fluor (44M55, 44M54, 46D53, 44M56); $t_{1/2}$ 1.1 x 10^{-11} s nucl res fluor (104M53); $t_{1/2}$ 2 x 10^{-11} s Coul exc (122B56); see also gammas of Au^{198} and Tl^{198}	see Au^{198} and Tl^{198}
		μ	~0 atomic spect (87M50)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{80}Hg^{199m}$	42 m (123B55); 44 m (15H47a, 60M48); 43 m (12M37, 6H37); others (1P37, 16W41, 28S41, 37W45a)	☢	IT (23F43);	γ	0.159 (e_K/γ 0.34), 0.368 (e_K/γ 0.98, e/γ 1.78, coinc with 0.159 γ) scint spect, γ-γ coinc (123B55); 0.155 (e/γ 0.25, K/L <0.4), 0.368 (e/γ >11, K/L 1.6) spect conv (15H48a); 0.159 (L_{II}/L_{III} 1.6) spect conv (63M52a); others (15H47a, 37M49, 1I53); see also gammas of Au^{199}, Tl^{199}, and Hg^{199}	Q_{IT} 0.526 (SHS); see Tl^{199}
		A	chem, excit (6H37, 12M37); mass spect (67B49b); not daughter Tl^{199} (67B53)			
Hg^{199}		%	16.84 (6N50a);	γ	Coulomb excitation (in Hg^{199}): 0.159, 0.209 scint spect (45D56, 122B56, 97H54); 0.208 level of Hg^{199}: $t_{1/2}$ 6×10^{-11} s nucl res fluor (119K57); $t_{1/2}$ ~7×10^{-11} s delay coinc (14G55); others (45D56, 39P56, 122B56, 44M56, 44M54a); 0.159 level of Hg^{199}: $t_{1/2}$ 2.4×10^{-9} s delay coinc (14G51a, 8B52a); see also gammas of Au^{199}, Tl^{199}, and Hg^{199m}	
		I	1/2 nucl induct (40P51); 1/2 atomic spect (87M50);			
		μ	+0.4993 nucl induct (67K56); others (87M50, 124B52, 61W53, 204B57)			
Hg^{200}		%	23.13 (6N50a);	γ	Coulomb excitation (in Hg^{200}): 0.368 ($t_{1/2}$ 4.6×10^{-11} s) scint spect (122B56); 0.375 ($t_{1/2}$ 7.5×10^{-11} s) scint spect (45D56); see also gammas of Tl^{200}	see Tl^{200}
		μ	~0 atomic spect (87M50)			
[Hg^{201m} / Hg^{203m}]	activity not observed (lim $t_{1/2}$ <1 m, >10 m) (67B53)					
Hg^{201}		%	13.22 (6N50a);			
		I	3/2 atomic spect (87M50);			
		μ	-0.607 atomic spect (67K56);			
		q	+0.45 atomic spect (88M55); 0.50 atomic spect (204B57); 0.6 quad res (47D54); others (39P56, 124B52, 87M50)			
Hg^{202}		%	29.80 (6N50a);	γ	Coulomb excitation (in Hg^{202}): 0.439 scint spect (45D56, 122B56); 0.439 level: $t_{1/2}$ 2.4×10^{-11} s nucl res fluor (44M55a); $t_{1/2}$ 3.0×10^{-11} s Coul exc (122B56); $t_{1/2}$ 3.9×10^{-11} s Coul exc (45D56); see also gammas of Tl^{202}	see Tl^{202}
		μ	~0 atomic spect (87M50)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{80}Hg^{203}$	46.9 d (21E56); 47.9 d (10C52b); 45.9 d (33W51a); 46.5 d (35L51a); 45.4 d (109W57); 43.5 d (9S48b); others (28S41, 3I47h, 2S47, 3M42)	☢	β^- (23F43);	β^-	0.208 spect, β-γ coinc (average of 5S49, 5S49a, 33W51a, 9S48b, 54M55, 6W56, 30T54, 20N58); no 0.486 β^- (lim 0.004%) spect (54M55); no 0.486 β^- spect (6W56, 47W54); others (37W47, 71A55a);	Q_{β^-} 0.487 (SHS); see Pb^{203} and Tl^{203} 
		A	excit (9K40); chem, excit, n-capt (16W41, 23F43); mass spect (5S49a, 67B49a)	γ	γ_1 0.279 spect, spect conv, β-γ coinc (5S49, 5S49a, 12H50); γ_1 0.2783 spect conv (6W56); γ_1 0.278 spect, spect conv (33W51a); γ_1 (e_K/γ 0.159, $K/L_I/L_{II}/L_{III}$ = 1/0.16/0.10/0.053) spect conv (26N56); γ_1 (e_K/γ 0.163, K/L 3.39) spect conv (20N58); γ_1 (e_K/γ 0.21) spect conv, scint spect (54M55, 17J52a); γ_1 (K/L 3.2) spect conv (54M55); γ_1 ($L_I/L_{II}/L_{III}$ = 0.15/0.11/0.053) spect conv (116S53, 116S53a); γ_1: $t_{1/2}$ 2.9 x 10^{-10} s delay coinc (130B57); $t_{1/2}$ 2.5 x 10^{-10} s delay coinc (26E57c); see also gammas of Tl^{203} and Pb^{203}; others (60W55, 60W56, 130B55, 42A55, 48D55, 30T54, 21O56, 47W54, 48D55)	
Hg^{204}		%	6.85 (6N50a);	γ	Coulomb excitation (in Hg^{204}): 0.43 scint spect (122B56)	
		μ	~0 atomic spect (87M50)			
Hg^{205}	5.5 m (3M42, 9K40); 5.6 m (35L51a); others (16W41, 23F43, 3M42)	☢	β^- (9K40);	β^-	1.8 abs (35L51a); 1.6 abs (9K40);	Q_{β^-} 1.75 (64K54)
		A	n-capt, excit (9K40, 9K42); sep isotopes, n-capt (35L51a)	γ	0.203 spect conv (37J54); see also gammas of Tl^{205}	
[Hg^{206}]	activity not observed (lim $t_{1/2}$ <10 h, >2 y) (33F56)	☢	[β^-] (33F56)			
$_{81}Tl^{195m}$	3.5 s (43A57b)	☢	IT (43A57b);	γ	0.0991 (L_{II}/L_{III} 1.4), 0.383, 0.393 spect conv (43A57b, 43A57, 67B57); see also gammas of Pb^{195}	
		B	chem (43A57b); daughter Pb^{195} (43A57b)			
Tl^{195}	1.2 h (20K55, 43A57)	☢	EC (43A57);	γ	0.0370 spect conv (43A57); see also gammas of Hg^{195m}	see Hg^{195m}
		A	chem, genet (20K55); mass spect, genet energy levels (43A57); parent Hg^{195} (20K55); not parent Hg^{195m} (20K55)			
Tl^{196}	1.8 h (43A58)	☢	EC (43A55);	γ	0.426 (K/L 2.8) spect conv (43A58, 43A57, 43A55); see also gammas of 5.6 d Au^{196}	see Au^{196}
		B	chem, genet energy levels, mass spect (43A58, 43A55, 43A57); daughter Pb^{196} (43A57)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{81}Tl^{197m}$	0.54 s (95H53); 0.6 s (43A57b)	☢	IT (43A57b);	γ	0.2225 ($K/L_I/L_{II}/L_{III}$ = 0.56/0.22/1.8/0.86), 0.385, 0.387 spect conv (43A57, 43A57b); 0.384 scint spect (95H53); see also gammas of Pb^{197m}	see Pb^{197m}
		B	excit (95H53); chem (43A57b)			
Tl^{197}	2.7 h (43A57); 2.8 h (20K55)	☢	EC (43A55);	γ	0.1335 (K/L 0.4, L_{II}/L_{III} 1.4), 0.1517 (K/L 5.2), 0.1731 (K/L 5) spect conv (43A57); 0.1526 spect conv (20K55); see also gammas of Hg^{197m}	see Hg^{197m}
		A	chem, excit, genet (20K55); mass spect, genet energy levels (43A55); parent Hg^{197} (20K55); not parent Hg^{197m} (20K55);			
		I	1/2 atomic beam (125B57)			
Tl^{198m}	1.90 h (43F56); 1.8 h (7O49); 1.9 h (67B53)	☢	EC ~60%, IT ~40% (43F56, 20K55);	γ	with IT: 0.2607 ($K/L_I/L_{III}$ = 44/26/18), 0.2824 (K/L_I 9) spect conv (35P54, 67B53, 43A57c); with EC: 0.0478 ($L_I/L_{II}/L_{III}$ = 1/40/40) spect conv (43A57c, 35P54, 67B53); 0.194 (?), 0.442 (K/L ~8), 0.586 (†10, K/L ~8), 0.635 (†10, K/L ~6) spect conv, scint spect (20K55); 0.411 (†13, coinc with 0.59 γ and 0.64 γ), 0.59 (†10, coinc with 0.64 γ), 0.64 (†10) scint spect, γ-γ coinc (43F56); others (7O49); see also gammas of Tl^{198}, Au^{198}, and Hg^{198}	Q_{IT} 0.543 (43A57c); see Au^{198}  (43A57c, 43F56)
		A	chem, excit (7O49, 67B53); mass spect (105M54); genet energy levels (43F56); daughter 25 m Pb^{198} (4N50, 7K51);			
		I	7 atomic beam (125B57)			
Tl^{198}	5.3 h (105M54); 5 h (67B53)	☢	EC (43F56);	γ	0.195, 0.284, 0.402, 0.411, 0.675 spect conv (67B53); 0.194, 0.227 (?), 0.283, 0.411, 0.675, ~1.075, ~1.23, ~1.44 spect conv, scint spect (20K55); see also gammas of Hg^{198}, Au^{198}, Pb^{198}, and Tl^{198m}; metastable state in Tl^{198}: 0.173 γ: $t_{1/2}$ 4×10^{-9} s delay coinc (61J57)	
		C	chem, genet energy levels (67B53); mass spect (105M54)			
Tl^{199}	7.4 h (105M54); 7 h (7O49)	☢	EC (7O49); no β^+ (1I51);	γ	0.0500, 0.1584, 0.2081, 0.2472 (L_I/L_{II} ~10), 0.3336, 0.455, 0.491 spect conv (67B53); 0.049, 0.078, 0.103, 0.157, 0.206, 0.245, 0.332, 0.454, 0.490 spect conv, γ-γ coinc (1I51, 1I53); see also gammas of Au^{199}, Hg^{199m}, and Hg^{199}	see Hg^{199m} and Au^{199}  (SHS, 67B53, 1I53)
		A	chem (9K40); chem, excit (7O49); mass spect (105M54); daughter Pb^{199} (4N50); not parent Hg^{199m} (67B53);			
		I	1/2 atomic beam (125B57)			

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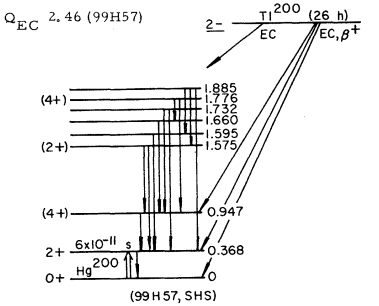
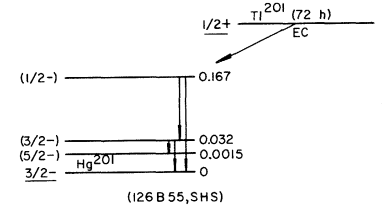
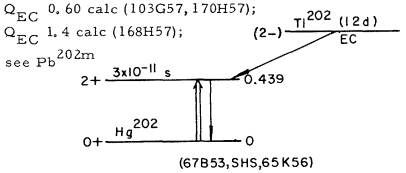
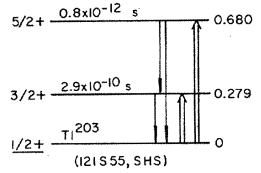
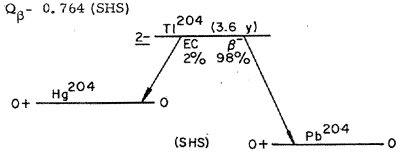
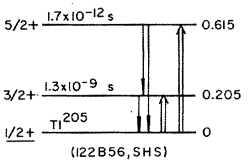
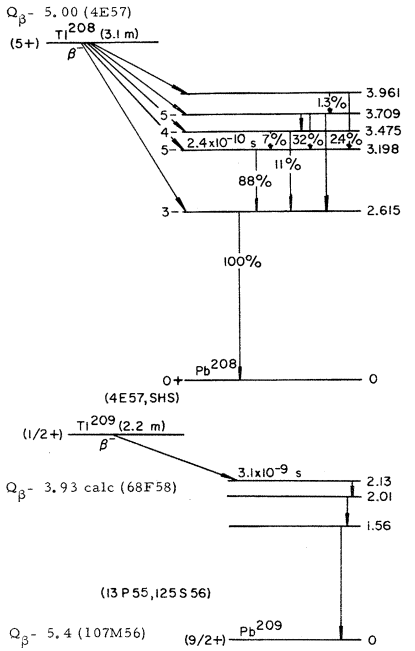
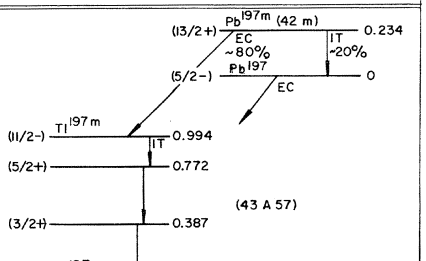
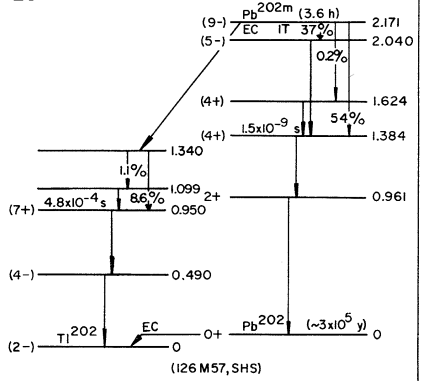
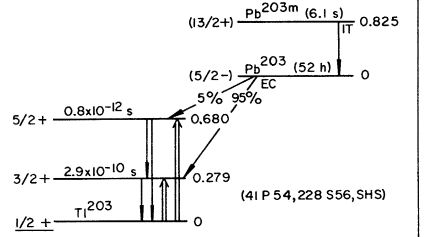
$_{81}Tl^{200}$	26.1 h (99H57); 27 h (7O49, 105M54)	☢	EC (7O49);	β^+	1.44 (†1.3), 1.05 (†7.3), 0.46 (†0.6) spect (99H57); 1.5 (43A57);	Q_{EC} 2.46 (99H57) 
			β^+ (weak) (99H57, 43A57);			
			no β^+ (1I51);	γ	γ_1 0.1165, γ_2 0.2520 (K/L 5.1), γ_3 0.2893 (K/L 3.4, coinc with γ_{12}), γ_4 0.3094 (K/L 5.2, coinc with γ_{11}), γ_5 0.3680 (†100, K/L_I 2.5, coinc with γ_2, γ_3, γ_4, γ_6, γ_{10}, $\gamma_{11}+\gamma_{12}$, γ_{13}, and γ_{14}), γ_6 0.579 (†14, e_K/γ 0.016, coinc with γ_9 and γ_{10}), γ_7 0.629 (K/L_I 6.4), γ_8 0.712, γ_9 0.787, γ_{10} 0.829 (†7, e_K/γ 0.035, K/L_I 4.8), γ_{11} 1.207 (†$\gamma_{11}+\gamma_{12}$ 30, K/L_I 3.8), γ_{12} 1.227, γ_{13} 1.364, γ_{14} 1.517 (†~2, e_K/γ 0.01) spect conv, scint spect, conv-conv coinc, γ-conv coinc (99H57, 64G56); 0.1163, 0.2521, 0.2891 (?), 0.368 (K/L 2), 0.579 (K/L 4), 0.628 (?), 0.660 (?), 0.788 (K/L 5), 0.828 (K/L 4), 1.205 (K/L 4.3), 1.224, 1.363, 1.515 spect conv (126B55, 67B53); ~1.58, ~1.68, 1.80, 1.95, 2.10 scint spect (103G57); others (1I51, 4N50, 65L57c); see also gammas of Hg^{200} and Pb^{200}; 0.148 level of Tl^{200}: $t_{1/2}$ 7.5 x 10^{-9} s delay coinc (82A57, 61J57)
		A	chem, excit (7O49); mass spect (105M54);			
			daughter Pb^{200} (4N50);			
		I	2 atomic beam (173M58)			
Tl^{201}	72 h (4N50); others (112S51, 9K40)	☢	EC (4N50);	γ	γ_1 0.0306 (L_I/L_{II} 10), γ_2 0.0321 (L_I/L_{II} 10), γ_3 0.135 (L_I/L_{II} 10, K/L 7.0), γ_4 0.1672 (L_I/L_{II} 10, K/L 6.2), (γ_1/γ_2 1.0, γ_4/γ_3 3.2), (γ_3 coinc with γ_1 and γ_2), (γ_4 not coinc with γ_1, γ_2 or γ_3) spect conv, γ-conv coinc (126B55, 67B53); others (4N50)	
		B	chem, excit, cross bomb (4N50);			
			daughter Pb^{201} (4N50);			
		I	1/2 atomic beam (173M58)			
202m, Tl^{204m}	6.2 x 10^{-5} s (18V56, 18V56a)	E	excit (18V56, 18V56a)	γ	0.42 (†11, e_K/γ 0.05), 0.70 (†10, e_K/γ 0.05) scint spect (18V56, 18V56a)	
Tl^{202}	12.0 d (170H57); 12.5 d (80M52); 11.5 d (2W50); 11.8 d (5F41)	☢	EC (9K40, 3M42); EC (L/K 0.56) (103G57); EC (L/K 0.23) (168H57); EC (L/K ~0.4) (81H54); EC (L/K ~1), no β^+ or β^- (2W50);	γ	0.4391 (K/L 2.6, L_I+L_{II}/L_{III} 3.5) no other γ, spect conv (67B53); 0.441 (e_K/γ 0.034, K/L 2.7) spect conv, scint spect (65K56); 0.950 level of Tl^{202}: $t_{1/2}$ 4.8 x 10^{-4} s delay coinc (82A57a, 63T57a); $t_{1/2}$ 5.9 x 10^{-4} s scint spect, Tl^{203} (γ, n) (18V56, 18V56a); see also gammas of Hg^{202} and Pb^{202m}	Q_{EC} 0.60 calc (103G57, 170H57); Q_{EC} 1.4 calc (168H57); see Pb^{202m} 
		A	chem, excit (9K40, 5F41);			
			daughter Pb^{202} (81H54)			
Tl	0.042 s (86L57a)	F	excit (86L57a)	γ	0.37 scint spect (86L57a)	
Tl	5 x 10^{-3} s (86L57a)	F	excit (86L57)	γ	~0.9 scint spect (86L57)	

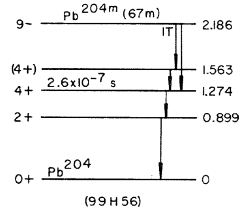
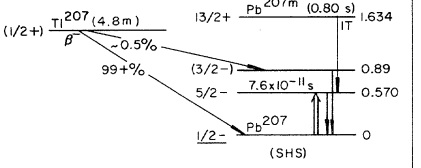
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{81}Tl^{203}$		%		γ	Coulomb excitation (in Tl^{203}): 0.279 (coinc with 0.403 γ), 0.403 scint spect, γ-γ coinc (121S55, 52M58); 0.280, 0.410 scint spect (121B55, 121B56); 0.279 level of Tl^{203}: $t_{1/2}$ 2.9×10^{-10} s delay coinc (130B57); $t_{1/2}$ 2.5×10^{-10} s delay coinc (26E57c); $t_{1/2}$ (photon) 3.3×10^{-10} s nucl res fluor (44M54b, 44M56); $t_{1/2}$ 3.0×10^{-10} s Coul exc (121S55, 52M58); 0.680 level of Tl^{203}: $t_{1/2}$ 0.8×10^{-12} s Coul exc (121S55, 52M58); others (28E53, 121S56); see also gammas of Hg^{203} and Pb^{203}	see Hg^{203} and Pb^{203} 
Tl^{204}	3.56 y (131M57); 4.26 y (22T55a); 4.1 y (98H54); 4.0 y (90H53); 2.50 y (88C55); others (55L56, 5F41, 9K40, 2S47, 7H49, 132S57)	☢	β^- ~98%, EC ~2% (33L52); β^- ~99%, EC ~1.5% (38M52, 38M52a); others (4Y54, 4Y55, 132S57, 130B56a);	β^-	0.764 spect, scint spect (average of 44F54, 33L52, 38M52a, 4Y54, 4Y55, 66K54, 130B56a); others (9S49, 6E50, 5F41);	Q_{EC} 0.38 (38J56); Q_{β^-} 0.764 (SHS) 
		A	chem, n-capt (5F40); mass spect (105M54);	EC	Hg K-x (33L52, 14M52a); internal bremsstrahlung endpoint: 0.29 scint spect, γ-γ coinc (38J56); 0.25 scint spect, γ-γ coinc (38M52a);	
		I μ	2 atomic beam (125B57, 127B56); ±0.089 atomic beam (125B57); ±0.062 atomic beam (127B56)	γ	no γ (lim 0.01%) (38M52); others (6E50, 5F41, 4Y54, 4Y55, 39J55, 125B56, 133H58); see also $Tl^{202m, 204m}$	
Tl^{205}		%	70.50 (1B50);	γ	Coulomb excitation (in Tl^{205}): 0.205 (coinc with 0.410 γ), 0.410, 0.615 scint spect, γ-γ coinc (121S55, 121S56, 52M58); 0.205, 0.410, 0.615 scint spect (122B55, 122B56); 0.205 level of Tl^{205}: $t_{1/2}$ 1.3×10^{-9} s Coul exc (121S55, 121S56, 52M58); 0.615 level of Tl^{205}: $t_{1/2}$ 1.7×10^{-12} s Coul exc (52M58); see also gammas of Hg^{205}	
		I μ	1/2 atomic spect (87M50); +1.6117 nucl induct, atomic spect (61W53)			
Tl^{206}	4.19 m (3S53); 4.23 m (5F40); 4.3 m (13A51); others (1P37, 6H37)	☢	β^- (5F40, 9K42);	β^-	1.51 spect (13A51); 1.65 abs (5F41); 1.8 abs (9K40); others (13Z56a);	Q_{β^-} 1.51 (13A51)
		A	n-capt (4P35); chem, genet (7B47); excit, sep isotopes (4N50a); daughter Bi^{210} (RaE) (7B47); daughter Bi^{210} (RaE) (1.7×10^{-4}%) (33F56); daughter 2.6×10^6 y Bi^{210} (99.6%) (52L54); daughter 2.6×10^6 y Bi^{210} (4N50a)	γ	no γ (5F40, 7B47, 13A51)	
Tl^{207} (AcC'')	4.79 m (3S53); 4.77 m (5F40); 4.76 m (1C31, 3S39); others (6B40, 10B46)	☢	β^-;	β^-	1.44 abs (6E50); 1.47 abs (3S39a); 1.6 abs (6L38);	Q_{β^-} 1.45 (64K54); see Bi^{207}
		A	chem, genet (1C31); daughter Bi^{211} (AcC)	γ	0.870 (~0.5%) (11S41); see also gammas of Bi^{207} and Po^{211}	

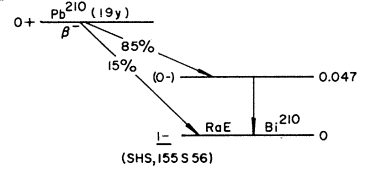
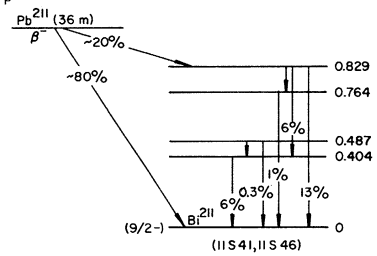
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{81}Tl^{208}$ (ThC'')	3.10 m (219B57); 3.1 m (1C31)	☢	β^-;	β^-	1.792 spect (6M48); 1.795 spect (14H34); 1.805 spect, β-γ coinc (4F48); 1.25, 1.52, 1.79 (~22%), 2.37 (~1.5%, coinc with 2.62 γ) β-γ coinc, abs (49D56); 1.80 (coinc with 0.583 γ), 1.6 (coinc with 0.277 γ), 1.25 (coinc with 0.511 γ) spect, β-γ coinc (4E57); no 5.1 β^- (lim 0.2%) (69C53); others (49D56a, 7S47, 3S33, 6M48);
		A	chem, genet (1C31); daughter Bi^{212} (ThC)	γ	2.62 (~100%, e/γ ~0.002), 0.859 (~15%, e/γ ~0.02), 0.582 (~80%, e/γ ~0.02), 0.510 (~25%, e/γ ~0.08), 0.277 (~10%, e/γ ~0.3) spect, spect conv (6M50); 2.6143, 0.51085 spect (49L52, 49L51); 2.6147 spect conv (110B51); 0.5830 (†40), 0.5108 (†15), 0.27735 (†5) cryst spect (100M52); 2.614, 0.5108 spect conv (106M54); 0.5833 spect conv (SHS, calc from 128B56); 0.233, 0.2520 (K/L 5), 0.583 (e_K/γ 0.015), 0.763 (†2.4, e_K/γ 0.032, K/L 5), 1.094 (e_K/γ 3×10^{-3}), 2.62 (†100, e_K/γ 0.0018) spect conv, γ-γ coinc, scint spect (4E57, 4E54b); 2.614 (e_K/γ 0.0017, K/L 5.5), 0.860 (K/L 5.5), 0.583 (L_I+L_{II}/L_{III} 9), 0.511 spect conv (123K56a, 123K56); no 3.2 γ (8B48, 9B50, 6M55, 51D57a); 0.583 γ: $t_{1/2}$ 2.4×10^{-10} s delay coinc (4E54a); others (4E54b, 58K53, 5S52a, 27N53, 27N54, 62W55, 63W55, 89C56, 49D56a, 8E32, 11B50, 12H51, 6W50, 2J47, 122G57, 96R58, 20Z57)
Tl^{209}	2.2 m (4H50)	☢	β^- (4H50);	β^-	1.99 spect (39W52a); 1.8 abs (4H50);
		A	chem, genet (4H50); daughter Bi^{213} (4H47, 11E47); parent Pb^{209} (4H47, 11E47)	γ	γ_1 0.12 (e_K/γ 0.4), γ_2 0.45, γ_3 1.56, (γ_1 coinc with γ_2 and γ_3), (γ_2 coinc with γ_1 and γ_3) scint spect, γ-γ coinc (13P55, 125S56); 0.12 scint spect (39W52a); γ_1: $t_{1/2}$ 3.1×10^{-9} s delay coinc (125S56)
Tl^{210} (RaC'')	1.32 m (1C31); 1.5 m (9B50); ~1.3 m (8D37)	☢	β^-; n ~0.02% (84K56, 84K57);	β^-	1.96 scint spect (107M56); 1.8 cl ch (6L38); 2.0 abs (8D37); others (51D57a);
		A	chem, genet (1C31); daughter Bi^{214} (RaC); parent Pb^{210} (RaD)	γ	γ_1 0.297, γ_2 0.78, γ_3 ~1.1 (weak), γ_4 ~1.3 (weak), γ_5 2.36, (all γ's coinc with β^-), (γ_1 coinc with γ_2, γ_3, γ_4, and γ_5), (γ_2 coinc with γ_3, γ_4, and γ_5), (γ_3 coinc with γ_5), β-γ coinc, γ-γ coinc, scint spect (107M56)
$_{82}Pb^{195}$	17 m (43A57)	☢	EC (43A57);	γ	with Tl^{195m}: 0.099 (L_I+L_{II}/L_{III} 1.8), 0.383, 0.393 spect conv (43A57, 67B57);
		B	chem, mass spect (43A57); parent Tl^{195m} (43A57b)		see also gammas of Tl^{195m}
Pb^{196}	37 m (43A57)	☢	EC (43A57);	γ	0.1668 (coinc with 0.253 γ), 0.2529 (K/L 4.4) spect conv, γ-γ coinc (43A57)
		B	chem, genet (43A57); parent Tl^{196} (43A57)		

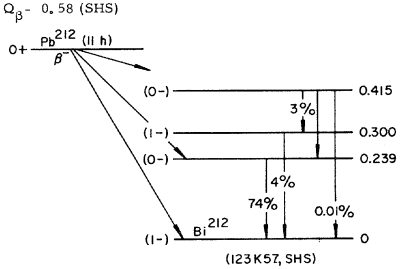
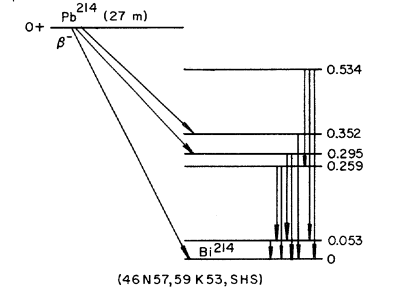


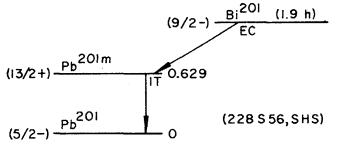
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{82}Pb^{197m}$	42 m (43A55)	☢	EC ~80%, IT ~20% (43A57);	γ	with IT: 0.2340 (K/L >0.3, L_I+L_{II}/L_{III} 1.5); with EC (with Tl^{197m}): 0.2219 (K/L 0.28, L_I+L_{II}/L_{III} 2.5), 0.385 (K/L 5.7), 0.387 (K/L 3.5) spect conv (43A57, 43A55); see also gammas of Tl^{197m}	
		B	chem, mass spect (43A55)			
Pb^{198}	25 m (7K51); no 25 m activity observed (43A57)	☢	EC (7K51);			
		E	chem, genet (7K51); parent Tl^{198m} (7K51, 4N50); daughter Bi^{198} (4N50)			
Pb^{198}	2.4 h (43A57)	☢	EC (43A55);	γ	0.1169 (K/L ~4), 0.1734 (K/L 0.65, L_I+L_{II}/L_{III} 1.2), 0.259 (K/L ~3), 0.290, 0.366 (coinc with 0.290 γ and 0.398 γ), 0.382 (?), 0.398 (K/L 2, L_I+L_{II}/L_{III} 2, coinc with 0.290 γ) spect conv, γ-γ coinc (43A57); 0.173 γ: $t_{1/2}$ 4×10^{-9} s delay coinc (61J57)	
		B	chem, mass spect (43A55)			
Pb^{199m}	12.2 m (43A55); 13 m (228S56)	☢	IT (43A55);	γ	with IT: 0.424 (K/L 1.9, L_I+L_{II}/L_{III} 3.2) spect conv (43A57); 0.41 (e_K/γ 2.4) scint spect (228S56)	
		B	chem, mass spect (43A55)			
Pb^{199}	90 m (43A55); ~80 m (4N50)	☢	EC (4N50);	β^+	2.8 spect (43A57);	
			β^+ (weak) (43A57);	γ	0.353 (coinc with 0.367 γ, K/L 5.3, L_I+L_{II}/L_{III} 40), 0.367 (K/L 4.4, L_I+L_{II}/L_{III} 7.4), 0.721 spect conv, conv-conv coinc (43A57)	
		A	chem, genet (4N50); chem, mass spect (43A55); parent Tl^{199}, daughter Bi^{199} (4N50)			
Pb^{200}	21.5 h (126B55); 18 h (64G56)	☢	EC (4N50);	γ	γ_1 0.0328, γ_2 0.1095, γ_3 0.1422 (K/L 4.5), γ_4 0.1480 (K/L 0.52, $L_I/L_{II}/L_{III}$ = 0.12/1/0.7), γ_5 0.1589, γ_6 0.2353 (K/L 5.5), γ_7 0.2573 (K/L 4.5), γ_8 0.268 (K/L 4.5), γ_9 0.290, γ_{10} 0.450 spect conv (126B55, 82A57); (γ_4 coinc with γ_2, γ_3, γ_6, and γ_8), (γ_4 not coinc with γ_5, γ_7, and γ_9) conv-conv coinc, spect conv (64G56); γ_4: $t_{1/2}$ 7.5×10^{-9} s delay coinc (82A57, 61J57)	
		A	chem, genet (4N50); parent Tl^{200}, daughter Bi^{200} (4N50); daughter Po^{204} (7K51)			
Pb^{201m}	61 s (228S56); 60 s (34F55); 50 s (89H52)	☢	IT (89H52);	γ	0.629 (e_K/γ 0.6, K/L 2.3, L_I+L_{II}/L_{III} 4), no other γ, spect conv, scint spect (228S56); 0.65 (e_K/γ 0.8) scint spect (34F55); 0.25, 0.42, 0.67 scint spect (89H52)	
		B	chem, excit (89H52); chem, genet (228S56); daughter 1.85 h Bi^{201} (228S56)			
Pb^{201}	9.4 h (126B55); 8 h (47W54, 4N50)	☢	EC (4N50);	β^+	~2.5 spect (43A57); 0.55 spect (126B57a);	
			β^+ (weak) (43A57, 126B57);	γ	0.1291, 0.2844 (?), 0.310, 0.330 (K/L 4.7, coinc with 0.361 γ), 0.361 (K/L 5.6), 0.394 (K/L 2.5), 0.406 (K/L 2.8), 0.585 (K/L 5.5), 0.692 (K/L 6.5), 0.708 (?), 0.766 (K/L 5.5), 0.825 (?), 0.907 (K/L 5.5), 0.946 (K/L 6.5), 1.099 (K/L 5.5) spect conv, conv-conv coinc (126B55, 47W54)	
		B	chem, genet (4N50); parent Tl^{201}, daughter 62 m Bi^{201}, daughter 1.85 h Bi^{201} (4N50); daughter Po^{205} (7K51)			

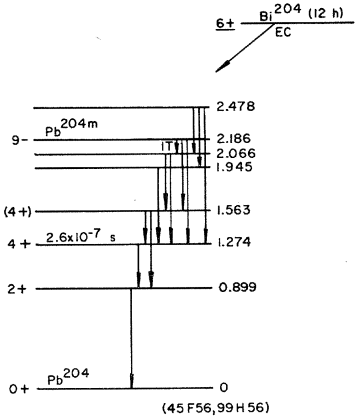
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{82}Pb^{202m}$	3.62 h (82A57a); 3.5 h (94M54a, 94M54b); 3.7 h (20N55)	☢	IT 90%, EC 10% (126M57);	γ	with IT: γ_1 0.1293 (K/L <0.008, L_I+L_{II}/L_{III} 1.9), γ_2 0.2403 (K/L 5.0), γ_3 0.422 (K/L 2.6, L_I+L_{II}/L_{III} 5.6), γ_4 0.547 (K/L 0.8, L_I+L_{II}/L_{III} 6), γ_5 0.658 (K/L 5.5), γ_6 0.787 (K/L 1.2, L_I+L_{II}/L_{III} ~10), γ_7 0.961 (K/L 5.0, L_I+L_{II}/L_{III} ~15) spect conv, conv-conv coinc (126M57, 126M56, 126B55); γ_1 0.129 (K/L <0.004, L_I+L_{II}/L_{III} 1.7), γ_3 0.422 (K/L ~2), γ_6 0.787 (K/L 1.3), γ_7 0.961 (γ_5 coinc with γ_3 and γ_7), (γ_6 coinc with γ_3 and γ_7), (γ_5 not coinc with γ_6) γ-γ coinc, scint spect, spect conv (20N55, 94M54a, 94M54b); 1.384 level of Pb^{202}: $t_{1/2}$ 1.5 x 10^{-9} s delay coinc (61J57); with EC: 0.1489 (K/L 6.1), 0.2411 (K/L 1.3, L_I+L_{II}/L_{III} 2.5), 0.336 (K/L ~5), 0.390 (K/L 6), 0.460 (K/L <1.7, L_I+L_{II}/L_{III} 5.1), 0.490 (K/L 3.5, L_I+L_{II}/L_{III} 8), no 0.401 γ, spect conv (126M57, 126B55); 0.950 level of Tl^{202}: $t_{1/2}$ 4.8 x 10^{-4} s delay coinc (82A57a); see also gammas of Tl^{202} and Bi^{202}	Q_{IT} 2.17 (94M54b, 94M54a); Q_{EC} 2.25 (126M57)  (126 M57, SHS)
Pb^{202}	~3 x 10^5 y yield (81H54); others (2T47, 4N50)	☢ A	EC (no K, lim 0.5%) (81H54); chem, genet, mass spect (81H54); parent Tl^{202} (81H54)	γ	L-x scint spect (81H54); 1.384 level of Pb^{202}: $t_{1/2}$ 1.5 x 10^{-9} s delay coinc (61J57)	
Pb^{203m}	6.1 s (82A57a); 6.5 s (228S56); 6.7 s (34F55, 67B55); 7.1 s (45F56); 5.6 s (89H52)	☢ A	IT (89H52); excit (89H52); chem, genet (228S56, 45F56); daughter Bi^{203} (228S56, 45F56)	γ	0.825 (e_K/γ ~0.2, K/L_I+L_{II} 3.3) scint spect, spect conv (228S56); 0.826 scint spect (45F56); 0.86 (e_K/γ ~0.13) scint spect (34F55, 67B55); 0.89 scint spect (89H52); see also gammas of Bi^{203}	 (41 P 54, 228 S56, SHS)
Pb^{203}	52.1 h (21B58); 52 h (5F40, 2T47); 54 h (9K40); others (5F41, 10B46)	☢ A	EC (3M42); EC to 0.279 level of Tl^{203}: L/K 0.21 (168H57); L/K 0.14 (41P54); EC to 0.680 level of Tl^{203}: L/K 0.36 (168H57); chem, excit (3M42); chem, excit, cross bomb (2T47); genet energy levels (47W54); daughter Bi^{203} (4N50)	γ	γ_1 0.279 ($K/L_I/L_{II}/L_{III}$ = 1/0.25/0.15/0.08), γ_2 0.401 spect conv (45F56); γ_1 0.279 (†100, K/L+M 2.6), γ_2 0.404 (†4.6, e_K/γ 0.12, K/L 6.0), γ_3 0.678 (†0.85, e_K/γ 0.009) spect conv, scint spect (47W54, 20N58); γ_1 (†100), γ_2 (†4.7), γ_3 (†0.87), γ_1 coinc with γ_2, scint spect, γ-γ coinc (41P54); γ_1 (†100), γ_2 (†4.2, e_K/γ 0.08), γ_3 (†0.83) scint spect (19V54); γ_1 (e_K/γ 0.14) scint spect (8B56); others (3M42, 9L44, 65L57a, 26V57); see also gammas of Hg^{203} and Tl^{203}	Q_{EC} 0.95 (20N58, recalc from 41P54); Q_{EC} 0.93 calc (168H57)
Pb^m	2 x 10^{-3} s (86L57)	E	excit (86L57)	γ	~0.7 scint spect (86L57)	

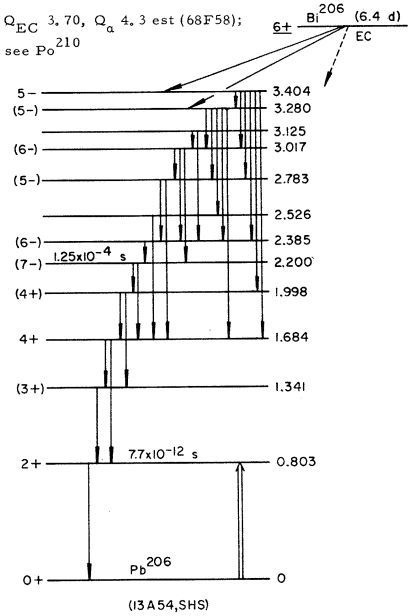
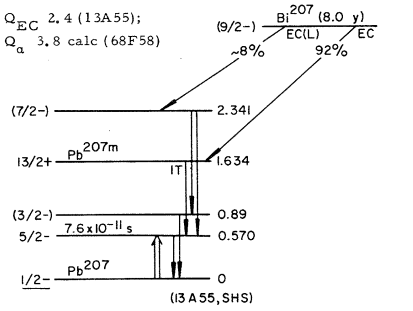
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{82}Pb^{204m}$	66.9 m (21B58); 67.5 m (99H56); 68 m (3M42); 65 m (5F41); others (7D39, 10B46)	☢	IT (3M42);	γ 0.2894, 0.3747 (e_K/γ 0.044, K/L 1.8), 0.622 (K/L 0.74), 0.899 (K/L 3.9), 0.912 (e_K/γ 0.055, K/L 1.7) spect conv (99H56); 0.2895, 0.3750, 0.899, 0.912 spect conv (45F56); 0.375 (coinc with 0.90 γ), 0.90 (coinc with 0.90 γ), scint spect, γ-γ coinc (55K54, 65W56, 81H56); 0.375 γ: $t_{1/2}$ 2.6 x 10^{-7} s delay coinc (55K54); $t_{1/2}$ 3 x 10^{-7} s delay coinc (14S50); others (14S50, 3M42, 5F41, 55K55, 40F54, 126B55, 14S55, 40F53, 94M54c); see also gammas of Bi^{204}	Q_{IT} 2.186 (99H56); see Bi^{204} 
		A	chem (5F41); chem, excit, genet (2T47, 7K51); mass spect (94M54c); daughter Bi^{204} (2T47, 14S50, 7K51);		
		μ	1.274 level of Pb^{204} (assuming I = 4): +0.22 ang corr attenuation (55K55, 81H56); others (40F53, 40F54)		
Pb^{204}		%	1.40 (64W56); 1.36 (90C52); 1.48 (6N38);		
		μ	ground state: ~0 atomic spect (87M50);		
		μ	1.274 level: +0.22 (see Pb^{204m})		
Pb^{205}	~5 x 10^7 y yield (81H56a)	☢	EC (L) (81H56a); no EC (K) (127S54, 128S54, 81H54, 100H56);	γ L-x scint spect (81H56a)	Q_{EC} 0.11 calc (68F58)
		D	chem, genet (81H56a); daughter Bi^{205} (81H56a)		
Pb^{206}		%	25.1 (90C52); 25.2 (64W56); 23.6 (6N38);	γ Coulomb excitation (in Pb^{206}): 0.80 scint spect (122B56); 0.81 ($t_{1/2}$ 7.7 x 10^{-12} s) scint spect (121S55a); 2.200 level of Pb^{206}: $t_{1/2}$ 1.23 x 10^{-4} s delay coinc (63T57); $t_{1/2}$ 1.28 x 10^{-4} s delay coinc (82A57a); others (18V56, 13A54, 13A53, 125K56); see also gammas of Bi^{206}	see Bi^{206}
		μ	~0 atomic spect (87M50)		
Pb^{207m}	0.80 s (79B55); 0.84 s (24C56); 0.82 s (51L51); 0.80 s (89H52); others (23F53, 121S55b, 20V56, 53R54, 53R53, 61I55)	☢	IT (24C50);	γ 0.5697, 1.064 spect conv (13A55); 0.57, 1.06 scint spect (24C56); 0.50, 1.01 scint spect (53R54); see also gammas of Pb^{207}, Tl^{207}, Po^{211m}, Po^{211}, and Bi^{207}	Q_{IT} 1.634 (SHS) see Bi^{207} 
		A	excit, sep isotopes (24C50); chem, genet (23F53); daughter Bi^{207} (23F53, 24C56, 52M53a, 47W54a); daughter Po^{211m} (40J54); not daughter Po^{211} (lim 0.005%) (23F53)		
Pb^{207}		%	21.7 (64W56); 21.3 (90C52); 22.6 (6N38);	γ Coulomb excitation (in Pb^{207}): 0.57 ($t_{1/2}$ 1 x 10^{-10} s) scint spect (121S55a); 0.58 scint spect (41A56, 41A56a); 0.570 level of Pb^{207}: $t_{1/2}$ 7.6 x 10^{-11} s delay coinc (14S57); $t_{1/2}$ 9 x 10^{-11} s delay coinc (64G56a); $t_{1/2}$ 1 x 10^{-10} s Coul exc (121S55a); see also gammas of Pb^{207m}, Bi^{207}, Po^{211m}, and Po^{211}	
		I	1/2 atomic spect (87M50);		
		μ	+0.584 nucl induct (222B57, 67K56, 61W53)		

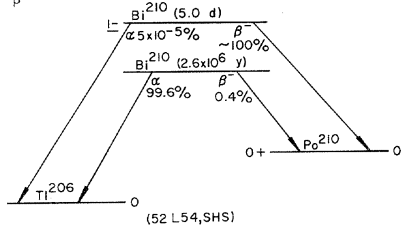
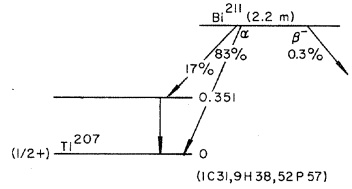
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{82}Pb^{208}$		% 52.3 (90C52); 51.7 (64W56); 52.3 (6N38); μ ~0 atomic spect (87M50)	γ 3.20 level of Pb^{208}: $t_{1/2}$ 2.4 x 10^{-10} s delay coinc (4E54a); see also gammas of Tl^{208}	see Tl^{208}
Pb^{209}	3.30 h (47W53); 3.22 h (5F41); 2.75 h (9K40); others (9K42, 3M42)	☢ β^- (9K40, 5F41); A chem (6T37, 9K40); chem, sep isotopes (5F41a); daughter Po^{213} (4H47, 11E47, 11M49); daughter Tl^{209} (11E47, 4H47)	β^- 0.635 spect (47W53, 47W52a); 0.63 spect (39W52a); 0.68 spect (11R47); others (9K40, 5F41); γ no γ, no conv (47W53, 47W52a); 2.13 level of Pb^{209}: $t_{1/2}$ 3.1 x 10^{-9} s delay coinc (125S56); see also gammas of Tl^{209}	Q_{β^-} 0.63 (68F58) see Tl^{209}
Pb^{210} (RaD)	19.4 y (22T55b); 22 y (1C31)	☢ β^-; A chem, genet (1C31); daughter Tl^{210} (RaC''); daughter Po^{214} (RaC'); parent 5 d Bi^{210} (RaE); not parent 2.6 x 10^6 y Bi^{210} (lim 10^{-4}%) (52L54)	β^- 0.017 ion ch, scint spect, β-γ coinc (average of 33J53, 51I52, 50L55, 47B52a); β_0 15%, β_{47} 85% range emuls (155S56); β_0 0.061 (19%) spect (65T57); others (33J52, 101H53, 8L39, 12S46, 46A56); γ 0.04650 ($L_I/L_{II}/L_{III}/M_I$ = 1.0/0.11/0.010/0.29) spect conv (8F57); 0.04652, no other γ between 0.016 and 0.060 (lim 0.1%) cryst spect (26E52); 0.0465 ($L_I/L_{II}/L_{III}/M$ = 1.0/0.08/0.007/0.26), no other γ (lim 0.5%) spect conv, scint spect (16W53); 0.0467 (3.5%) spect conv, abs (24B30, 8S31, 19G32, 6D33); 0.0465 (4.5%, e_L/γ 13) scint spect, ion ch (33F57a); ~0.047 (3.8%) scint spect (50D54, 50D53); ~0.047 (e_L/γ ~16, $L_I/L_{II}/L_{III}/M$ = 1.0/0.09/0.019/0.29) spect conv (6C50); ~0.047 ($L_I/L_{II}/L_{III}/M$ = 1.0/0.15/0.009/0.26) spect conv (44A56, 117B53); ~0.047 (e/γ ~23) spect conv (33L51); ~0.047 (e/γ ~17) spect conv (14B51); others (221B57, 8F52, 9T46, 9T43, 10C51, 4T52a, 63C52, 35C52, 68K53, 33F56a, 123C58)	Q_{β^-} 0.064 (to RaE) (SHS)  (SHS, 155S56)
Pb^{211} (AcB)	36.1 m (3S39); 36.0 m (1C31)	☢ β^-; A chem, genet (1C31); daughter Po^{215} (AcA); parent Bi^{211} (AcC)	β^- 1.39 (~80%), ~0.5 (~20%) abs (3S39a); γ 0.065, 0.083, 0.404, 0.425, 0.487, 0.764, 0.829 spect, spect conv, abs (11S42); 0.829 (5%) (54M44); 0.83 scint spect (73P57)	Q_{β^-} 1.4 (SHS)  (11S41, 11S46)

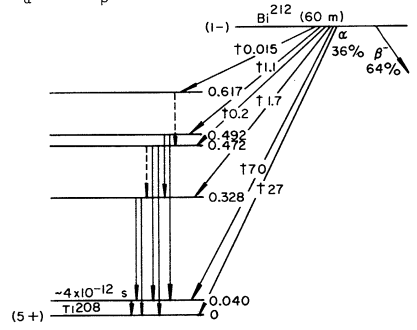
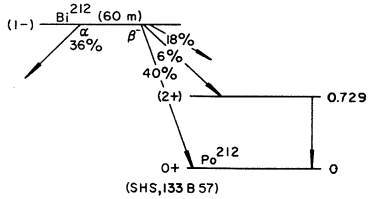
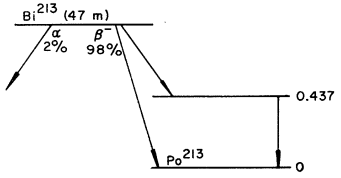
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{82}Pb^{212}$ (ThB)	10.64 h (22T55c, 109M53); 10.67 h (129B52); 10.6 h (1C31, 16D55)	☢ β^-; A chem, genet (1C31); daughter Po^{216} (ThA); parent Bi^{212} (ThC)	β^-: 0.355, 0.589 spect, β-γ coinc (4F48); 0.331, 0.569 (~12%) spect (6M48a); 0.340 spect (6G49); 0.36 spect (3S33); γ: γ_3 0.2386 spect conv (106M54, 49L51); cryst spect (100M52); γ_1 0.1151 ($K/L_I/L_{II}/L_{III}$ = 4.5/1.0/0.12/<0.02), γ_2 0.1767 (K/L_I 5.1), γ_3 0.2386 ($K/L_I+L_{II}/L_{III}$ = 6.0/1.0/0.007), γ_4 0.3001 (K/L 5.9), γ_5 0.4152, no 0.249 γ spect conv (123K57, 123K56b); 0.115, 0.176, 0.238, 0.249, 0.299 spect conv (8E32); γ_3 0.238 (~40%), γ_4 0.300 (~4%) spect (6M50); γ_3 ($K/L_I/L_{II}$ = 5.9/1.0/0.1) spect conv (129S56); γ_1 (K/L 5) spect conv (46N57); γ_3 (K/L 5.5) spect conv (28N55); γ_3 ($L_I/L_{II}/L_{III}$ = 1.0/0.11/0.008) spect conv (70K55); γ_3 ($L_I/L_{II}/L_{III}$ = 1.0/0.12/0.007) spect conv (123K56c); γ_3 ($K/L_I/L_{II}/L_{III}$ = 6.7/1.0/0.05/<0.01) spect conv (88S50); γ_3 (e/γ ~1), γ_4 (e/γ ~0.3) calc from (9F39, 6M48a, 6M50); others (7S44, 14G53, 7S52, 69K54, 7S56, 5S53, 89C56, 117S52, 11S46, 20Z57)	Q_{β^-} 0.58 (SHS)  (123K57, SHS)
Pb^{214} (RaB)	26.8 m (1C31)	☢ β^- (3S33, 7R36); A chem, genet (1C31); daughter Po^{218} (RaA); parent Bi^{214} (RaC)	β^-: β_1 0.67 (†33), β_2 ~0.73 (†100), 0.35 (?) spect (130B52); β_1 0.59 (†56), β_2 0.65 (†44) spect, β-γ coinc (59K53); β_3 1.03 (6%) spect (51D56); others (3S33, 8C41); γ: γ_1 0.05323, γ_2 0.24192 (†20), γ_4 0.29522 (†55), γ_5 0.3520 (†100) cryst spect (100M52); γ_1 0.0532 ($L_I/L_{II}/L_{III}$ = 1.0/0.19/0.01), γ_2 0.2419 ($K/L_I/L_{II}/L_{III}$ = 5.5/1.0/0.22/<0.01), γ_3 0.2589 (K/L_I 5.8), γ_4 0.2952 ($K/L_I/L_{II}/L_{III}$ = 6.5/1.0/0.16/<0.01), γ_5 0.3520 ($K/L_I/L_{II}/L_{III}$ = 5.9/1.0/0.18/<0.01) spect conv (110M54); 0.196 (weak), 0.206, 0.242 (e_K/γ 0.63, K/L 5.3), 0.259, 0.272 (weak), 0.275, 0.279 (weak), 0.295 (K/L 5.6), 0.352 (K/L 5.7), 0.481, 0.534, 0.549 (weak), 0.777 (0.053 γ coinc with 0.242 γ, 0.481 γ, and 0.777 γ), spect conv, γ-conv coinc, scint spect (46N57); γ_1 (1.6%) crit abs (9T43a); γ_2 (K/L_I ~6.7), γ_4 (K/L_I ~6.7), γ_5 (K/L_I 5.9) spect conv (59K51); β_1 coinc with γ_5, β_2 coinc with γ_4, β-conv coinc (130B52, 59K53); γ_5 not coinc with γ_4 or γ_2, conv-conv coinc (59K53); others (8E34, 10C51, 25P53, 7S44)	Q_{β^-} 1.02 (SHS)  (46N57, 59K53, SHS)
$_{83}Bi^{<198}$	1.7 m (4N50)	☢ α (2T48); E (2T48); chem (4N50)	α: 6.2 ion ch (4N50)	Q_α 6.3 (13P56)
Bi^{198}	7 m genet (4N50)	☢ EC 99+%, α 0.05% (4N50); D chem (2T48); chem, genet (4N50); parent 25 m Pb^{198} (4N50)	α: 5.83 ion ch (4N50)	Q_α 5.95 (13P56)

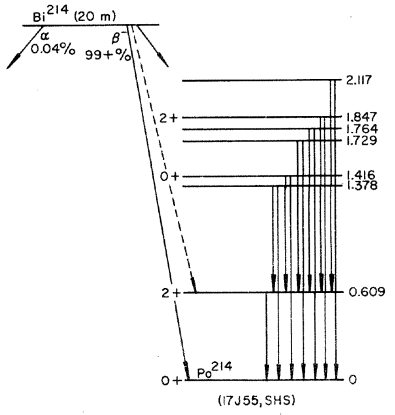
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{83}Bi^{199}$	~25 m genet (4N50)	☢ EC 99+%, α ~0.01% (4N50); B chem (2T48); chem, genet (4N50); parent Pb^{199} (4N50)	α 5.47 ion ch, abs mica (4N50)	$Q_α$ 5.58 (13P56)
Bi^{200}	35 m genet (4N50); others (17V55a)	☢ EC (4N50); B chem, genet (4N50); parent Pb^{200} (4N50); daughter Po^{200} (7K51a)		
Bi^{201}	62 m (4N50); others (17V55a)	☢ EC 99+%, α 3×10^{-3}% (4N50); B chem (2T48); chem, genet (4N50); parent Pb^{201} (4N50); daughter Po^{201} (?) (7K51a)	α 5.15 ion ch (4N50)	$Q_α$ 5.25 (13P56)
Bi^{201}	1.85 h (228S56); ~2 h (genet (4N50); others (17V55a)	☢ EC (4N50); B chem, genet (4N50); parent Pb^{201} (4N50); parent Pb^{201m} (228S56); daughter Po^{201} (?) (7K51a)	γ with Pb^{201m}: 0.629 ($e_K/γ$ 0.6, K/L 2.3, L_I+L_{II}/L_{III} 4), no other γ, scint spect, spect conv (228S56)	
Bi^{202}	95 m (7K51); others (17V55a)	☢ EC (7K51); B chem, genet (7K51); daughter Po^{202} (7K51)	γ 0.422, 0.961 spect conv (126M57); see also gammas of Pb^{202m}	see Pb^{202m}
Bi^{203}	12.3 h (228S56); 11.5 h (45F58); 12 h genet (4N50)	☢ EC (4N50); $β^+$ weak (51N58); α ~10^{-5}% (15D52a); A chem, genet (4N50); parent Pb^{203} (4N50); parent Pb^{203m} (228S56, 45F58); daughter Po^{203} (7K51); daughter At^{207} (12B51); I 9/2 atomic beam (92L58)	α 4.85 range emuls (15D52a); $β^+$ 1.35, 0.74 spect (51N58); γ 0.0603, 0.1263 (L_I+L_{II}/L_{III} 1.5), 0.1865 (K/L 5), 0.2636 (K/L 5), 0.3814 (K/L 5), 0.6263, 0.7224 (K/L 3.3), 0.7583, 0.8197 (K/L 4.5), 0.8252 (K/L 3.4), 0.8467, 0.932, 1.034 (K/L 5), 1.184, 1.256, 1.510, 1.523, 1.537, 1.846, 1.896 spect conv, γ-γ, conv-γ coinc, scint spect (51N58, 228S56); 0.1264 (L_{II}/L_{III} 1.3), 0.1865 (K/L_I 5.2), 0.2640 (K/L_I 4.3), 0.382, 0.606, 0.708, 0.722, 0.820, 0.825 (with Pb^{203m}, K/L 4), 1.034, 1.536, other weak gammas, spect conv (45F56, 45F58); others (65W56); see also gammas of Pb^{203m}	$Q_α$ 4.95 (13P56); see Pb^{203}

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{83}Bi^{204}$	11.6 h (65W56); 11.0 h (45F58); 13.5 h (228S56); 12 h (2T47)	☢	EC, no β^+ (2T47); no β^+ (lim 0.6%) (45F56);	γ	0.0785 (L_{II}/L_{III} ~1.3), 0.0802, 0.0909 ($L_I/L_{II}/L_{III}$ ~2.2/1.7/1), 0.0922 ($L_I/L_{II}/L_{III}$ ~2.6/1.3/1), 0.1002, 0.1409 (K/L ~5), 0.1702 (K/L 6), 0.1759 (K/L ~5), 0.2134, 0.2160 (K/L 6), 0.2191 (K/L 4), 0.2219 (K/L 6), 0.2275, 0.2405 (K/L 6), 0.2490 (K/L 5), 0.2529, 0.2893 (K/L 6), 0.2929 (K/L ~5), 0.3305 (K/L ~5), 0.3680 (K/L ~2), 0.3747 ($K/L_I+L_{II}/L_{III}$ = 12/4.1/1), delay coinc with 0.29 γ, 0.50 γ, 0.67 γ, 0.90 γ, 0.98 γ, and 1.20 γ), 0.405 (K/L ~3), 0.4122 (K/L ~4), 0.4215 (K/L 6), 0.4385 (K/L ~6), 0.4734, 0.502 (K/L ~4), 0.522, 0.532 (K/L 6), 0.542, 0.622, 0.661 (K/L 5), 0.663, 0.671 (K/L 5.8, delay coinc with 0.375 γ and 0.90 γ), 0.692, 0.709, 0.710, 0.719, 0.791, 0.8992 (K/L 4.4), 0.9117 ($K/L_I+L_{II}/L_{III}$ = 24/14/3), 0.918 (K/L ~5), 0.984, 1.203 (K/L 5), 1.211 spect conv, scint spect, γ-conv coinc (228S58); 0.0786 (L_{II}/L_{III} 1.2), 0.0802 (L_I/M_I 4.3), 0.1004 (L_I/L_{II} large), 0.1091 (?), 0.1198, 0.1409 (K/L_I 2.5), 0.1445 (L_I/L_{II} large), 0.1649 (?), 0.1700 (K/L_I 6.0), 0.1762 (K/L_I 2.5), 0.1849, 0.2127, 0.2135, 0.2162 (K/L_I 3.0), 0.2195 ($K/L_{II}/L_{III}$ = 6.2/1.0/0.6), 0.2225 (K/L_I 2.1), 0.2271, 0.2407 (K/L_I 2.2), 0.2491 (K/L 3.4), 0.2524, 0.2895 (K/L_I 3.7), 0.291 (K/L_I 7.5), 0.331 (K/L_I 6.5), 0.375 ($K/L_I+L_{II}/L_{III}$ = 2.2/1.0/0.3), 0.406 (K/L_I 3.3), 0.412, 0.422 (K/L 4.2), 0.439, 0.440, 0.502, 0.522 (K/L_I+L_{II} 3.1), 0.533, 0.622, 0.662 (K/L_I 6.3), 0.663 (K/L_I+L_{II} 2.2), 0.671 (K/L_I 5.9), 0.710, 0.725, 0.792, 0.899 ($K/L_I+L_{II}/L_{III}$ = 5.0/1.0/0.2), 0.912 ($K/L_{II}+L_{III}$ 1.6), 0.918 (K/L_I 2.0), 27 other gammas, no 0.981 γ scint spect, spect conv (45F56, 45F58); 0.371, 0.668, 0.895, 0.981 (coinc with 0.668 γ and 1.20 γ), 1.20, 1.73, 2.10 spect conv, scint spect, γ-γ coinc (65W56); others (14S50a, 14S50); see also Pb^{204m}	 (45F56,99H56)
Bi^{205}	14.5 d (7K51); 15.3 d (45F58); others (17V55a)	☢	EC (7K51);	β^+	0.93 spect (133S57);	Q_{EC} 2.65 (133S57); Q_a 4.5 est (68F58)
			β^+ weak (45F56, 133S57, 18V57);	γ	γ_1 0.1152, γ_2 0.2359, γ_3 0.2605 ($K/L_I/L_{II}$ = 4/1/0.2), γ_4 0.2823 (K/L_I+L_{II} 5.5), γ_5 0.2842 ($K/L_I/L_{II}$ = 6.2/1/0.16), γ_6 0.3494 (K/L 5.9), γ_7 0.3832, γ_8 0.4936, γ_9 0.512 (K/L 6), γ_{10} 0.550, γ_{11} 0.571 (2.3%, e_K/γ 0.05, K/L 5.5), γ_{12} 0.580 (K/L 7), γ_{13} 0.627, γ_{14} 0.689, γ_{15} 0.703 (14.5%, e_K/γ 0.010, K/L 4.2), γ_{16} 0.745, γ_{17} 0.758, γ_{18} 0.761, γ_{19} 0.911 (3.3%, K/L 4.0), γ_{20} 0.988 (14%, e_K/γ 0.003, K/L 4.0), γ_{21} 1.003, γ_{22} 1.014, γ_{23} 1.044 (2.2%, e_K/γ 0.02, K/L 5.7), γ_{24} 1.190 (K/L 3.8), γ_{25} 1.337, γ_{26} 1.352, γ_{27} 1.503, γ_{28} 1.552, γ_{29} 1.615 (K/L 7), γ_{30} 1.766 (γ_{30} + γ_{31} 52%, K/L 6.0), γ_{31} 1.777, γ_{32} 1.863 (γ_{32} + γ_{33} 9%), γ_{33} 1.907, γ_{34} 2.60 (0.3%), (γ_3 coinc with γ_4 + γ_5, γ_6, γ_{11}, and γ_{29}), (γ_4 coinc with γ_5), (γ_4 + γ_5 coinc with γ_9 and γ_{11}), (γ_6 coinc with γ_{11}), (γ_{15} coinc with γ_5, γ_6, γ_{19}, β^+, and γ_{32} + γ_{33}) spect conv, scint spect, conv-conv coinc, γ-conv coinc (133S57, 64G56); 0.1122 (L_{II}/L_{III} 1.4), 0.2605, 0.2824, 0.2840 (K/L 4.7), 0.3493, 0.4935, 0.512, 0.571 (†35), 0.580, 0.703 (†100, K/L 5.5), 0.988, 1.043; weak transitions 0.131, 0.149, 0.193, 0.383, 0.526, 0.531, 0.550, 0.574, 0.626, 0.745, 0.759, 0.911, 1.014, 1.073, 1.190, 1.35, 1.62 spect conv, scint spect (45F56, 45F58); 0.284, 0.704 (K/L ~5), 0.912, 0.989, 1.045 (K/L ~4), 1.074, 1.190 (K/L ~4), 1.615 (K/L ~4), 1.766 (K/L ~6), 1.778, 1.864 spect conv (13A54); 0.28 (†5.2), 0.33 (†2.4), 0.38 (†1.2), 0.47 (†4.3), 0.52 (†~15), 0.57 (†~30), 0.62 (†6.1), 0.70 (†100, coinc with 0.28 γ, 0.91 γ, and 1.87 γ), 0.76 (†~20), 0.91 (†22), 0.99 (†57), 1.04 (†52), 1.18 (†10), 1.35 (†~6), 1.52 (†9), 1.62 (†17), 1.76 (†120, not coinc with γ), 1.87 (†29) scint spect, γ-γ coinc (18V57); others (7K51); see also gammas of Po^{209}	
		A	chem, genet, sep isotopes (7K51); daughter Po^{205} (7K51); daughter At^{209} (12B51); parent Pb^{205} (81H56a)			
		A	chem, sep isotopes, cross bomb, genet (2T47); parent Pb^{204m} (2T47, 14S50, 7K51); daughter Po^{204} (7K51);			
		I	6 atomic beam (92L58)			

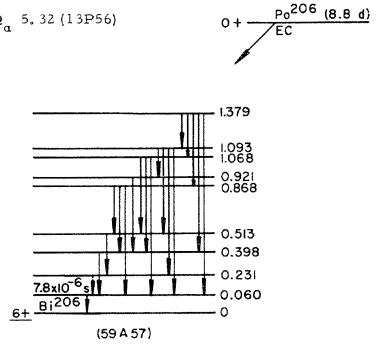
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{83}Bi^{206}$	6.4 d (9K40); 6.30 d (59A57)	☢	EC (9L44, 13A51c); no β^+ (lim 0.4%) (13A53, 13A54);	γ	γ_1 0.1072, γ_2 0.1236, γ_3 0.1841 (K/L_I+L_{II} 6.0), γ_4 0.2025 ($K/L_I+L_{II}/L_{III}$ = 0.2/1/0.4), γ_5 0.2343 (K/L_I+L_{II} 5.2), γ_6 0.2628 (K/L_I+L_{II} 6.0), γ_7 0.3136, γ_8 0.343 (K/L_I+L_{II} 5.4), γ_9 0.386, γ_{10} 0.398 (K/L_I+L_{II} 5.7), γ_{11} 0.497 (K/L_I+L_{II} 5.8), γ_{12} 0.516 ($K/L_I+L_{II}/L_{III}$ = 1.8/1/0.2), γ_{13} 0.538 (K/L_I+L_{II} 5.7), γ_{14} 0.621 (K/L_I+L_{II} 5.4), γ_{15} 0.632, γ_{16} 0.657 (K/L_I+L_{II} 5.4), γ_{17} 0.740, γ_{18} 0.754, γ_{19} 0.803 (K/L_I+L_{II} 4.8), γ_{20} 0.816, γ_{21} 0.842, γ_{22} 0.881 (K/L_I+L_{II} 4.9), γ_{23} 0.895, γ_{24} 1.019 (K/L_I+L_{II} 6.2), γ_{25} 1.099 (K/L_I+L_{II} 7.1), γ_{26} 1.405, γ_{27} 1.596 (K/L_I+L_{II} 8.0), γ_{28} 1.720 (K/L_I+L_{II} 6.5), (γ_3 coinc with γ_6, γ_{10}, γ_{11}, $\gamma_{22}+\gamma_{23}$, and γ_{24}), γ_8 coinc with γ_{11}, γ_{12}, γ_{13}, and γ_{19}), (γ_{10} coinc with γ_{11}), (γ_{13} coinc with γ_{19}) conv-conv coinc, spect conv (13A54, 13A53);	Q_{EC} 3.70, Q_α 4.3 est (68F58); see Po^{210} 
		A	chem, sep isotopes (5F41a, 2T47); genet energy levels (13A54, 12lS55a);			
			daughter Po^{206} (2T47a);			
			daughter At^{210} (4N50b);			
		I	6 atomic beam (173M57)			
					γ_3 (↑21, e_K/γ ~1.1), γ_6 (↑2.9, e_K/γ 0.66), γ_7 (↑3.0, e_K/γ 0.046), γ_8 (↑31, e_K/γ 0.22), γ_{10} (↑13, e_K/γ 0.14), γ_{11} (↑18, e_K/γ 0.08), γ_{12} (↑50, e_K/γ 0.043), γ_{13} (↑47, e_K/γ 0.047), γ_{14} (↑4.0, e_K/γ 0.073), γ_{15} (↑4.5, e_K/γ 0.050), γ_{16} (↑5.3, e_K/γ 0.016), γ_{17} (↑3.6, e_K/γ 3.3×10^{-3}), γ_{18} (↑2.7, e_K/γ 2.9×10^{-3}), γ_{19} (↑100, e_K/γ 9×10^{-3}), γ_{22} (↑72, e_K/γ 7×10^{-3}), γ_{23} (↑21, e_K/γ 0.017), γ_{24} (↑8.1, e_K/γ 0.014), γ_{25} (↑12, e_K/γ 2.4×10^{-3}), γ_{27} (↑8.0, e_K/γ 7×10^{-4}), γ_{28} (↑30, e_K/γ 1.0×10^{-3}) spect, spect conv (51N57);	
					2.200 level of Pb^{206}:	
					$t_{1/2}$ 1.23×10^{-4} s delay coinc (63T57);	
					$t_{1/2}$ 1.28×10^{-4} s delay coinc (82A57a);	
					0.060 level of Bi^{206}:	
					$t_{1/2}$ 7.8×10^{-6} s (59A57, 59A58a);	
					others (13A51a, 9K40, 5F41, 2T47a, 14S55, 65L57c); see also gammas of Pb^{206}, Po^{206}, and Po^{210}	
Bi^{207}	8.0 y (88C55); 27 y (13A55); others (4N51)	☢	EC (5G50, 4N51); EC (L) to 2.341 level of Pb^{207}: 8%, no EC (K) (13A55, 56L55);	γ	γ_1 0.5697 spect conv (128B56);	Q_{EC} 2.4 (13A55); Q_α 3.8 calc (68F58) 
		A	chem, genet (52M53a);		γ_1 0.5697 (K/L 3.4), γ_2 0.89 (e_K/γ 0.024), γ_3 1.064 (K/L 4.0), γ_4 1.43 (e_K/γ 0.005), γ_5 1.771 (e_K/γ 0.0025, K/L 4.4), (γ_1 coinc with γ_3 and γ_5), (γ_2 coinc with γ_4) spect conv, scint spect, γ-γ coinc (13A55, 13A53a);	
			daughter At^{211} (4N51);			
			parent Pb^{207m} (52M53a, 47W54a, 23F53, 24C56)		0.5689, 1.063 spect (9Y55);	
					γ_1 (↑100), γ_3 (↑77), γ_5 (↑9) scint spect (56L55);	
					γ_1 (↑100, e_K/γ 0.015), γ_3 (↑82, e_K/γ 0.096) scint spect (52M53a);	
					γ_1 (↑100, e_K/γ 0.018, K/L+M 3.0), γ_3 (↑74, e_K/γ 0.11, K/L+M 3.4) scint spect, spect conv (47W54a);	
					γ_1 (↑100), γ_3 (↑64), γ_5 (↑10) scint spect (41P54a);	
					γ_1: $t_{1/2}$ 7.6×10^{-11} s delay coinc (14S57);	
					$t_{1/2}$ 9×10^{-11} s delay coinc (64G56a);	
					others (14S55, 7G51a, 4N51, 56R57, 65L57d); see also gammas of Tl^{207}, Pb^{207m}, Pb^{207}, and Po^{211}	

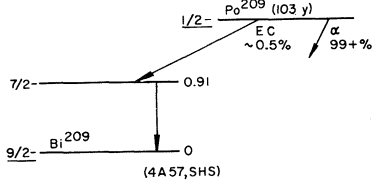
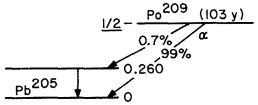
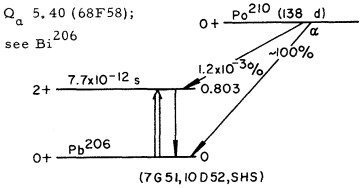
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{83}Bi^{208}$	~3 x 10^4 y yield (88R58); others (10D57)	☢	EC, no β^+ (lim 0.3%) (44E57a);	γ	2.61 scint spect, x-γ coinc (88R58, 44E57a); metastable state in Bi^{208}: γ_1 0.51 (†90, e_K/γ 0.3), γ_2 0.92 (†100, e_K/γ 0.3) scint spect, Bi^{209} (γ, n) (18V56a, 18V56); γ_1 and γ_2: $t_{1/2}$ 2.7 x 10^{-3} s scint spect, Bi^{209} (γ, n) (18V56a, 18V56); $t_{1/2}$ 3 x 10^{-3} s Bi^{209} (p, pn) (86L57); others (10D57); see also gammas of Tl^{208} and Po^{208}	Q_{EC} 2.9 est, Q_α 3.1 est (68F58); see Tl^{208}
		B	chem (4N51); excit, genet energy levels (88R58)			
Bi^{209}	>2 x 10^{18} y sp act (91H58); 2 x 10^{17} y sp act (21R52, 37P56); 3 x 10^{17} y sp act (7F51)	☢	no α (91H58); α (7F51, 37P56);	α	no 3.0 α range emuls (91H58); 3.0 range emuls (37P56, 21R52); 3.2 range emuls (7F51);	Q_α 3.2 calc (68F58)
		%	100 (6N38);	γ	Coulomb excitation (in Bi^{209}): no γ (91C54, 27T54, 122B55)	
		I	9/2 atomic spect (87M50);			
		μ	+4.0388 nucl induct (67K56, 61W53);			
		q	-0.4 atomic spect (87M50)			
Bi^{210} (RaE)	5.013 d (55R56); 4.99 d (55L53); 5.02 d (111B52); 4.85 d (7S47f); others (1C31, 15H45a, 2T47, 2S47, 12L36, 10C40, 47H40)	☢	β^- 99+%, α 5 x 10^{-5}% (7B47);	β^-	1.155 spect (24P54); 1.17 spect (117B53, 10L37, 9F39a, 9N40, 2Z49, 10L49); others (112M56, 42P53, 42P53a, 45T55, 13Z56, 29N53, 33L55, 145M57, 96G58);	Q_{β^-} 1.16 (SHS) 
		A	chem, genet (1C31);	γ	no γ (19G36, 6L47, 10C51, 33F56a, 16W53, 6M53, 132B53)	
			daughter Pb^{210} (RaD), parent Po^{210} (RaF); parent Tl^{206} (7B47); parent Tl^{206} (1.7 x 10^{-4}%) (33F56);			
		I	1 atomic spect (111M54, 24P54); others (38F53)			
Bi^{210}	2.6 x 10^6 y yield (28H53)	☢	α 99.6%, β^- 0.4% (52L54);	α	4.94 ion ch (52L54); 4.97 ion ch (54R54)	Q_α 5.03 (52L54); Q_{β^-} 1.14 calc (68F58)
		A	chem, genet (4N50a); chem, mass spect (52L54); parent Po^{210} (0.4%) (52L54); parent Tl^{206} (99.6%) (52L54); parent Tl^{206} (4N50a); not daughter Pb^{210} (lim 10^{-4}%) (52L54)			
Bi^{211} (AcC)	2.16 m (1C31); 2.15 m (114S54)	☢	α 99.7%, β^- 0.3% (1C31);	α	6.617 (†83), 6.273 (†17) spect (52P57); 6.618 (†84), 6.272 (†16) spect (9H38, 1R31); 6.621 (†83, 6.274 (†17.4) spect (13V52);	Q_α 6.75, Q_{β^-} 0.61 calc (68F58) 
		A	chem, genet (1C31);	γ	0.351 (e_K/γ 0.24) spect conv (52P57);	
			daughter Pb^{211} (AcB), parent Po^{211} (AcC'), parent Tl^{207} (AcC'');		0.35 scint spect (73P57); ~0.35 (e_K/γ 0.18, K/L 5.5) (4T52b, 10F52);	
			daughter At^{215} (5K44)		others (3S39a, 16H25, 66G53)	

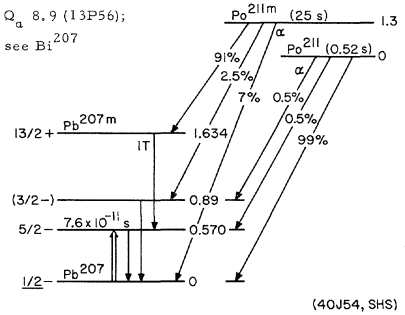
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{83}Bi^{212}$ (ThC)	60.5 m (1C31)	☢	β^- 63.8%, α 36.2% (137S56); β^- 64.6%, α 35.4% (109M53); β^- 66.3%, α 33.7% (6K38);	α	6.086 (†27.2), 6.047 (†69.9), 5.765 (†1.7), 5.622 (†0.15), 5.603 (†1.1), 5.481 (†0.016) spect (48R51); 6.082 (†27), 6.042 (†70), 5.760 (†1.8), 5.618 (†0.2), 5.599 (†1.1) spect (11L34); 5.477 (†0.014), 5.341 (†10^{-3}), 5.298 (†1.3×10^{-4}), 5.188 (†5×10^{-5}) spect (3W57, 3W57a); others (92C53, 124K56);
		A	chem, genet (1C31); daughter Pb^{212} (ThB), parent Po^{212} (ThC') and Tl^{208} (ThC''); daughter At^{216} (5K43, 13G48, 11M51)	β^-	2.250 spect (6M48a); 2.256 spect, β-γ coinc (4F48); 2.27 (†40), 1.55 (†6.4), 0.93 (†4.8) 0.67 (†3.8), 0.45 (†5.4), 0.08 (†3) spect, β-α coinc (133B57); others (7C48, 3S33, 49D56, 46T50);
				γ	with α: 0.040 (strong), 0.144, 0.164, 0.288, 0.328, 0.432, 0.452, 0.472, other gammas also reported, spect, spect conv (11S37, 11S46); 0.03985 ($L_I/L_{II}/L_{III}$ = 1.0/0.09/0.008), 0.1449 spect conv (20Z57, 106M54, 123K56b); 0.287 (K/L 5.3), 0.327 (K/L 5), 0.431, 0.451 (e_K/γ 0.1, K/L 5), 0.471 spect conv, α-γ coinc (28N55); 0.040 (e_L/γ 22) scint spect (103H56); 0.040 γ: $t_{1/2}$ ~4×10^{-12} s Doppler broadening (202S57a, recalc from 133B56b); others (21K47, 9F39, 14B49, 117S52, 14G53, 133B56, 88S51a, 88S52, 103H56, 49D54, 66W55, 71K50, 96R58, 7S56, 110M55, 133B56a, 88S51c); with β^-: 0.729 cryst spect (100M52); 0.72 (~19%), 0.83 (~19%), 1.03 (~6%), 1.34 (~5%), 1.61 (~7%), 1.81 (~7%), 2.20 spect (2J47) (intensities calc from 2J47); 0.73, 1.04, 1.34, 1.50, 1.80, 2.20 scint spect (89C56); 0.726 (~6%, e/γ 0.015) spect (6M50); 0.727 (K/L 4.3) spect conv (123K56a); 1.62 (†7), no 1.1 γ (lim †8), no 1.35 γ (lim †4), no 1.5 γ (lim †3), no 1.8 γ (lim †2), no 2.2 γ (lim †1) spect (6M55); no 0.84 γ scint spect, α-γ coinc (133B57); others (5L47, 122G57)
					Q_α 6.21, Q_{β^-} 2.25 (68F58)  
Bi^{213}	47 m (4H47); 46 m (11E47)	☢	β^- 98%, α 2% (11E47, 4H50a);	α	5.86 ion ch (11E47); 6.0 ion ch (4H47);
		A	chem, genet (11E47, 4H47); daughter At^{217}, parent Po^{213} (4H47, 11E47, 4H50a); parent Tl^{209} (4H50)	β^-	1.39, 0.96 spect (39W52); ~1.3 abs (4H47, 11E47);
				γ	0.437 spect conv, scint spect (39W52); ~0.44 (e_K/γ 0.2) scint spect (130S55); others (125S56)
					Q_α 5.97, Q_{β^-} 1.39 (68F58) 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{83}Bi^{214}$ (RaC)	19.7 m (1C31); 19.9 m (51D56a)	☢ β^- 99+%, α 0.04% (1C31);	α	5.505 (†45), 5.444 (†55) spect (11L34); 5.52 (†37), 5.47 (†46), 5.33 (†17) spect (7C48a);	Q_α 5.61, Q_{β^-} 3.18 (68F58)
		A chem, genet (1C31); daughter Pb^{214} (RaB), daughter At^{218}, parent Po^{214} (RaC'), parent Tl^{210} (RaC'')	β^-	0.4 (9%), 1.0 (23%), 1.51 (40%), 1.88 (9%), 3.26 (19%), no 2.6 β, spect (51D56a); 0.4 (~20%), 1.0 (22%), 1.45 (29%), 1.72 (7%), 2.57 (6%), 3.18 (13%) abs (56R55); 1.65 (~77%), 3.17 (~23%) spect (8C41, 5L47); others (3S33, 59K53, 47W52c, 32N57, 84K56a);	
			γ	with β^-: γ_1 0.6094 cryst spect (100M52); γ_1 0.6093 (†100, $K/L_I/L_{II}/L_{III}$ = 5/1/0.7/0.3), γ_2 0.769 (†22, K/L 3.9), γ_3 0.935 (†10, K/L 3.2), γ_4 1.120 (†77, K/L 4.2), γ_5 1.155 (K/L 5.2), γ_6 1.238 (†27, K/L 3.3), γ_7 1.281 (K/L 3.5), γ_8 1.378 (†35, K/L 3.3), γ_9 1.416 (K/L 5.1), γ_{10} 1.509 (†12), γ_{11} 1.728, γ_{12} 1.764 (†61, K/L 4.2), γ_{13} 1.849 (†6), γ_{14} 2.017, γ_{15} 2.117, γ_{16} 2.204 (†20, K/L 7.1), γ_{17} 2.432 (†8) spect, spect conv (110M54, 110M54a); γ_1 (†100), 0.652, 0.661, 0.703 (†4), γ_2 (†15), 0.787 (†4), 0.806 (†4), 0.821 (†3), γ_3 (†11), γ_4 (†44), γ_5 (†9), 1.207 (†4), γ_6 (†19), γ_7 (†6), γ_8 (†16), 1.385, 1.391, 1.397, 1.402, 1.408, γ_9 (e_K/γ >0.1), 1.438, γ_{10} (†9), 1.583 (†5), 1.605 (†2), γ_{11} (†6), γ_{12} (†55), 1.784 (†9), 1.791 (†3), γ_{13} (†6), 1.862 (†5), 1.900 (†4), γ_{14} (†1), 2.085 (†2), γ_{15} (†5), γ_{16} (†22), 2.290 (†2), 2.340 (†1), γ_{17} (†9) spect (16D56b); γ_1 (†100), γ_2 (†15), γ_3 (†12), γ_4 (†29), γ_6 (†11), γ_8 (†10), γ_{10} (†8), γ_{12} (†36), γ_{13} (†2), γ_{16} (†11), γ_{17} (†6) spect, spect conv (59K52, 5M50); 0.768 (K/L 5), 0.807 (K/L 3), 0.935 (K/L 5.4), 1.120 (K/L 5.6), 1.150, 1.238 (K/L 5.7) spect conv (46N57); γ_{17} (†9), 2.68 (†0.2), 2.77 (†0.2), 2.89 (†0.2), 2.99 (†0.2), 3.07 (†0.2) spect (16D58); γ_{16} (†20), 2.72 (†0.5), 2.89 (†0.1), 3.03 (†0.26) spect (51D57a); (γ_1 coinc with γ_2, γ_3, γ_4, γ_6, γ_8, γ_{10}, and γ_{13}) β-γ coinc, γ-γ coinc, scint spect (57R55); (γ_1 coinc with 2.50 β) β-γ coinc, scint spect (17J55, 9B56); with α: 0.0625, 0.191 spect conv (10C51); others (8E34, 10C51, 49D54a, 49D54b, 49D53, 49D52, 134B55, 49L53, 48M49a, 13A54a, 25P53, 110M52, 49D56b, 32N57, 8E30, 8C41, 16D56g, 9B58)	
Bi^{215}	8 m (8H53)	☢ β^- (8H53); A chem, genet (8H53); daughter At^{219} (8H53); parent Po^{215} (8H53)			Q_α 5.25 est, Q_{β^-} 2.21 calc (68F58)
$_{84}Po^{196}$	1.9 m (34A56)	☢ α (34A56); C chem (34A56)	α	6.14 ion ch (34A56)	Q_α 6.27 (SHS)
Po^{197}	~4 m (4R54)	☢ α (4R54); C chem, decay charac (4R54)	α	6.040 spect (4R54)	Q_α 6.17 (13P56)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{84}Po^{198}$	~6 m (4R54)	☢ C	α (4R54); chem, decay charac (4R54)	α	5.935 spect (4R54)	Q_α 6.06 (13P56)
Po^{199}	~11 m (4R54)	☢ C	α (4R54); chem, decay charac (4R54)	α	5.846 spect (4R54)	Q_α 5.97 (13P56)
Po^{200}	11 m (7K51a); ~8 m (4R54)	☢ D	EC, α (7K51a); chem, genet (7K51a); parent Bi^{200} (7K51a)	α	5.770 spect (4R54); 5.84 ion ch (7K51a)	Q_α 5.89 (13P56)
Po^{201}	18 m (7K51a); ~17 m (4R54)	☢ B	EC, α (7K51a); chem, genet (7K51a); parent Bi^{201} (7K51a)	α	5.671 spect (4R54); 5.70 ion ch (7K51a)	Q_α 5.79 (13P56)
Po^{202}	51 m (131S57); 56 m (31B54); 55 m (4R54)	☢ B	EC 98%, α 2% (131S57); chem, genet, excit (7K51); parent Bi^{202} (7K51); daughter Rn^{206} (131S57, 9M55)	α	5.575 spect (4R54); 5.57 ion ch (131S57); 5.61 ion ch (31B54)	Q_α 5.69 (13P56)
Po^{203}	42 m (8B56); 47 m genet (7K51)	☢ B	EC (7K51); chem, genet (7K51); parent Bi^{203} (7K51)			
Po^{204}	3.8 h (7K51, 4R54); 3.5 h (31B56)	☢ A	EC ~99%, α ~1% (7K51); chem, genet (7K51); daughter Rn^{208} (9M55); parent Bi^{204}, parent Pb^{200} (7K51); daughter At^{204} (12B51)	α	5.370 spect (4R54); 5.37 ion ch (7K51); 5.35 ion ch (31B56)	Q_α 5.48 (13P56)
Po^{205}	1.8 h (8B56); 1.5 h genet (7K51)	☢ A	EC 99+%, α 0.074% (17H51a); chem, genet, sep isotopes, excit (7K51); parent Bi^{205}, parent Pb^{201} (7K51); daughter At^{205} (12B51)	α	5.2 ion ch (7K51)	Q_α 5.3 (13P56)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{84}Po^{206}$	8.8 d (41J56); 8.1 d (232B57); 10 d (31B54); 9 d (2T47a)	☢	EC 95%, α 5% (9M55); EC ~90%, α ~10% (2T47a); no β^+ (lim 0.1%) (59A57);	α	5.218, no 5.064 α (lim 0.5%) spect (104H56, 131S56); 5.21 ion ch (7K51a); others (4R53, 31B57);	Q_α 5.32 (13P56) 
		A	chem, genet, sep isotopes (2T47a); parent Bi^{206} (2T47a); daughter Rn^{210} (9M55, 9M52a); daughter At^{206} (12B51)	γ	0.0599 ($L_I/L_{II}/L_{III}$ = 0.03/1.1/1.0), 0.0829 (L/M ~3), 0.1176 (K/L 4.5), 0.1406 (K/L 4.7), 0.1708 (K/L 5.3), 0.1715 (K/L 3.5), 0.2821 (K/L 5.8), 0.2865 (K/L 5.6, L_I+L_{II}/L_{III} >80), 0.3115 (K/L 6.0, L_I+L_{II}/L_{III} >10), 0.338 (K/L 5.6, L_I+L_{II}/L_{III} >30), 0.355 (K/L 5), 0.463 (K/L 6.5), 0.469 (K/L 4), 0.511 (K/L 5.6, L_I+L_{II}/L_{III} >20), 0.522 (K/L 5.5), 0.555 (K/L 6.2), 0.580 (K/L 5.6), 0.646 (K/L 4.3). 0.669 (K/L 5.6), 0.678 (K/L 3), 0.808 (K/L 5.6), 0.862 (K/L 5.4), 0.981 (K/L 5.7), 1.008 (K/L 4.5), 1.033 (K/L 6.0), 1.320 spect conv, scint spect, conv-conv coinc (59A57); 0.0600, 0.286 (†35, K/L 5.4), 0.311 (K/L 5.0), 0.338 (†41, e_K/γ 0.21), 0.463, 0.472, 0.512, 0.522, 0.807 (†57, e_K/γ 0.017), 0.980 (K/L 4.3), 1.031 (†84, e_K/γ 0.0062, K/L 6.5) spect conv, scint spect (131S56); 0.060 γ: $t_{1/2}$ 7.8 x 10^{-6} s (59A57, 59A58a); others (2T47a)	
Po^{207}	5.7 h (8B56); 6.2 h (41J56); 5.7 h (2T47a)	☢	EC 99+%, α ~10^{-2}% (2T47a); β^+ ~0.2% (131S56);	α	5.10 ion ch (7K51a);	Q_α 5.20 (13P56)
		A	chem, excit, sep isotopes (2T47a); chem, genet (131S56); daughter Rn^{211} (131S56); daughter At^{207} (12B51)	γ	0.1000 (L_I+L_{II}/L_{III} 8), 0.1496 (K/L ~5, L_I+L_{II}/L_{III} >16), 0.1561 (K/L 5.8), 0.1580 (K/L 0.75, L_I+L_{II}/L_{III} 1.9), 0.2052 (K/L 5.1), 0.2220, 0.2227 (K/L ~5.6, L_I+L_{II}/L_{III} >15), 0.2240 (K/L 5.5), 0.2496 (K/L 5.6, L_I+L_{II}/L_{III} >160), 0.2880 (K/L 5.7), 0.2971 (K/L ~3.5), 0.3075 (K/L 5.6), 0.3302 (K/L ~4.8), 0.3452 (K/L 5.6), 0.3693 (K/L 6.0), 0.4024 (K/L 5), 0.4057 (K/L 5.7), 0.5317 (K/L 6.4), 0.630 (K/L 6.2), 0.670 (K/L ~6.2), 0.688 (K/L 6), 0.743 (K/L 6.1), 0.771 (K/L 5.3), 0.892 (K/L 5), 0.912 (K/L 5.4), 0.948 (K/L 3.2), 0.993 (K/L 6.0), 1.149 (K/L 5.3), 1.212 (K/L 3), 1.318, 1.360 (K/L 5.3), 1.373 (K/L 5.5), 1.586, 1.663 (K/L ~5), 1.763 (K/L ~5), 1.847, 2.061 (K/L 5.6) spect conv (59A58); 0.0604, 0.2230 (K/L_I 6.4), 0.2330 (K/L_I 0.5), 0.2495, 0.2708, 0.307, 0.329, 0.345 (K/L ~5), 0.406 (†22, e_K/γ 0.28, K/L 6.1, coinc with 0.743 γ and 0.992 γ), 0.630, 0.743 (†73, e_K/γ 0.04, K/L 5.6), 0.992 (†100, e_K/γ 0.02, K/L ~5, coinc with 0.743 γ and 1.149 γ), 1.149 (†~1, K/L ~4), other gammas also reported, spect conv, scint spect, γ-γ coinc (131S56);	
Po^{208}	2.93 y (2T50)	☢	α (2T47a); EC (weak) (4A57);	α	5.108 spect (4A52b); 5.109 spect (4R54); 5.10 ion ch (7K51a);	Q_α 5.21, Q_{EC} 1.31 calc (68F58)
		A	chem, excit, sep isotopes (2T47a); daughter Rn^{212}, daughter 1.7 h At^{208} (8H50, 9M52a); daughter 6.3 h At^{208} (12B51)	γ	with EC: 0.285 (~0.003%), 0.60 (complex, ~0.006%, coinc with 0.285 γ) scint spect, γ-γ coinc (4A57); others (52D55, 2T47a)	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{84}Po^{209}$	103 y sp act (45A56)	☢	α	4.877 spect (4A52b); 4.86 ion ch (7K51a);		Q_α 4.97, Q_{EC} 1.90 calc (68F58)  (4A57,SHS)  (4A57, SHS)
		A	γ	with α: 0.260 (~0.4%, e_K/γ 0.75) α-γ coinc, scint spect (4A57); with EC: 0.91 (~0.5%, e_K/γ 0.021) x-γ coinc, scint spect (4A57); others (52D55); see also gammas of Bi^{205}		
		I		1/2 atomic spect (21V55)		
Po^{210} (RaF)	138.401 d (29E54); 138.37 d (93C53); 138.4 d (67G53); 138.3 d (5B49); others (2T47a, 47H40, 10C40, 1C31)	☢	α;	5.305 spect (64W58); 5.299 spect (11L34); 5.304 spect (92C53); 5.298 spect (9H38, 16S51, 92A58); 5.303 spect (7C46); ~4.5 (weak) α-γ coinc, scint spect (10D52);		Q_α 5.40 (68F58); see Bi^{206}  (7G51, 10D52, SHS)
				β stable (cons energy) (68F58);		
		A		chem, genet (1C31);		
				daughter 2.6×10^6 y Bi^{210} (0.4%) (52L54);		
				daughter At^{210} (10K49, 12B51);	γ	
				daughter Bi^{210} (RaE); others (46A57, 46A58)		
			γ_1	0.804 (K/L+M 3.8) spect conv (13A54);		
			γ_1	0.800 (e/γ ~0.03, K/L 3.7) spect, spect conv (13A51a);		
			γ_1	(1.2×10^{-3}%) scint spect (61H55, 58R55, 47A56, 227S56b);		
			γ_1	(1.8×10^{-3}%, e/γ ~0.07), no 0.08 γ ion ch, crit abs, γ-γ coinc (7G51);		
				1.472 level of Po^{210}: $t_{1/2}$ 1.5×10^{-9} s delay coinc (14S55);		
				others (3R52, 1Z48, 18P52, 10D47, 49R52, 63B52, 3R53, 10C51, 7S47a, 3S53a);		
				see also gammas of Bi^{206}, Pb^{206}, and At^{210}		

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{84}Po^{211m}$	25 s (40J54, 114S54); ~27 s (67W54)	☢ α (114S54);	α	7.14 (90.5%), 7.85 (2.5%), 8.70 (7.0%) ion ch (40J54); 7.14 ion ch (114S54);		$Q_α$ 8.9 (13P56); see Bi^{207}
		A chem, excit (114S54); genet energy levels (40J54); parent Pb^{207m} (40J54); not parent Po^{211} (lim 1%) (40J54); not daughter At^{211} (lim 0.01%) (114S54)	γ	$γ_1$ 0.56, $γ_2$ 1.06, $γ_1$ coinc with $γ_2$, 7.14 α not coinc with $γ_1$ or $γ_2$ scint spect, α-γ, γ-γ coinc (40J54); see also gammas of Bi^{207} and Pb^{207}		
Po^{211} (AcC')	0.52 s (114S54, 13L51); ~0.5 s (67W54)	☢ α; β stable (cons energy) (68F58);	α	$α_0$ 7.442 spect (15B54); $α_0$ 7.434 range air (11L34); $α_0$ (99%), 6.895 (0.50%), 6.569 (0.53%), no 6.34 α (lim 0.02%) spect (74H53); 6.90 (0.6%), 6.57 (0.5%), 6.34 (0.1%) ion ch (4N51); others (114S54);		 (40J54, SHS)
		A genet (1C31); daughter Bi^{211} (AcC); daughter At^{211} (11C40, 11C40a); daughter Rn^{215} (11M52); not parent Pb^{207m} (lim 0.005%) (23F53); not daughter Po^{211m} (lim 1%) (40J54)	γ	0.562, 0.88 α-γ coinc, scint spect (63M54); see also gammas of Bi^{207} and Pb^{207}		$Q_α$ 7.59 (68F58)
Po^{212} (ThC')	3.04×10^{-7} s delay coinc (4B49); 3.0×10^{-7} s delay coinc (11H48); others (3J48, 4V49, 11D39, 16B43, 105H53)	☢ α; β stable (cons energy) (68F58);	α	8.780 spect (15B54, 9H38); long range α's: 10.543 (0.018%), 10.422 (0.002%), 9.492 (0.004%) spect (15B54, 48R51); others (46A55, 46A54a, 92C53)		$Q_α$ 8.95 (68F58)
		A genet (1C31); daughter Bi^{212} (ThC); daughter Rn^{216} (11M49, 11M51)				
Po^{213}	4.2×10^{-6} s delay coinc (3J48)	☢ α (4H47, 11E47); β stable (cons energy) (68F58);	α	8.35 spect (130S55); 8.34 ion ch (11E47, 5C48, 4H50a)		$Q_α$ 8.51 (68F58)
		A genet (4H47, 11E47); daughter Bi^{213}, parent Pb^{209} (4H47, 11E47, 4H50a); daughter Rn^{217}, parent Pb^{209} (11M49, 11M51)				
Po^{214} (RaC')	1.64×10^{-4} s delay coinc (13D50); 1.58×10^{-4} s delay coinc (135B53); others (11D39, 6R41, 5W42, 4J43, 14L47, 4B48, 5R47)	☢ α; β stable (cons energy) (68F58);	α	7.680 spect (15B36, 9H38); 7.683 spect (16S51); long range α's: 8.277 (0.4 x 10^{-4}%), 8.938 (0.45 x 10^{-4}%), 9.065 (22 x 10^{-4}%), 9.313 (0.4 x 10^{-4}%), 9.489 (1.4 x 10^{-4}%), 9.657 (0.4 x 10^{-4}%), 9.779 (1.1 x 10^{-4}%), 9.905 (0.4 x 10^{-4}%), 10.074 (1.7 x 10^{-4}%), 10.146 (0.4 x 10^{-4}%), 10.326 (1.1 x 10^{-4}%), 10.506 (0.2 x 10^{-4}%) spect (15B54)		$Q_α$ 7.83 (68F58)
		A genet (1C31); daughter Bi^{214} (RaC), parent Pb^{210} (RaD); daughter Rn^{218} (4S48)				
Po^{215} (AcA)	1.83×10^{-3} s delay coinc (5W42)	☢ α 99+%, $β^-$ 5×10^{-4}% (5K44, 8A50);	α	7.36 spect (52P57); 7.38 spect (15B54); others (46A55a)		$Q_α$ 7.50 (52P57); $Q_{β^-}$ 0.76 calc (68F58)
		A genet (1C31); daughter Rn^{219} (An), parent Pb^{211} (AcB); parent At^{215} (5K44); daughter Bi^{215} (8H53)				

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$_{84}Po^{216}$ (ThA)	0.158 s (5W42)	☢	α; β stable (cons energy) (68F58); α 99+%, β^- 0.014% (5K43);	α	6.775 spect (15B54)	Q_α 6.90 (68F58)
		A	genet (1C31); daughter Rn^{220} (Tn), parent Pb^{212} (ThB); parent At^{216} (5K43) (?)			
Po^{217}	<10 s (9M56)	☢	α, no β^- (lim 20%) (9M56);	α	6.54 ion ch (9M56)	Q_α 6.66, Q_{β^-} 1.29 est (68F58)
		B	genet (9M56); daughter Rn^{221} (9M56, 9M52a)			
Po^{218} (RaA)	3.05 m (1C31)	☢	α 99+%, β^- 0.02% (5K43a, 106H52);	α	5.998 spect (15B36, 9H38); 5.996 spect (109B53)	Q_α 6.11, Q_{β^-} 0.39 calc (68F58)
		A	chem, genet (1C31); daughter Rn^{222} (Rn), parent Pb^{214} (RaB); parent At^{218} (5K43a)			
$_{85}At^{<202}$	43 s (12B51)	☢	α, EC (12B51);	α	6.50 ion ch (12B51)	Q_α 6.63 (13P56)
		D	chem, excit (12B51)			
$At^{<203}$	1.7 m (12B51)	☢	α, EC (12B51);	α	6.35 ion ch (12B51)	Q_α 6.48 (13P56)
		D	chem, excit (12B51)			
At^{203}	7 m (12B51, 31B56)	☢	α, EC (12B51);	α	6.10 ion ch (12B51); 6.09 ion ch (31B56)	Q_α 6.22 (13P56)
		D	chem, excit (12B51, 4M50)			
At^{204}	~25 m genet (12B51)	☢	EC (12B51);			
		B	chem, excit, genet (12B51); parent Po^{204} (12B51)			
At^{205}	25 m (12B51, 31B54); 23 m (31B56)	☢	α, EC (12B51);	α	5.90 ion ch (12B51, 31B54); 5.94 ion ch (31B56)	Q_α 6.02 (13P56)
		B	chem, excit, genet (12B51, 4M50); parent Po^{205} (12B51)			
At^{206}	2.9 h (131S56); 2.6 h genet (12B51)	☢	EC (12B51);			
		B	chem, excit, genet (12B51); parent Po^{206} (12B51)			
At^{207}	1.8 h (31B54, 131S57); 2.0 h (12B51)	☢	EC ~90%, α ~10% (2T48a, 12B51);	α	5.75 ion ch (12B51, 31B54, 131S57, 31B56)	Q_α 5.86 (13P56)
		A	chem, excit, genet (2T48a, 12B51); parent Po^{207}, parent Bi^{203} (12B51); daughter Rn^{207} (31B54, 131S57)			

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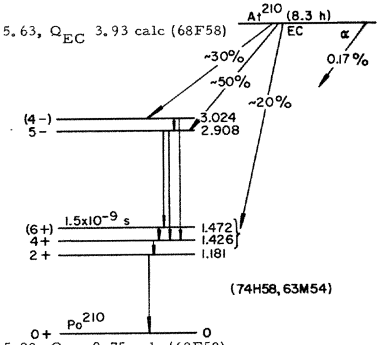
$_{85}At^{208}$	6.3 h genet (12B51); 6.2 h (131S56)	☢ EC (12B51); B chem, excit, genet (12B51); parent Po^{208} (12B51)			
At^{208}	1.6 h (131S56); 1.7 h (12B51)	☢ EC 99+%, α 0.5% (8H50); A chem, genet (8H50); daughter Fr^{212}, parent Po^{208} (8H50, 9M52a)	α γ	5.65 ion ch (8H50); with EC: 0.18 (†20), 0.25, 0.66 (†80, coinc with 0.18 γ and 0.25 γ) scint spect, γ-γ coinc (131S56); with α: 0.12 scint spect, α-γ coinc (131S56)	$Q_α$ 5.76 (13P56)
At^{209}	5.5 h (12B51)	☢ EC ~95%, α ~5%, (12B51); A chem, genet, excit (12B51); parent Po^{209}, parent Bi^{205} (12B51); daughter Rn^{209} (9M52a, 9M55)	α γ	5.642 spect (104H56, 131S56); 5.65 ion ch (12B51); 0.0908, 0.1950 (†24, K/L 4.9, coinc with 0.545 γ and 0.780 γ), 0.545 (†66, $e_K/γ$ 0.12, K/L 3.8), 0.780 (†100, $e_K/γ$ 0.05, coinc with 0.545 γ) no 0.0838 γ spect conv, scint spect, γ-γ coinc (131S56); 0.0838 (L_{II}/L_{III} 1.2), 0.0911 (L_{II}/L_{III} 1.1), 0.195 (K/L_I 4), 0.548 (K/L 2.8), 0.784 spect conv (63M54)	$Q_α$ 5.75, Q_{EC} 3.43 calc (68F58)
At^{210}	8.3 h (10K49)	☢ EC 99+%, α 0.17% (74H53); EC 99+%, α 0.1% (4N50b); A chem, excit, genet (10K49); parent Po^{210} (10K49, 12B51); parent Bi^{206} (4N50b)	α γ	5.519 (†32), 5.437 (†31), 5.355 (†37) spect (74H53); with EC: 0.0465 (L_{II}/L_{III} 1.4), 0.0834, 0.1161 (K/L 5.9), 0.1252, 0.2451 (†81, K/L 1.2), 0.402, 0.853, 1.181 (†100, K/L 4.7), 1.436, 1.482, 1.598, other gammas also reported, spect conv, scint spect, γ-γ coinc (74H58); $γ_1$ 0.0468 ($L_I/L_{II}/L_{III}$ = 0.04/1.2/1.0), $γ_2$ 0.1165 (L_I/L_{II} 9), $γ_3$ 0.2460 (†80, K/L 0.8, $L_I/L_{II}/L_{III}$ = ~0.3/1.8/1.0), $γ_4$ 0.404 ($e_K/γ$ ≥0.1, K/L+M 5), $γ_5$ 0.701, $γ_6$ 1.185 (†100, $e_K/γ$ 0.005, K/L+M 3.9), $γ_7$ 1.441 ($e_K/γ$ 0.001), $γ_8$ 1.487 ($e_K/γ$ 0.001, K/L+M 3.6), $γ_9$ 1.604 (†19, $e_K/γ$ 0.001), $γ_{10}$ 2.23 (weak), 2.6 (very weak), ($γ_3$ coinc with $γ_1$, $γ_6$, $γ_7 + γ_8$, $γ_9$, and $γ_{10}$), ($γ_6$ coinc with $γ_1$, $γ_7 + γ_8$, $γ_9$, and $γ_{10}$), ($γ_1$ coinc with $γ_7 + γ_8$) spect conv, scint spect, γ-γ coinc (63M54); $γ_1$: $t_{1/2}$ 1.5 x 10^{-9} s delay coinc (14S55, 63M54); others (131S56)	$Q_α$ 5.63, Q_{EC} 3.93 calc (68F58) 
At^{211}	7.20 h (68G56); 7.5 h (11C40, 10K49)	☢ α 40.9%, EC 59.1% (4N51); A chem, excit, genet (11C40, 10K49); parent Bi^{207} (4N51); daughter Rn^{211} (9M55, 9M52a); parent 0.52 s Po^{211} (AcC') (11C40, 11C40a); not parent 25 s Po^{211m} (lim 0.01%) (114S54)	α γ	5.862 spect (74H53); 5.89 ion ch (2T48a, 12B51); 0.67 (weak) scint spect (63M54); others (68G56)	$Q_α$ 5.98, Q_{EC} 0.75 calc (68F58)
At^{212}	0.22 s (67W54); 0.25 s (7W48)	☢ α (7W48); E excit (7W48)			$Q_α$ 7.7 est, Q_{EC} 1.68 est (68F58)
At^{213}		☢ α (57K51); E genet, decay charac (57K51); descendant Pa^{225} (57K51)	α	9.2 range emuls (57K51)	$Q_α$ 9.4, Q_{EC} 0.24 calc (68F58)

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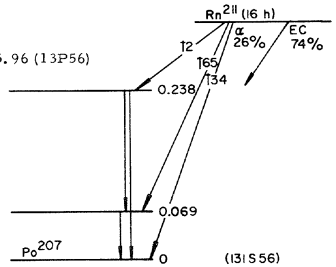
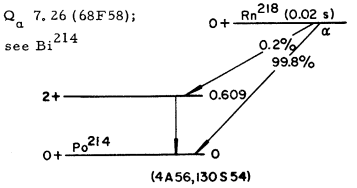
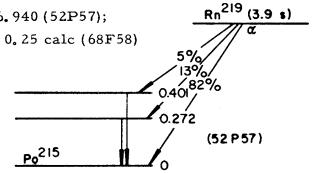
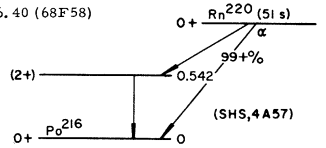
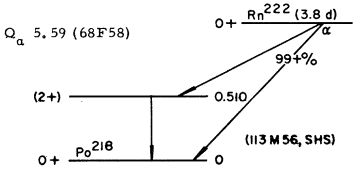
$_{85}At^{214}$	~2 x 10^{-6} s est (11M51)	☢ α (11M49); B genet (11M49); daughter Fr^{218} (11M49, 11M51)	α	8.78 ion ch (11M49, 11M51)		$Q_α$ 8.95, Q_{EC} 1.03 calc, $Q_{β^-}$ 0.77 est (68F58)
At^{215}	~10^{-4} s delay coinc (13G48, 11M51); short (5K44)	☢ α (5K44, 13G48); A genet (5K44, 13G48); daughter Fr^{219}, parent Bi^{211} (AcC) (13G48, 11M51, 11M49); daughter Po^{215} (AcA), parent Bi^{211} (AcC) (5K44)	α	8.00 ion ch (13G48, 11M51); 8.4 ion ch (5K44)		$Q_α$ 8.15, $Q_{β^-}$ 0.00 calc (68F58)
At^{216}	~3 x 10^{-4} s delay coinc (11M49, 11M51); short (5K43)	☢ α (5K43, 13G48); A genet (13G48); daughter Fr^{220}, parent Bi^{212} (ThC) (13G48, 11M51); parent Bi^{212} (ThC) (5K43); daughter Po^{216} (ThA) (5K43); note: Po^{216} β stable (68F58)	α	7.79 ion ch (13G48, 11M51); 7.64 ion ch (5K43)		$Q_α$ 7.94, $Q_{β^-}$ 2.03 calc, Q_{EC} 0.46 calc (68F58)
At^{217}	0.018 s delay coinc (4H47, 4H50a); 0.021 s delay coinc (11E47)	☢ α (11E47, 4H47); A genet (11E47, 4H47); daughter Fr^{221}, parent Bi^{213} (11E47, 4H47, 4H50a); daughter Fr^{221} (5C48)	α	7.05 spect (130S55); 7.02 ion ch (5C48); 7.00 ion ch (4H47)		$Q_α$ 7.18, $Q_{β^-}$ 0.68 calc (68F58)
At^{218}	1.5-2.0 s (3W48); several sec (?) (5K43a)	☢ α (5K43a); α 99+%, $β^-$ 0.1% (3W48); E genet (5K43a); daughter Po^{218} (RaA), parent Bi^{214} (RaC) (5K43a, 3W48)	α	6.63 ion ch (5K43a); 6.7 (3W48)		$Q_α$ 6.75, $Q_{β^-}$ 2.67 calc (68F58)
At^{219}	0.9 m (8H53)	☢ α ~97%, $β^-$ ~3% (8H53); B chem, genet (8H53); daughter Fr^{223} (AcK), parent Rn^{219} (An), parent Bi^{215} (8H53)	α	6.27 ion ch (8H53)		$Q_α$ 6.39, $Q_{β^-}$ 1.67 calc (68F58)
$_{86}Rn^{204}$	3 m (131S57, 9M55)	☢ α (9M55, 131S57); D chem, decay charac (131S57, 9M55)	α	6.28 ion ch (131S57)		$Q_α$ 6.4 (13P56)
Rn^{206}	6.5 m (31B54); 6.2 m (131S57); 5.3 m (232B57); 7 m (67W54)	☢ α 65%, EC 35% (131S57, 9M55); α 22%, EC 78% (232B57); B chem, genet (31B54, 131S57); parent Po^{202} (131S57, 9M55)	α	6.25 ion ch (31B54, 131S57)		$Q_α$ 6.37 (13P56)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{86}Rn^{207}$	11 m (31B54); 10 m (131S57)	☢ EC 96%, α 4% (131S57, 9M55); A chem, genet (31B54); parent At^{207} (31B54, 131S57)	α	6.14 ion ch (13P56 calc from 131S56); 6.09 ion ch (31B54)		$Q_α$ 6.24 (13P56)
Rn^{208}	23 m (9M55); 21 m (131S57)	☢ EC ~80%, α ~20% (9M55, 131S57); B chem, genet (9M55); parent Po^{204} (9M55)	α	6.141 spect (9M55a, 9M55); 6.14 ion ch (131S57)		$Q_α$ 6.26 (13P56)
Rn^{209}	30 m (9M55)	☢ EC 83%, α 17% (9M55); B chem, genet (9M55); daughter Ra^{213}, parent At^{209} (9M55, 9M52a)	α	6.037 spect (9M55a, 9M55)		$Q_α$ 6.15 (13P56)
Rn^{210}	2.7 h (9M52a, 9M55); 2.1 h (13G49)	☢ α ~96%, EC ~4% (9M55); A chem, genet (9M55, 9M52a); parent Po^{206} (9M52a, 9M55)	α	6.037 spect, ion ch (9M55a, 9M52a)		$Q_α$ 6.15 (13P56)
Rn^{211}	16 h (9M52a, 9M55)	☢ EC 74%, α 26% (9M55); A chem, genet (9M52a); parent At^{211} (9M52a, 9M55); parent Po^{207} (131S56)	α γ	5.847 (†33.5), 5.779 (†64.5), 5.613 (†2.0) spect, ion ch (9M55a, 9M52a); with α: 0.0687 (†100, L_{II}/L_{III} 1.1), 0.169 (†6.5), 0.234 (†6.5) spect conv, α-γ coinc, scint spect (9M55a, 131S56); with EC: $γ_1$ 0.032, $γ_2$ 0.1139, $γ_3$ 0.1686 ($K/L_I/L_{II}/L_{III}$ = 1.3/<0.3/1.0/1.0), $γ_4$ 0.232, $γ_5$ 0.264 (K/L 5.0), $γ_6$ 0.296, $γ_7$ 0.333 (K/L 6.3), $γ_8$ 0.445 (†39, K/L 1.9), $γ_9$ 0.680 (†100, K/L 3.5), $γ_{10}$ 0.865 (†24), $γ_{11}$ 0.947 (†29), $γ_{12}$ 1.13 (†52, K/L 3.6), $γ_{13}$ 1.37 (†52, K/L ~7), $γ_{14}$ 1.80 (†0.8), ($γ_8$ coinc with $γ_4$, $γ_9$, $γ_{12}$, and $γ_{13}$), ($γ_9$ coinc with $γ_9$, $γ_{11}$, $γ_{12}$, and $γ_{13}$), ($γ_{12}$ coinc with $γ_4$) spect conv, ion ch, scint spect, γ-γ coinc (131S56, 9M55)	$Q_α$ 5.96 (13P56) 
Rn^{212}	23 m (13G49, 8H50, 9M52a)	☢ α (8H50); A chem, genet (8H50, 13G49); daughter Fr^{212}, parent Po^{208} (8H50, 9M52a)	α	6.264 spect, ion ch (9M55a, 9M52a)		$Q_α$ 6.38, Q_{EC} 0.00 est (68F58)
Rn^{215}	~10^{-6} s est (11M52)	☢ α (11M52); B genet (11M52); daughter Ra^{219}, parent Po^{211} (AcC') (11M52)	α	8.6 ion ch (11M52)		$Q_α$ 8.76, Q_{EC} 0.00 est (68F58)
Rn^{216}	~10^{-4} s est (11M51)	☢ α (11M49, 11M51); β stable (cons energy) (68F58); A genet (11M49, 11M51); daughter Ra^{220}, parent Po^{212} (ThC') (11M49, 11M51)	α	8.01 ion ch (7O50)		$Q_α$ 8.16 (68F58)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{86}Rn^{217}$	$\sim 10^{-3}$ s delay coinc (11M51)	☢ α (11M51); β stable (cons energy) (68F58);	α	7.74 ion ch (11M51)		Q_α 7.89 (68F58)
		A genet (11M49, 11M51); daughter Ra^{221}, parent Po^{213} (11M49, 11M51)				
Rn^{218}	0.019 s delay coinc (4S48)	☢ α (4S48); β stable (cons energy) (68F58);	α	7.13 spect (4A56, 130S54); 7.12 ion ch (1J48);		Q_α 7.26 (68F58); see Bi^{214}  (4A56, 130S54)
		A genet (4S48); daughter Ra^{222}, parent Po^{214} (RaC') (4S48)	γ	0.609 (0.2%) α-γ coinc, scint spect (4A56, 130S54)		
Rn^{219} (An)	3.92 s (1C31)	☢ α;	α	6.813 (82%), 6.547 (13%), 6.419 (5%), no 6.197 α (lim 0.2%) spect (52P57); 6.807 (69%), 6.542 (15%), 6.418 (12%), 6.197 (4%) spect (15B54, 4R36);		Q_α 6.940 (52P57); Q_{β^-} 0.25 calc (68F58) 
		A chem, genet (1C31); daughter Ra^{223} (AcX), parent Po^{215} (AcA); daughter At^{219} (8H53)	γ	0.272 (8.6%, $K/L_I/L_{II}/L_{III}$ = 1.0/0.35/0.40/0.17), 0.401 (4.8%, K/L 1.8), no 0.59 γ spect conv, scint spect (52P57); 0.067, 0.124, 0.198 (strong), 0.267, 0.321, 0.392, 0.589 (weak) spect conv (11S37); 0.123, 0.270, 0.590 cryst spect (8F40); 0.40 scint spect (73P57)		
Rn^{220} (Tn)	51.5 s (132S55); 54.5 s (1C31)	☢ α; β stable (cons energy) (68F58);	α	6.282 spect (15B36, 9H38); 6.278 spect (109B53); α_0 (99.7%), 5.747 (0.3%) spect (4A57, 13P56);		Q_α 6.40 (68F58)  (SHS, 4A57)
		A chem, genet (1C31); daughter Ra^{224} (ThX), parent Po^{216} (ThA)	γ	0.542 (~0.03%) scint spect (113M56)		
Rn^{221}	25 m (9M56)	☢ β^- ~80%, α ~20% (9M56);	α	6.0 ion ch (9M56)		Q_α 6.11, Q_{β^-} 0.95 est (68F58)
		B chem, genet (9M52a); parent Fr^{221}, parent Po^{217} (9M56, 9M52a)				
Rn^{222} (Rn)	3.8229 d (109M56); 3.825 d (22T55, 22T51, 55R56a, 1C31)	☢ α; β stable (cons energy) (68F58);	α	5.486 spect (15B36, 9H38); 5.482 spect (109B53);		Q_α 5.59 (68F58)  (113M56, SHS)
		no β^- (lim 10^{-4}%) (5K46); A chem, genet (1C31); daughter Ra^{226}, parent Po^{218} (RaA)	γ	0.510 (~0.07%) scint spect (113M56)		
$_{87}Fr^{212}$	19.3 m (8H50)	☢ EC 56%, α 44% (8H50);	α	6.342 (†24), 6.387 (†39), 6.411 (†37) spect (9M55a)		Q_α 6.53 (13P56)
		A chem, genet (8H50); chem, mass spect (9M52a); parent Rn^{212}, parent At^{208} (1.7 h) (8H50, 9M52a)				

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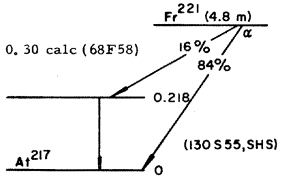
$_{87}Fr^{217}$		☢ α (57K51); E genet, decay charac (57K51); descendant Pa^{225} (57K51)	α	8.3 range emuls (57K51)	Q_α 8.46, Q_{EC} 0.81 calc (68F58)
Fr^{218}	5 x 10^{-3} s est (11M51)	☢ α (11M51); B genet (11M49, 11M51); daughter Ac^{222}, parent At^{214} (11M49, 11M51)	α	7.85 ion ch (11M51)	Q_α 8.00, Q_{β^-} 0.25 est, Q_{EC} 1.77 calc (68F58)
Fr^{219}	0.02 s delay coinc (11M51)	☢ α (13G48); β stable (cons energy) (68F58); A genet (13G48); daughter Ac^{223}, parent At^{215} (13G48, 11M49, 11M51)	α	7.30 ion ch (11M51)	Q_α 7.44 (68F58)
Fr^{220}	27.5 s (11M51)	☢ α (13G48); A genet (13G48); daughter Ac^{224}, parent At^{216} (13G48, 11M49, 11M51)	α	6.69 ion ch (11M51)	Q_α 6.81, Q_{EC} 0.87 calc, Q_{β^-} 1.27 calc (68F58)
Fr^{221}	4.8 m (4H50a); 5 m (11E47)	☢ α (11E47, 4H47); A chem, genet (4H47, 11E47); daughter Ac^{225}, parent At^{217} (11E47, 4H47, 5C48, 4H50a); daughter Rn^{221} (9M56, 9M52a)	α γ	6.33 (84%), 6.12 (16%) spect (130S55); 6.30 (~75%), 6.05 (~25%) ion ch (4H50a, 4H47, 5C48); 0.216 (14%, e_L/γ 0.16, K/L 0.3, coinc with 6.07 α) spect conv, scint spect, ion ch, α-γ coinc (15M55); 0.220 (13%, e/γ 0.28) scint spect (130S55); others (125S56)	Q_α 6.45, Q_{β^-} 0.30 calc (68F58) 
Fr^{222}	14.8 m (8H50a)	☢ β^- 99+%, α 0.01-0.1% (8H51a); B chem, genet (8H50a); parent Ra^{222}, ancestor Bi^{214} (8H50a, 8H51a)			Q_α 6.05 est, Q_{β^-} 2.05 est, Q_{EC} 0.07 est (68F58)
Fr^{223} (AcK)	22 m genet (7P56, 48A55, 7P39)	☢ β^- (7P39a, 8G47); α ~4 x 10^{-3}% (8H53); α ~6 x 10^{-3}% (48A55, 7P56); A chem, genet (7P39, 7P39b); daughter Ac^{227}, parent Ra^{223} (AcX) (7P39, 7P39a, 7P39b, 7P41, 7P46, 8G47, 6L50); parent At^{219} (8H53)	α β^- γ	5.34 range emuls (48A55, 7P56); 1.15 scint spect (8H54); 1.2 cl ch (7P39a, 7P39b, 6L50); 0.0498 (40%), 0.080 (24%), 0.215 (3%), 0.31 (0.8%) scint spect, ion ch (8H54); 0.0486 (27%) crit abs (6L50); others (6L44, 7P46); see also gammas of Th^{227} (RdAc)	Q_α 5.44, Q_{β^-} 1.15 (68F58); see Th^{227}
$_{88}Ra^{213}$	2.7 m (9M55)	☢ α (9M52a); B chem, genet (9M52a); parent Rn^{209} (9M52a, 9M55)	α	6.90 ion ch (9M55)	Q_α 7.03 (13P56)
Ra^{219}	~10^{-3} s est (11M52)	☢ α (11M52); B genet (11M52); daughter Th^{223}, parent Rn^{215} (11M52)	α	8.0 ion ch (11M52)	Q_α 8.15, Q_{EC} 0.71 calc (68F58)

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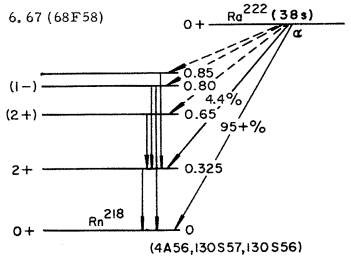
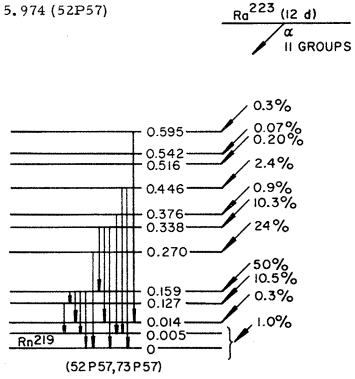
$_{88}Ra^{220}$	0.03 s est (11M51)	☢	α (11M51);	α	7.43 ion ch (11M51)	Q_α 7.57 (68F58)
		A	genet (11M49, 11M51); daughter Th^{224}, parent Rn^{216} (11M49, 11M51)			
Ra^{221}	30 s (11M51)	☢	α (11M51); β stable (cons energy) (68F58);	α	6.71 ion ch (11M51)	Q_α 6.83 (68F58)
		A	chem, genet (11M49, 11M51); daughter Th^{225}, parent Rn^{217} (11M49, 11M51)			
Ra^{222}	38 s (4S48); 37 s (4A56)	☢	α (4S48); β stable (cons energy) (68F58);	α	6.55 spect (4A56); 6.51 ion ch (1J48);	Q_α 6.67 (68F58) 
		A	chem, genet (4S48); daughter Th^{226}, parent Rn^{218} (4S48); daughter Fr^{222} (8H51a, 8H50a)	γ	γ_1 0.3246 spect conv (119S56); γ_1 (3.6%, e_K/γ 0.08), γ_2 0.325 (8×10^{-3}%), γ_3 0.48 (7×10^{-3}%), γ_4 0.52 (2×10^{-3}%), γ_5 0.80 (0.02%), (γ_1 coinc with γ_2, γ_3, and γ_4) scint spect, α-γ, γ-γ coinc (4A56, 130S56, 130S57)	
Ra^{223} (AcX)	11.68 d (107H54); 11.2 d (1C31); 11.1 d (136B53); others (13S47)	☢	α; β stable (cons energy) (68F58);	α	5.867 (1.0%), 5.862 (?), 5.853 (0.3%), 5.830 (0.05%, ?), 5.742 (10.5%, coinc with 0.122 γ), 5.712 (50%, coinc with 0.144 γ and 0.154 γ), 5.602 (24%, coinc with 0.270 γ), 5.534 (10.3%, coinc with 0.18 γ, 0.27 γ, and 0.34 γ), 5.497 (0.9%, coinc with 0.371 γ), 5.429 (2.4%), 5.360 (0.20%), 5.334 (0.07%), 5.287 (?), 5.282 (?) spect, α-γ coinc (52P57); 5.860 (weak), 5.730 (9%), 5.704 (53%), 5.596 (24%), 5.528 (9%), 5.487 (2%), 5.419 (3%) spect (4R52b); others (11L34, 4R36, 4R37);	Q_α 5.974 (52P57) 
		A	chem, genet (1C31); daughter Th^{227} (RdAc), daughter Fr^{223} (AcK), parent Rn^{219} (An); daughter Ac^{223} (11M51); daughter Fr^{223} (AcK) (7P39, 7P39a, 7P39b, 7P41, 7P46, 8G47, 6L50)	γ	0.0312, 0.1222 (2%, e_K/γ 3.6, $K/L_I/L_{II}/L_{III}$ = 1.0/0.24/0.05/0.02), 0.1442 (4.1%, $K/L_I/L_{II}/L_{III}$ = 1.0/0.27/0.03/0.01), 0.1541 (5.5%, K/L_I 4.3), 0.1586 (K/L_I 5.7), 0.1798 (0.5%, K/L_{II} 4), 0.2696 (10%, e_K/γ 0.95, $(K/L_I/L_{II}$ = 1.0/0.21/0.01), 0.324 (2.3%, $K/L_I/L_{II}/L_{III}$ = 1.0/0.25/0.18/0.13), 0.338 (2.8%, e_K/γ 0.33, K/L_I 3.1), 0.371 (0.45%, e_K/γ 0.71), 0.441, 0.446, (K/L_I 2.5), 0.580 (?) spect conv, scint spect, α-γ, γ-γ coinc (52P57); 0.148 (12%), 0.268 (15%), 0.33 (9%) scint spect, α-γ, γ-γ coinc (73P57, 73P57a); 0.144, 0.155, 0.180, 0.270, 0.340 cryst spect (8F40); others (137B55, 136M55, 11S37)	

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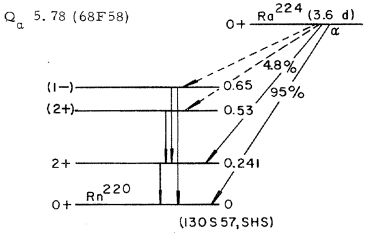
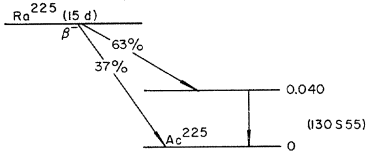
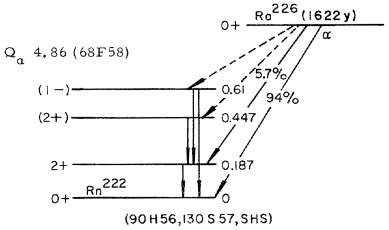
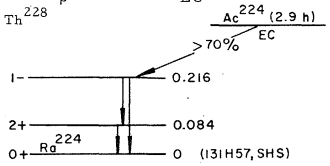
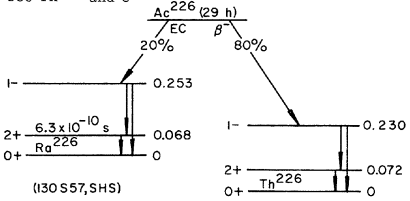
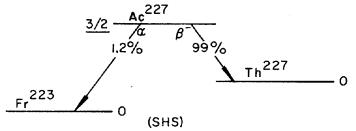
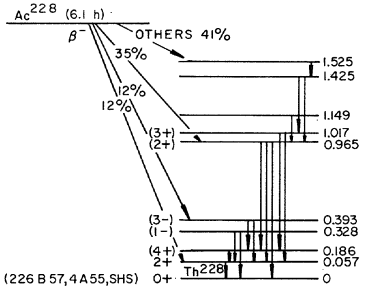
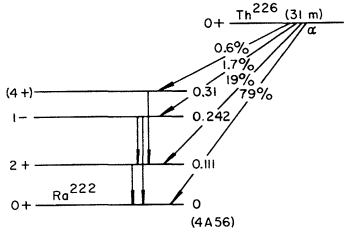
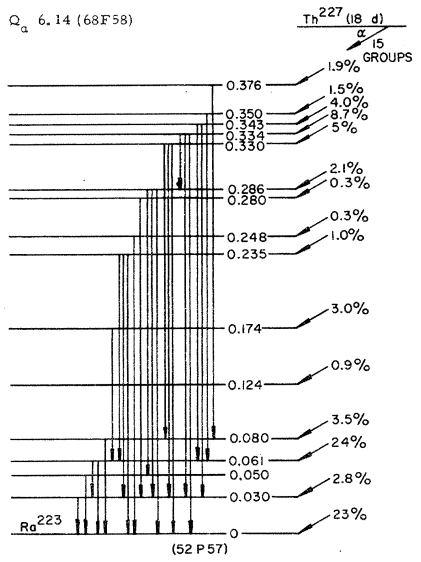
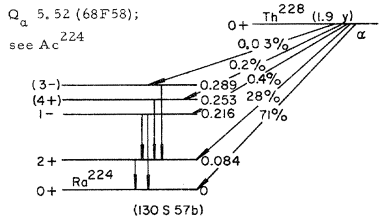
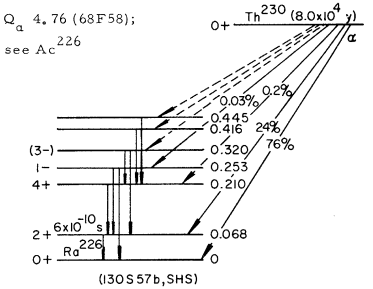
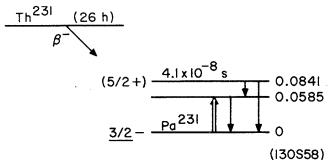
$_{88}Ra^{224}$ (ThX)	3.64 d (1C31); others (13S47)	☢	α; β stable (cons energy) (68F58);	α	5.681 (95%), 5.445 (4.9%), no other alphas (lim 0.1%) spect (4A53); 5.681 (95%), 5.448 (4.6%), 5.194 (0.4%) spect (4R49); 5.681 spect (15B36); 5.679 spect (109B53); others (2C57);	Q_α 5.78 (68F58) 
		A	chem, genet (1C31); daughter Th^{228} (RdTh), parent Rn^{220} (Tn); daughter Ac^{224} (13G48, 11M49, 11M51)	γ	γ_1 0.24098 cryst spect (100M52, assigned to Ra^{224} by 4R54a); γ_1 0.2411 (3.7%, e_K/γ 0.13, $K/L_{II}/L_{III}$ = 0.46/0.3/0.28) spect conv, scint spect (4R54a); γ_1 0.24, γ_2 0.29 (~8 x 10^{-3}%), γ_3 0.41 (~4 x 10^{-3}%), γ_4 0.65 (~9 x 10^{-3}%), (γ_1 coinc with γ_2 and γ_3) scint spect, γ-γ coinc (130S57); others (114M54, 4R52, 1M28, 4F49)	
Ra^{225}	14.8 d (4H50a); 14 d (11E47)	☢	β^- (11E47, 4H47); no α (lim 0.01%) (9M56);	β^-	0.32 scint spect (15M55, 13P55); β_0 (37%), β_{40} (63%) β-γ coinc, scint spect (130S55); others (4H50a, 11E47);	Q_α 5.33 est, Q_{β^-} 0.36 (68F58) 
		A	chem, genet (11E47, 4H47); daughter Th^{229}, parent Ac^{225} (11E47, 4H47, 4H50a)	γ	0.040 (33%, coinc with 0.32 β^-) scint spect, β-γ coinc (15M55); 0.040 ($e_L/\gamma \leq 1$, coinc with 0.32 β^-) scint spect, β-γ coinc (13P55); others (125S55)	
Ra^{226}	1622 y sp act (2K49a); 1617 y sp act (230S56); 1631 y sp act (3C46); 1590 y sp act (1C31)	☢	α; β stable (cons energy) (68F58);	α	4.777 spect (109B53, 109B51, 4R52b); α_0 (94%), α_{188} (5.7%) spect (4A52c); α_0 (95%), α_{186} (4.8%) ion ch (7K51a); α_0 (94%), α_{187} (6.5%) spect (4R49a);	Q_α 4.86 (68F58) 
		A	chem, genet (1C31); daughter Th^{230} (Io), parent Rn^{222} (Rn)	γ	γ_1 0.186 spect conv (10C51); γ_1 0.188 (16H24, 7R36); γ_1 (e_K/γ 0.15, K/L+M 0.45), 0.66 cl ch (59R54, 59R54a); γ_1 (e/γ 0.22, K/L+M 0.62) emuls (42J55); γ_1 (e/γ ~1) α-conv coinc, abs (14V52); γ_1 (†400), γ_2 0.260 (†1), no 0.45 γ (lim †0.05), no 0.66 γ (lim †0.05), (γ_1 coinc with γ_2) scint spect, γ-γ coinc (90H56); γ_2 0.26 (~7 x 10^{-3}%), γ_3 0.42 (~2 x 10^{-4}%), γ_4 0.61 (~2 x 10^{-4}%), (γ_1 coinc with γ_2 and γ_3) scint spect, γ-γ coinc (130S57); others (5A56, 11M54, 8S43); 0.068 level of Ra^{226}: $t_{1/2}$ 6.3 x 10^{-10} s delay coinc (23V58); see also gammas of Th^{230}	
Ra^{227}	41.2 m (107B53)	☢	β^- (8P49);	β^-	1.31 abs (107B53);	Q_α 4.43 est, Q_{β^-} 1.31 (68F58); see Pa^{231}
		A	n-capt, genet (8P49); parent Ac^{227} (8P49)	γ	0.0275, 0.30, 0.50 scint spect, spect conv (130S57); 0.291 (4%), 0.498 (0.6%) scint spect (107B53); see also gammas of Pa^{231}	

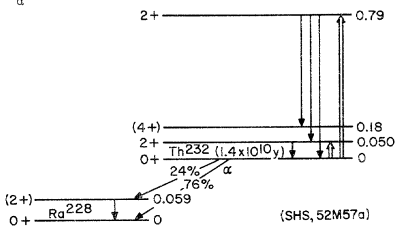
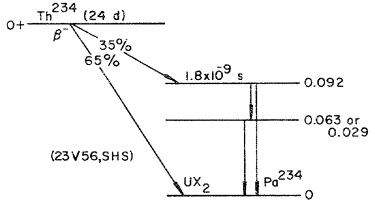
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{88}Ra^{228}$ ($MsTh_1$)	6.7 y (1C31)	☢ β^-; no α (lim 2 x 10^{-6}%) (4F57); A chem, genet (1C31); daughter Th^{232}, parent Ac^{228} ($MsTh_2$)	β^- ~0.012 (?) cl ch (6L48, 6L49a); 0.053 spect, abs (8L39); γ no 0.03 (lim 1%) crit abs (3R53a); ~0.03 cl ch (6L48, 6L49)	Q_α 3.95 est, Q_{β^-} 0.04 (68F58)
Ra^{229}	[short] (41D52)	☢ [β^-] (41D52); F n-capt, genet (41D52); [parent Ac^{229}] (41D52)		Q_{β^-} 1.76 est (68F58)
Ra^{230}	1 h (5J52)	☢ β^- (5J52); D chem (5J52); parent Ac^{230} (5J52)	β^- 1.2 abs, spect (5J52)	Q_{β^-} 0.9 est (68F58)
$_{89}Ac^{221}$		☢ α (57K51); E genet, decay charac (57K51); descendant Pa^{225} (57K51)	α 7.6 range emuls (57K51)	Q_α 7.7, Q_{EC} 1.7 est (68F58)
Ac^{222}	5.5 s (11M52)	☢ α (11M51); B genet (11M49, 11M51); daughter Pa^{226}, parent Fr^{218} (11M49, 11M51, 11M52)	α 6.96 ion ch (11M51)	Q_α 7.09, Q_{EC} 2.19 calc (68F58)
Ac^{223}	2.2 m (11M51)	☢ α 99%, EC 1% (11M51); A genet (13G48); daughter Pa^{227}, parent Fr^{219}, parent Ra^{223} (AcX) (13G48, 11M49, 11M51)	α 6.64 ion ch (11M51)	Q_α 6.76, Q_{EC} 0.55 calc (68F58)
Ac^{224}	2.9 h (11M51)	☢ EC ~90%, α ~10% (11M51); A chem, genet (13G48); daughter Pa^{228}, parent Fr^{220}, parent Ra^{224} (ThX) (13G48, 11M49, 11M51)	α 6.17 ion ch (11M51); γ with EC: 0.133 (†100), 0.217 (†224), no γ >0.22 (lim 2%) scint spect (131H57, 131H57a); see also gammas of Th^{228}	Q_α 6.28, Q_{β^-} 0.29 calc, Q_{EC} 1.37 calc (68F58); see Th^{228} 
Ac^{225}	10.0 d (4H50a, 11E47)	☢ α (11E47, 4H47); β stable (cons energy) (68F58); A chem, genet (4H47, 11E47); daughter Ra^{225}, parent Fr^{221} (4H47, 11E47, 4H50a); daughter Pa^{229} (8H49a); daughter Th^{225} (11M49, 11M51); parent Fr^{221} (5C48)	α 5.818 (54%), 5.782 (28%), 5.721 (9.5%), 5.713 (2.6%), 5.672 (0.8%), 5.627 (3.8%), 5.599 (0.6%), 5.570 (0.7%), 5.543 (0.07%) spect (130S57, 104H56); 5.80 ion ch (4H50, 5C48); γ 0.0366 ($L_I/L_{II}/L_{III}$ ~0/1/1), 0.0384 ($L_I/L_{II}/L_{III}$ ~0/1/1), 0.0628 (L_I/L_{II} large, L_{II}/L_{III} large), 0.0873 (?, L_I/L_{II} large, L_{II}/L_{III} large), 0.0994 (L_I/L_{II} large, L_{II}/L_{III} large), 0.150, 0.187 spect conv, scint spect (130S57, 130S55); others (15M55, 125S56)	Q_α 5.92 (68F58)

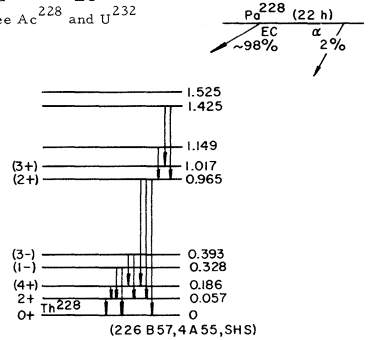
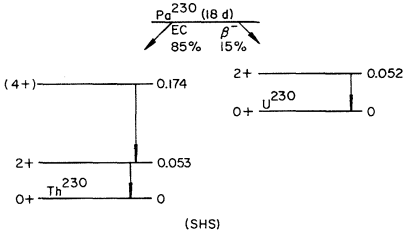
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{89}Ac^{226}$	29 h (6S50)	☢	β^- ~80%, EC ~20% (130S57);	β^-	~1.2 abs (17H50);	Q_α 5.49 est, Q_{β^-} 1.1 calc, Q_{EC} 0.70 calc (68F58); see Th^{230} and U^{230} 
		A	chem, genet (6S48); daughter Pa^{230}, parent Th^{226} (6S48, 6S50, 11M50)	γ	with β^-: 0.0721, 0.1581 (†100), 0.2303 (†151) spect conv, scint spect (130S55a, 130S57); with EC: 0.0676, 0.185 (†100), 0.253 (†132) spect conv, scint spect, γ-γ coinc (130S57); see also gammas of Th^{230} and U^{230}	
Ac^{227}	21.6 y (22T55); 22.0 y (13H50a); 21.7 y (4C44); 21.2 y (227S56a); others (1C31)	☢	β^- ~99% (7P39, 8P49a); α 1.2% (2M14, 7P39, 7P46, 8P49a);	α	4.942 spect (4R52b); 4.94 (100%) ion ch (13G48a); others (3G47);	Q_α 5.03 (68F58); Q_{β^-} 0.046 (138B55) 
		A	chem, genet (1C31); daughter Pa^{231}, parent Th^{227} (RdAc); parent Fr^{223} (AcK) (7P39, 7P46, 8G47, 6L50); daughter Ra^{227} (8P49);	β^-	0.046 ion ch (138B55, 138B55a); 0.04 spect (3F50); others (7P46, 6L44);	
		I μ q	3/2 atomic spect (36T51); +1.1 atomic spect (38F55); -1.7 atomic spect (38F55)	γ	no 0.037 γ scint spect, ion ch (55B55, 3R53a, 138B55, 138B55a); 0.037 (weak) abs (6L43, 6L44, 7P46); (0.2%) (6L50); 0.027 or 0.030 level of Ac^{227}: $t_{1/2}$ 4.2×10^{-8} s delay coinc (4T53); $t_{1/2}$ 3.7×10^{-8} s delay coinc (46F56); see also gammas of Pa^{231}	
Ac^{228} ($MsTh_2$)	6.13 h (1C31)	☢	β^-;	β^-	2.18 (10%), 1.85 (9.6%), 1.7 (6.7%), 1.11 (53%), 0.64 (7.6%), 0.45 (13%) spect, β-γ coinc (72K53, 82C52, 4F52); 2.10 (coinc with 0.058 γ), 1.76 (coinc with 0.338 γ, 0.209 γ, and 0.129 γ), 1.18 spect, β-γ coinc (226B57); others (4F38, 6L38, 3L39, 5J51);	Q_α 4.61 est, Q_{β^-} 2.18 (68F58); see Pa^{228} and U^{232} 
		A	chem, genet (1C31); daughter Ra^{228} ($MsTh_1$), parent Th^{228} (RdTh)	γ	0.0568 (L_{II}/L_{III} 1.2), 0.0781 (L_{II}/L_{III} 1.0), 0.0978, 0.1130, 0.1275 (L_{II}/L_{III} 1.3), 0.179, 0.184 (K/L_I 4.7), 0.232, 0.336 (K/L_I 4), 0.410, 0.458 (K/L_I 2), 0.907 (K/L_I 3), 0.965 (K/L_I 1.5), 1.035, 1.095, 1.59, 1.64 spect conv, β-γ, γ-γ coinc (72K53); 0.057 (L_{II}/L_{III} 1.2), 0.078, 0.097, 0.128 (K/L_{II}/L_{III} = 0.05/1.4/1.0), 0.184 (K/L+M 4.7) spect conv (140B54); 0.098 (coinc with 0.41 γ, 0.46 γ, and ~0.94 γ), 0.127 (coinc with 0.22 γ), 0.155, 0.220, 0.278, 0.336, 0.41 (coinc with 0.97 γ), 0.46 (coinc with 0.91 γ), 0.79 (coinc with 0.278 γ and 0.336 γ), 0.91, 0.97, 1.59 scint spect, γ-γ coinc (139B54); 0.058 (L_I+L_{II}/L_{III} 1.2, coinc with 0.129 γ, 0.209 γ, 0.338 γ, and 0.908 γ), 0.100 (coinc with 0.408 γ, 0.460 γ, 0.908 γ, and 0.966 γ), 0.129 (K/L 0.12, L_I+L_{II}/L_{III} 1.7, coinc with 0.209 γ), 0.184 (coinc with 0.908 γ and 0.966 γ), 0.209 (K/L ~5), 0.270 (K/L ~4, coinc with 0.79 γ), 0.328 (K/L ~5, coinc with 0.79 γ), 0.338 (K/L 5), 0.408 (coinc with 0.831 γ and 0.960 γ), 0.460 (coinc with 0.908 γ and 0.960 γ), 0.779, 0.790, 0.831, 0.908, 0.960, 0.966 spect conv, scint spect, γ-γ, γ-conv coinc (226B57); others (75S54, 17S55, 5T26, 13B24, 5J51); see also gammas of Pa^{228} and U^{232}	

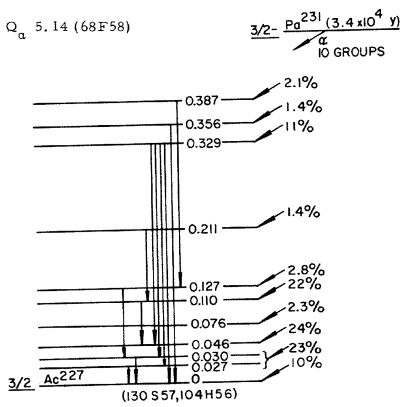
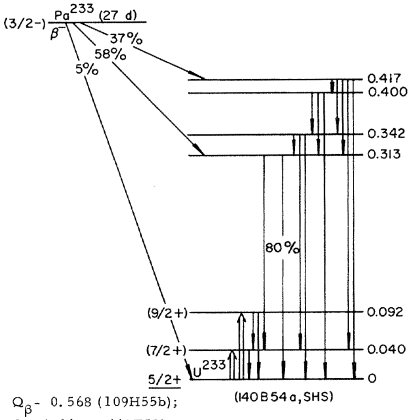
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{89}Ac^{229}$	66 m (41D52)	☢ β^- (41D52); B chem, n-capt (41D52); daughter Ra^{229} (41D52)			Q_α 4.2 est, Q_{β^-} 1.1 est (68F58)
Ac^{230}	<1 m genet (5J52)	☢ β^- (5J52); F genet (5J52); daughter Ra^{230} (5J52)	β^-	~2.2 abs, spect (5J52)	Q_α 3.8 est, Q_{β^-} 2.8 est (68F58)
$_{90}Th^{223}$	~0.1 s est (11M52)	☢ α (11M52); B genet (11M52); daughter U^{227}, parent Ra^{219} (11M52)	α	7.55 ion ch (11M52)	Q_α 7.69, Q_{EC} 1.64 calc (68F58)
Th^{224}	~1 s est (11M51)	☢ α (11M51); β stable (cons energy) (68F58); A genet (11M49, 11M51); daughter U^{228}, parent Ra^{220} (11M49, 11M51)	α	7.13 ion ch (7O50)	Q_α 7.26 (68F58)
Th^{225}	8.0 m (11M51)	☢ α ~90%, EC ~10% (11M51); A chem, genet (11M49, 11M51); daughter U^{229}, parent Ra^{221}, parent Ac^{225} (11M49, 11M51)	α	6.57 ion ch (11M51)	Q_α 6.69, Q_{EC} 0.47 calc (68F58)
Th^{226}	30.9 m (4S48)	☢ α (4S48); β stable (cons energy) (68F58); A chem, genet (4S48); daughter U^{230}, parent Ra^{222} (4S48); daughter Ac^{226} (6S48, 6S50)	α γ	6.33 (79%), 6.22 (19%), 6.10 (1.7%), 6.03 (0.6%) spect (4A56); 6.30 ion ch (1J48); 0.1111 spect conv (119S56); 0.112 (4.8%, e/γ 3.0, e_K/γ <0.4, coinc with 0.13 γ and 0.20 γ), 0.131 (0.4%), 0.20 (0.4%), 0.242 (1.2%) scint spect, α-γ, γ-γ coinc (130S54, 4A56)	Q_α 6.44 (68F58) 

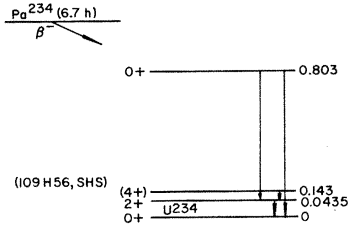
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{90}Th^{227}$ (RdAc)	18.17 d (107H54); 18.6 d (8P49b); 18.9 d (1C31)	☢ α; β stable (cons energy) (68F58);	α	6.036 (23%), 6.007 (2.8%), 5.976 (24%), 5.958 (3.5%), 5.914 (0.9%), 5.865 (3.0%), 5.805 (1.0%), 5.793 (0.3%), 5.761 (0.3%), 5.755 (21%), 5.712 (5.0%), 5.708 (8.7%), 5.699 (4.0%), 5.692 (1.5%), 5.667 (1.9%), no 5.728 α (lim 0.3%) spect (52P57); 6.030 (19%), 6.001 (5%), 5.972 (21%), 5.952 (13%), 5.922 (~2%), 5.860 (4%), 5.796 (2%), 5.749 (17%), 5.728 (~1%), 5.704 (15%), 5.651 (~2%) spect (8F55); others (11L34);	Q_α 6.14 (68F58) 
		chem, genet (1C31);	A		
		daughter Ac^{227}, parent Ra^{223} (AcX);			
		daughter Pa^{227} (11M51, 13G48);			
		daughter U^{231} (14C50)	γ	0.0300 (L_{II}/L_{III} 0.3), 0.0316 (L_{II}/L_{III} 0.3), 0.0501 ($L_I/L_{II}/L_{III}$ = 0.7/0.8/1.0), 0.0616 (L_{II}/L_{III} 0.9), 0.1004 (L_{II}/L_{III} 1.3), 0.1133 (L_{II}/L_{III} 1.4), 0.2050, 0.2346, 0.2361, 0.2564 ($K/L_I/L_{II}/L_{III}$ = 3/0.4/2.5/1.0), 0.2863, 0.3048, 0.3128, 0.3347 spect conv (8F55); 0.0298 ($L_I/L_{II}/L_{III}$ = 0.22/0.79/1.0), 0.0316 ($L_I/L_{II}/L_{III}$ = 0.7/0.8/1.0), 0.0482 (L_{II}/L_{III} 1.4), 0.0500 (7.5%, $L_I/L_{II}/L_{III}$ = 1.1/0.9/1.0), 0.0613 (L_{II}/L_{III} 1.1), 0.0686 ($L_I/L_{II}/L_{III}$ = 2.7/2.2/1.0), 0.0797 ($L_I/L_{II}/L_{III}$ = 1.0/1.0/1.0), 0.1001 ($L_I/L_{II}/L_{III}$ = 0.25/1.3/1.0), 0.1130 ($K/L_{II}/L_{III}$ = 3.4/1.9/1.0), 0.1733 ($K/L_{II}/L_{III}$ = 1.8/0.6/1.0), 0.2052 (K/L_I 4.8), 0.2349 (K/L_I 3.7), 0.2361 (10%, K/L_I 7), 0.2477, 0.2503 (K/L_{II} 7.1), 0.2564 ($K/L_I/L_{II}/L_{III}$ = 3/~0/2.1/1.0), 0.2818 ($K/L_I/L_{II}$ = 7/1.0/1.0), 0.2861 (K/L 5.2), 0.2897 (K/L 2.2), 0.2968 ($K/L_{II}/L_{III}$ = 1.0/1.7/1.3), 0.3000, 0.3045 ($K/L_I/L_{II}$ = 15/3.0/1.0), 0.3127 (K/L_I+L_{II} 4.0), 0.3297 (K/L_{II} 3), 0.3343 ($K/L_{II}/L_{III}$ = 13/3/1.0) spect conv, scint spect (52P57); 0.0498 (15%, coinc with 0.235γ), 0.235 scint spect, γ-γ coinc (8H54); others (3R50, 3B44, 9T42, 46F56, 3R53a, 8F40); see also gammas of Fr^{223} (AcK)
$_{90}Th^{228}$ (RdTh)	1.910 y (73K56); 1.90 y (1C31)	☢ α; β stable (cons energy) (68F58);	α	5.421 (71%), 5.338 (28%), 5.208 (0.4%), 5.173 (0.2%), 5.137 (0.03%) spect (4A53, 130S57b); 5.423 (72%), 5.338 (28%) spect (4R49b); others (2C57);	Q_α 5.52 (68F58); see Ac^{224} 
		chem, genet (1C31);	A		
		daughter Ac^{228} ($MsTh_2$), parent Ra^{224} (ThX);			
		daughter U^{232} (9G49);			
		daughter Pa^{228} (11M51)	γ	0.0845 (L_{II}/L_{III} 1.2) spect conv (4R54a, 4R52a); 0.0844 (↑100), 0.132 (↑11), 0.167 (↑6), 0.214 (↑18) ion ch (30N54); 0.084 (1.6%, e/γ ~16, coinc with 0.137 γ, 0.169 γ, and 0.205 γ), 0.137 (0.26%, e/γ <1), 0.169 (0.09%, e/γ ~1.2), 0.205 (0.03%), 0.212 (0.27%, e/γ <1) scint spect, γ-γ coinc, α-γ coinc (130S57a, 4A53, 130S54, 130S57b); 0.084 (↑100), 0.133 (↑14), 0.172 (↑10), 0.216 (↑17) scint spect (141B53); ~0.08 (e_L/γ 10) abs (3R53a); others (1M28, 11S41a, 3R50, 103B51, 6J53, 142B53, 5A56, 14V52, 89C56); see also gammas of Ac^{224}
$_{90}Th^{229}$	7340 y genet (4H50a); ~10^4 y genet (11E47)	☢ α; β stable (cons energy) (68F58);	α	5.02 (~10%), 4.94 (~20%), 4.85 (~70%) ion ch (4H50a);	Q_α 5.11 (68F58)
		chem, genet (11E47, 4H47, 4H50a);	A		
		daughter U^{233}, parent Ra^{225} (11E47, 4H47, 4H50a)	γ	0.148 (↑5), 0.200 (↑15) scint spect (130S55)	

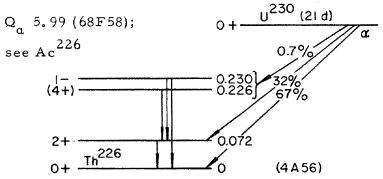
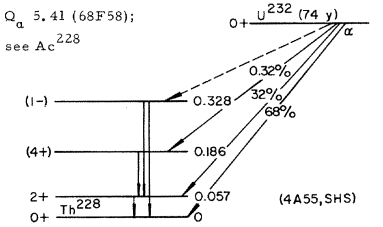
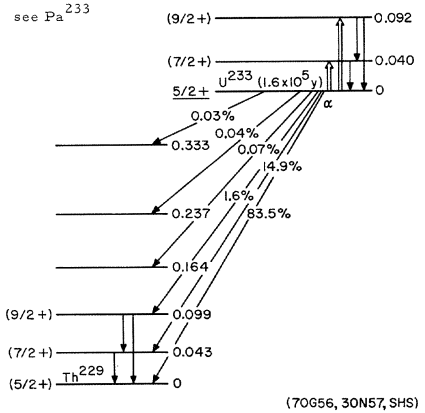
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{90}Th^{230}$ (Io)	8.0×10^4 y sp act (8H49b); 8.2×10^4 y genet (1C30); spont fission: $\geq 1.5 \times 10^{17}$ y (24S52)	☢	α; β stable (cons energy) (68F58);	α	α_0 4.682 (76%), 4.615 (24%) spect (104H56); α_0 (75%), α_{67} (25%), α_{210} (0.12%), α_{250} (0.03%) ion ch (22V53); α_0 (76%), α_{67} (23%), α_{142} (0.07%), α_{215} (0.20%), α_{250} (0.07%), α_{328} (0.08%), α_{399} (0.07%), α_{485} (0.06%) spect (4R54b, 4R48); others (59R53, 1G22, 2C57);
		A	chem, genet (1C31); daughter U^{234} (U_{II}), parent Ra^{226}; daughter Pa^{230} (4S48a)	γ	0.0678 (L_{II}/L_{III} 1.0), 0.141, 0.203, 0.257 spect conv (4R54c, 4R51); γ_1 0.068 (0.59%), γ_2 0.11 (~1×10^{-4}%), γ_3 0.142 (0.07%), γ_4 0.184 (1.4×10^{-2}%), γ_5 0.206 (~5×10^{-6}%), γ_6 0.235 (~5×10^{-6}%), γ_7 0.253 (1.7×10^{-2}%), γ_8 ≈ energy of γ_7 (~8×10^{-4}%), (γ_1 coinc with γ_3, γ_4, and γ_8), (γ_3 coinc with γ_2, γ_5, and γ_6) scint spect, α-γ, γ-γ coinc (130S57b, 130S55a); γ_1 0.068 (0.64%), γ_3 0.142 (0.08%), γ_4 0.195 (5×10^{-3}%), γ_7 0.255 (3×10^{-3}%), (γ_1 coinc with γ_3 and γ_4) scint spect, γ-γ coinc (143B56, 7R53); 0.067 (0.33%), 0.15 (0.04%), 0.20 (?, ~3×10^{-3}%), 0.254 (0.01%) scint spect (141B53); others (22V55, 10F54, 147B54, 10F55, 27T53, 3R53a, 5A56, 4C48, 14V52, 10F51, 3R50, 5W39, 6J51); γ_1: $t_{1/2}$ 6.3×10^{-10} s delay coinc (23V58); see also gammas of Ac^{226}
					Q_α 4.76 (68F58); see Ac^{226}  (130S57b, SHS)
Th^{231} (UY)	25.64 h (1J51); 25.5 h (3K49); 24.6 h (1C31); 24.0 h (12G32); others (5N38)	☢	β^-;	β^-	0.090 (8%), 0.134 (20%), 0.218 (33%), 0.299 (39%) spect (50J57); 0.094 (45%), 0.216 (11%), 0.302 (44%) spect (3F53); 0.305 (coinc with 0.084 γ) β-γ coinc, scint spect (115M56); others (5E37, 1J51, 10S51);
		A	chem, genet (1C31); daughter U^{235} (AcU), parent Pa^{231}	γ	0.0172, 0.0181, 0.02565 (13%, $M_I/M_{II}/M_{III}$ = 0.5/1.0/1.2), 0.05853 (e/γ very large, $L_I/L_{II}/L_{III}$ = 0.02/1.0/0.9), 0.0638, 0.0685, 0.0761 (?), 0.08116 (e_{L_I}/γ 2.9, $L_I/M_I/M_{II}$ = 4.7/1.0/0.15), 0.08201 (e_{L_I}/γ 2.8, L_I/L_{II} ~10), 0.08417 (11%, e_{L_I}/γ 1.3, $L_I/L_{II}/L_{III}$ = 1.57/1.00/0.056), 0.0898, 0.0993 (2%), 0.1358, 0.1461 (0.136 γ + 0.146 γ 0.2%), 0.1633 0.2%), 0.18 (~0.06%), 0.218 (0.05%), 0.31 (0.004%), (0.026 γ not coinc with 0.084 γ), (0.026 γ and 0.084 γ both coinc with 0.136 + 0.146 γ, 0.163 γ, and 0.218 γ) scint spect, spect conv, γ-γ, β-γ coinc (130S58); 0.0255, 0.0585, 0.0719, 0.0812, 0.0841, 0.0974, 0.140, 0.165, 0.223 spect conv, scint spect, ion ch (115M56); 0.022 (†1.7), 0.0594, 0.0631, 0.0848 (†1.0), 0.1218 (†0.02), 0.1674 (†0.02), 0.208 (†0.003), 0.230 (†0.001) spect conv, scint spect (3F53); 0.026 γ and 0.084 γ: $t_{1/2}$ 4.1×10^{-8} s delay coinc (125S55); $t_{1/2}$ 4.5×10^{-8} s delay coinc (115M56); others (10S51, 3K49); see also gammas of Pa^{231} and U^{231}
					Q_α 4.21 calc, Q_{β^-} 0.38 (68F58)  (130S58)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{90}Th^{232}$	1.39 x 10^{10} y sp act (31P56, 6K38); 1.45 x 10^{10} y sp act (10M56); 1.42 x 10^{10} y genet (137S56); spont fission: >10^{20} y (53P55); 1.4 x 10^{18} y (24S52)	☢	α; β stable (cons energy) (68F58);	α	4.007 (α_0), α_{55} ion ch (20H57); 3.99 range emuls (44P54); others (7F51a, 1S37, 2C57);	Q_α 4.08 (68F58) 
		A	chem, genet (1C31); parent Ra^{228} ($MsTh_1$);	γ	0.059 (conv electrons 24%) α-conv coinc, emuls (43P55); 0.060 (conv electrons 22%) α-conv coinc, emuls (5A56, 5A52); ~0.055 (conv electrons 24%) α-conv coinc, emuls (15D52); Coulomb excitation (in Th^{232}): 0.050 scint spect (27T54, 45D56); 0.053, 0.61, 0.74, 0.79 scint spect (121S55a, 52M57a); 0.719 (K/L 3.5) spect conv (101M56); see also gammas of U^{236}	
		%	100 (1A35, 1D36)			
Th^{233}	22.12 m (43J55); 22.4 m (40D57); 23.3 m (2B50); 23.5 m (13S47a); 23.6 m (31R52); 23 m (2G41)	☢	β^- (13S47a);	β^-	1.23 spect (2B50, 31R52, 40D57); 1.245 (<87%), 1.158, 1.073, 0.88, 0.79, 0.58 spect (3F57a); 1.2 abs (13S52, 13S41);	Q_α 3.83 est, Q_{β^-} 1.23 (68F58); see Np^{237}
		A	chem, n-capt (1M38); parent Pa^{233} (1M38, 2G41, 13S41, 16H41a, 13S47a)	γ	0.0292 (2.1%, e/γ 2.8), 0.0567 (e/γ large), 0.0869 (2.7%, e/γ 0.9), 0.171 (0.7%), 0.195 (0.3%), 0.253, 0.359, 0.453 (1%), 0.590, 0.670 (0.25%), 0.751, 0.895 (0.14%) scint spect, spect conv (3F57a); no γ (2B50, 31R52, 40D57); see also gammas of Np^{237}	
Th^{234} (UX_1)	24.10 d (3K48); 24.1 d (3S39); 24.5 d (1C31)	☢	β^-; no α (lim 10^{-4}%) (53D55);	β^-	0.100 (35%, coinc with 0.091 γ), 0.191 (65%) β-γ coinc, abs, spect (108H55); 0.103 (34%), 0.193 (66%) spect (10S53); 0.111 (~20%), 0.205 (~80%) spect (16B46); 0.104 (44%), 0.192 (56%) spect (19H50); others (7J46, 4F38a, 108H53);	Q_{β^-} 0.25, Q_α 3.59 est (68F58) 
		A	chem, genet (1C31); daughter U^{238}, parent Pa^{234m} (UX_2); parent Pa^{234} (UZ) (0.63%) (14Z54)	γ	0.0290, 0.0628 (e_L/γ 0.45), 0.0914 (e_{L_I}/γ 2.0 L/M+N 3.1) spect conv (109H56); 0.029 (e_L/γ 10, coinc with 0.064 γ), 0.064 (e_L/γ 0.25), 0.093 (e_L/γ 2.5), all gammas coinc with 0.10 β^-, scint spect, β-γ, γ-γ coinc (17J54); 0.063 γ and 0.092 γ: $t_{1/2}$ 1.8 x 10^{-9} s delay coinc (23V56); others (19H50, 16B46, 1M23)	
Th^{235}	<<10 m genet (20H50)	☢	[β^-] (20H50);			Q_α 3.35 est, Q_{β^-} 1.8 est (68F58)
		F	n-capt, genet (20H50); [parent Pa^{235}] (20H50)			
$_{91}Pa^{225}$	2.0 s (57K51)	☢	α (57K51);			Q_α 7.4 est, Q_{EC} 2.4 est (68F58)
		E	excit, decay charac (57K51); ancestor Ac^{221}, Fr^{217}, At^{213} (57K51)			
Pa^{226}	1.8 m (11M51)	☢	α (11M51);	α	6.81 ion ch (11M51)	Q_α 6.93, Q_{EC} 2.68 calc (68F58)
		B	chem, genet (11M49, 11M51); parent Ac^{222} (11M49, 11M51, 11M52)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{91}Pa^{227}$	38.3 m (11M51); others (6O48)	☢	α ~85%, EC ~15% (11M51);	α	6.46 ion ch (11M51)	$Q_α$ 6.58, Q_{EC} 0.99 calc (68F58)
		A	chem, genet (13G48); parent Ac^{223}, parent Th^{227} (RdAc) (13G48, 11M51); daughter Np^{231} (15M50)			
Pa^{228}	22 h (11M51)	☢	EC ~98%, α ~2% (11M51);	α	6.09 (†75), 5.85 (†25) ion ch (11M51);	$Q_α$ 6.25, Q_{EC} 2.10 calc (68F58)
		A	chem, genet (13G48); daughter U^{228}, parent Ac^{224}, parent Th^{228} (RdTh) (13G48, 11M49, 11M51)	γ	with EC: 0.0575 (L_{II}/L_{III} 1.0), 0.0777, 0.0966, 0.1286 (L_{II}/L_{III} 1.5), 0.156, 0.185 (†4, K/L 6), 0.224 (†18), 0.283 (K/L 3.2), 0.329 (†0.329 γ + 0.337 γ: 10), 0.337, 0.411 (†8, K/L 2.5), 0.445 (K/L 7, †0.445 γ + 0.466 γ: 20), 0.466 (K/L 2.2), 0.793, 0.914 (K/L 4), 0.968 (†40, K/L 3.5), 1.095, 1.572 (†6) spect conv, scint spect (109H56a, 109H55); see also gammas of Ac^{228} ($MsTh_2$) and U^{232}	see Ac^{228} and U^{232} 
Pa^{229}	1.5 d (8H48)	☢	EC 99+%, α 0.25% (21S51); EC ~99%, α ~1% (11M51);	α	5.69 ion ch (11M48); 5.66 ion ch (8H48)	$Q_α$ 5.77, Q_{EC} 0.30 calc (68F58)
		A	chem, genet (8H49a); parent Ac^{225} (8H49a); daughter U^{229} (11M51)			
Pa^{230}	17.7 d (5O49); 17.0 d (4S48); others (8H49a, 8H49)	☢	EC ~85%, $β^-$ ~15%, $β^+$ (?, ~0.03%) (109H55a); α ~0.003% (11M51);	$β^-$	0.41 spect (109H55a, 109H54, 109H55); ~0.43 abs (5O49);	$Q_α$ 5.30 calc, $Q_{β^-}$ 0.41, Q_{EC} 1.24 calc (68F58)
		A	chem, excit, genet (4S48); parent U^{230} (4S48); parent Th^{230} (Io), parent Ac^{226} (11M50)	γ	with EC: 0.0528 (L_{II}/L_{III} 1.2), 0.121, 0.255 (†70), 0.445 (†195, K/L 6.1), 0.535 (weak), 0.636 (K/L_I 1.8), 0.712, 0.953 (†700, K/L_I 3.4), 1.013 (†105) spect conv, scint spect (109H55a, 109H55, 109H54); with $β^-$: 0.0517 spect conv (13H56); see also gammas of U^{234}	

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{91}Pa^{231}$	3.43 x 10^4 y sp act (8W49); 3.2 x 10^4 y sp act (2G30)	☢ α; β stable (cons energy) (68F58); A chem, genet (1C31); daughter Th^{231} (UY), parent Ac^{227}; daughter U^{231} (14C50); I 3/2 atomic spect (87M50)	α 5.046 (10%), 5.017 (23%), 5.001 (24%), 4.971 (2.3%), 4.938 (22%), 4.921 (2.8%), 4.839 (1.4%), 4.722 (11%), 4.696 (1.4%), 4.666 (2.1%) spect (104H56, 104H55); 5.049 (12%), 5.021 (23%), 5.006 (26%), 4.974 (1.5%), 4.942 (24%), 4.848 (1.5%), 4.727 (10%), 4.704 (?, 0.8%), 4.671 (1.3%) spect (44A56, 70G55); 5.042 (11%), 5.002 (47%), 4.938 (25%), 4.838 (3%), 4.720 (11%), 4.660 (~2%) spect (4R49c, 13C51); others (9T46a, 2C57); γ 0.0189 (?), 0.0275, 0.0299, 0.0381, 0.0440 (?), 0.0526, 0.0571 ($L_I/L_{II}/L_{III}$ ~0/1/1), 0.0635 ($L_I/L_{II}/L_{III}$ ~0/1/1), 0.0740 ($L_I/L_{II}/L_{III}$ ~0/1/1), 0.0772, 0.0967 (L_{II}/L_{III} ~1), 0.1007 (L_{II}/L_{III} ~1), 0.1026 (L_{II}/L_{III} ~1), 0.2598, 0.2831, 0.2994, 0.302, 0.329, 0.356 spect conv (130S57); 0.027 (e/γ <10), 0.034, 0.0380 (L_I+L_{II}/L_{III} ~1), 0.0569 (L_I+L_{II}/L_{III} ~1), 0.0635 (L_I+L_{II}/L_{III} ~1), 0.082, 0.102 (L_{II}/L_{III} 1), 0.198 (K/L 0.2), 0.259 (K/L 2), 0.301 (e_K/γ ~1.6, K/L 5), 0.331 (e_K/γ 1.6, K/L 6), 0.357 (K/L 5), 0.383 spect conv, abs, range emuls (10F53, 10F52a); 0.027 (†100), 0.048 (†5), 0.295 (†100) scint spect (116M54, 3R53a, 3R52a); 0.290 (e_K/γ ~0.05, coinc with 0.027 γ) scint spect, γ-γ coinc (46F56); 0.027 γ: $t_{1/2}$ 4.2 x 10^{-8} s delay coinc, α-γ coinc (4T53); $t_{1/2}$ 3.7 x 10^{-8} s delay coinc, γ-γ coinc (46F56); Coulomb excitation (in Pa^{231}): 0.0575 ion ch (30N57); 0.084 level of Pa^{231}: $t_{1/2}$ 4.1 x 10^{-8} s delay coinc (12S55); others (5A56, 1M28a, 4T52, 17S51, 4T49); see also gammas of Ra^{227}, Th^{231}, and U^{231}	Q_α 5.14 (68F58)  (130S57, 104H56)
Pa^{232}	1.31 d (88B54); 1.32 d (1J50); 1.4 d (5O49); 1.6 d (9G49); others (4S48)	☢ β^- (9G49); no EC (lim 2%) (88B52a); A chem, genet (9G49); parent U^{232} (9G49, 5O49)	β^- 0.26 (74%), 0.37 (13%), 0.54 (5%), 0.72 (2%), 1.24 (6%) spect (109H54); 0.30 (90%), 0.50 (8%), 1.27 (2%) spect (88B54); others (1J48b); γ 0.0472 (L_{II}/L_{III} 1.1), 0.1091 (L_{II}/L_{III} 2.2), 0.389 (K/L 2), 0.455 (K/L 4), 0.517 (K/L 8.5), 0.584 (K/L ~2), 0.662 (?, K/L <1), 0.690, 0.821 (K/L 4), 0.844, 0.868 (K/L 4), 0.896 (K/L >6), 0.973 (K/L 6), 1.085, 1.153 spect conv (109H55, 109H54); others (1J48b, 5O49); see also gammas of Pu^{236}	Q_α 4.47 calc, Q_{β^-} 1.24, Q_{EC} 0.35 calc (68F58); see Pu^{236}
Pa^{233}	27.0 d (117M56, 109W57); 27.4 d (2G41); others (4S48, 9G49)	☢ β^- (1M38, 2G41, 13S41); A chem, genet (1M38, 2G41, 13S41); daughter Th^{233} (1M38, 2G41, 13S41, 16H41a, 13S47a); parent U^{233} (13S47a); daughter Np^{237} (4H47, 15M47)	β^- 0.15 (37%), 0.257 (58%), 0.568 (5%) spect (109H55b, 109H54); ~0.14 (~50%), 0.256 (~45%), 0.568 (~5%) spect (140B54a); others (13S52, 21H41, 2L47, 11K50); γ 0.016, 0.028, 0.0401, 0.0578, 0.0748, 0.086, 0.104, 0.272, 0.301 (†22, K/L_I 6.3), 0.313 (†150, e_K/γ 0.74, K/L_I 4.0), 0.341 (†6, K/L_I 5.5), 0.376, 0.400, 0.417, 0.476 (?) spect conv, scint spect, β-conv coinc (109H55b, 109H54); 0.029, 0.041, 0.058, 0.076, 0.087, 0.105, 0.273, 0.302, 0.313, 0.342, 0.377, 0.400, 0.416 spect conv (11K50); 0.017 (?), 0.029, 0.041, 0.058, 0.076, 0.087, 0.104, 0.272 (?), 0.301, 0.313, 0.342, 0.400, 0.417 spect conv (140B54a); 0.087 level of Pa^{233}: $t_{1/2}$ 3.69 x 10^{-8} s delay coinc (13E54); others (2L47); see also gammas of U^{233} and Np^{237}	 (140B54a, SHS) Q_{β^-} 0.568 (109H55b); Q_α 4.36 est (68F58)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{91}Pa^{234m}$	1.175 m (112B51); 1.14 m (1C31)	☢ β^- 99+%, IT 0.63% (14Z54); β^- 99+%, IT 0.15% (4F38a, 16B45); no α (lim 10^{-4}%) (53D55); A chem, genet (1C31); daughter Th^{234} (UX_1), parent U^{234} (U_{II}); parent Pa^{234} (UZ) (14Z54)	β^- 0.58 (1%), 1.50 (9%), 2.31 (90%) spect (10S53, 19H50, 108H55); 2.32 (98%) spect (16B45); γ 0.043, 0.230, 0.255, 0.770, 0.803, 0.807, 1.01, 1.24, 1.44, 1.69, 1.83 spect conv, scint spect (109H56); 0.230, 0.298, 0.356, 0.423, 0.447, 0.500, 0.58, 0.73, 0.80, 0.88, 0.93, 1.04 spect conv (108H53); 0.25, 0.33 (?), 0.38 (?), 0.75 (†12), 1.00 (†37), 1.81 (†4), (0.25 γ coinc with 0.75 γ) scint spect, γ-γ coinc (17J54); 0.76 (†26), 1.00 (†37), 1.49 (†1), 1.7 (†1), 1.84 (†4) scint spect (95C54); 0.822, 0.806, 0.782 (weak, e/γ large) spect conv (16B43a, 16B45); see also gammas of Pa^{234} (UZ), Np^{234}, and Pu^{238}	Q_{β^-} 2.31 (108H55); see Pu^{238}
Pa^{234} (UX_2)	6.66 h (14Z54); 6.7 h (1C31); others (50K52)	☢ β^-; A chem, genet (1C31); parent U^{234} (U_{II}); daughter Pa^{234} (UX_2) (14Z54); daughter Th^{234} (UX_1) (0.63%) (14Z54)	β^- 0.16 (28%), 0.32 (32%), 0.53 (27%), 1.13 (13%) spect (109H56, 109H53, 109H55); 0.45 (90%), ~1.2 (10%) spect (16B45); others (4F38a, 141B53a); γ 0.0430 (L_{II}/L_{III} 1.0), 0.0992 (L_{II}/L_{III} 1.3), 0.125, 0.153 (L_{II}/L_{III} 2.1), 0.225 (e_K/γ 0.6, K/L 6), 0.293, 0.333, 0.368 (e_K/γ 0.24, K/L 3.5), 0.566 (e_K/γ 0.1, K/L 3.5), 0.603 (?), 0.732 (e_K/γ 0.012), 0.803 (K/L 2.4), 0.877 (e_K/γ 0.01), 0.924 (e_K/γ 0.0045), 1.24, 1.43, 1.68 spect conv, scint spect (109H56, 109H53, 109H55); 0.25, 0.76 (†6), 0.91 (†7, coinc with 0.25 γ and 0.76 γ), 1.68 (†2) scint spect, γ-γ coinc (17J54); 0.104 (?), 0.126 (?), 1.60 (?), 0.230, 0.276, 0.60, 0.76, 0.86 spect (141B53a); others (16B45, 4F38a, 4F38b); see also gammas of Pa^{234m} (UX_2), Np^{234}, and Pu^{238}	Q_α 4.26 est, Q_{β^-} 2.25 (68F58); see Pu^{238} 
Pa^{235}	23.7 m (11M50); 23 m (20H50)	☢ β^- (11M50, 20H50); B chem, excit, sep isotopes (11M50); genet (20H50); daughter Th^{235} (20H50)	β^- 1.4 abs (11M50); γ no γ, abs (11M50)	Q_α 4.15 est, Q_{β^-} 1.4 (68F58)
Pa^{237}	11 m genet (14C54)	☢ β^- (14C54); B chem, genet, excit (14C54); parent U^{237} (14C54)		Q_{β^-} 2.2 est (68F58)
$_{92}U^{227}$	1.3 m (11M52)	☢ α (11M52); B chem, genet (11M52); parent Th^{223} (11M52)	α 6.8 ion ch (11M52)	Q_α 7.2 est, Q_{EC} 2.3 est (68F58)
U^{228}	9.3 m (11M51)	☢ α ~80%, EC ~20% (11M51); A chem, genet (11M49, 11M51); parent Th^{224}, parent Pa^{228} (11M49, 11M51); daughter Pu^{232} (8J48, 7O51a)	α 6.67 ion ch (7O50)	Q_α 6.79, Q_{EC} 0.25 calc (68F58)
U^{229}	58 m (11M51)	☢ EC ~80%, α ~20% (11M51); A chem, genet (11M49, 11M51); parent Th^{225}, parent Pa^{229} (11M49, 11M51)	α 6.42 ion ch (11M51)	Q_α 6.53, Q_{EC} 1.23 calc (68F58)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{92}U^{230}$	20.8 d (4S48)	☢	α (4S48); β stable (cons energy) (68F58);	α	5.884 (67.2%), 5.813 (32.1%), 5.658 (0.7%) spect (4A56, 130S54); 5.85 ion ch (1J48);	Q_α 5.99 (68F58); see Ac^{226} 
		A	chem, genet (4S48); daughter Pa^{230} (4S48, 5O49); daughter Pu^{234} (13P49, 7O51a); parent Th^{226} (4S48)	γ	0.07213 (0.75%), 0.1543, 0.158, 0.232 (0.24%) spect conv, scint spect, α-γ coinc (119S56, 4A56, 130S54); see also gammas of Ac^{226}	
U^{231}	4.3 d (14C50); 4.2 d (5O49)	☢	EC 99+%, α 5.5×10^{-3}% (14C50);	α	5.45 ion ch (14C50);	Q_α 5.55, Q_{EC} 0.37 calc (68F58); see Th^{231}
		A	chem, sep isotopes, excit (5O49); genet (14C50); parent Th^{227}, parent Pa^{231} (14C50)	γ	0.0181, 0.02564 ($M_I/M_{II}/M_{III}/M_{IV}/M_V$ = 0.6/1.0/1.6/0.6/0.6), 0.05854 ($L_I/L_{II}/L_{III}$ = 0.3/1.0/0.9), 0.0685, 0.0813 (L_I/L_{II} large), 0.0821 (L_I/L_{II} large), 0.08418 ($L_I/L_{II}/L_{III}$ = 2.0/1.0/0.1), 0.1082, 0.22 spect conv, scint spect (130S58); see also gammas of Th^{231}	
U^{232}	74 y sp act (134S54); 70 y yield (8J49); ~30 y yield (9G49); spont fission: ~8×10^{13} y (8H56)	☢	α (9G49); β stable (cons energy) (68F58);	α	5.318 (68%), 5.261 (32%), 5.134 (0.32%) spect (4A55);	Q_α 5.41 (68F58); see Ac^{228} 
		A	chem, genet (9G49); daughter Pa^{232} (9G49, 5O49); daughter Pu^{236} (8J49); parent Th^{228} (RdTh) (9G49)	γ	0.0579 (0.21%, e/γ 150, coinc with 0.131 γ), 0.131 (0.075%, $e_K/\gamma \leq 0.4$, e/γ ~3.2), 0.268 (4×10^{-3}%), 0.326 (4×10^{-3}%) α-γ, γ-γ coinc, scint spect, ion ch (4A55); 0.060 (†210, e_L/γ 120, coinc with 0.130 γ and 0.270 γ), 0.130 (†107, e_K/γ 0.4), 0.270 (†8), 0.330 (†6) scint spect, γ-γ coinc (17S55); others (15D52); see also gammas of Ac^{228} ($MsTh_2$) and Pa^{228}	
U^{233}	1.62×10^5 y sp act + mass spect (8H52a); 1.63×10^5 y sp act + mass spect (15L45); 1.2×10^5 y yield (13S52)	☢	α (13S52); β stable (cons energy) (68F58);	α	4.816 (83.5%), 4.773 (14.9%), 4.717 (1.6%), 4.655 (0.07%), 4.582 (0.04%), 4.489 (0.03%) spect (70G56, 44A56, 70G55, 70G56a); 4.82 ion ch (5C48); others (15C47, 11E47, 54D56);	Q_α 4.90 (68F58); see Pa^{233} 
		A	chem, genet (13S47a, 13S52); daughter Pa^{233} (13S47a); parent Th^{229} (11E47, 4H47);	γ	0.0428 (0.05%), 0.0561 (0.01%) ion ch (12W52); ~0.043, ~0.056, 0.099 α-conv coinc emuls (113B52); Coulomb excitation (in U^{233}): 0.0404, 0.0515 (†10), 0.092 (†48) ion ch (30N57, 30N56); others (4S52, 5A56); see also gammas of Pa^{233}	
		I	5/2 atomic spect (21V54, 21V55a, 99K55, 100K55, 15Z56); 5/2 paramag res (88D57);			
		μ	±0.51 paramag res (88D57);			
		q	±3.4 paramag res (88D57); others (204B57a, 99K55, 99K56)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{92}U^{234}$ (U_{II})	2.48×10^5 y sp act (12F52); 2.52×10^5 y sp act + mass spect (13K52, 13K49); 2.67×10^5 y yield (10G49); 2.35×10^5 y sp act + mass spect (15C46); spont fission: 2×10^{16} y (13G52)	☢ β stable (cons energy) (68F58); A chem, genet, mass spect (1C31); daughter Pa^{234m} (UX_2), daughter Pa^{234} (UZ), parent Th^{230} (Io); % 0.0056 (64W56); 0.0057 (57L56); 0.0058 (1B50)	α γ	4.768 (72%), 4.717 (28%) spect (78G55, 44A56); 4.768 ion ch (20H57); α_0 (77%), α_{56} (23%), α_{170} (~0.3%) ion ch, α-γ coinc (22V53a); 4.76 ion ch (1S39, 13G51); others (18S37, 3A47, 2C57); 0.050, 0.117 scint spect (17S51a); 0.053, 0.118 scint spect (11B52a); 0.053 (e_L/γ 130) scint spect, α-γ coinc (32V57); ~0.45 (~2 x 10^{-5}%), ~0.50 (~1 x 10^{-5}%) scint spect (130S57); others (10M47, 17S51, 13E54, 4T52); see also gammas of Pa^{230}	Q_α 4.85 (68F58) U^{234} (2.5 x 10^5 y) 0+ ~0.3% α (4+) 0.174 28% 72% 2+ 0.053 Th^{230} 0+ 0 (SHS)
U^{235m}	26.5 m (4A57a); 26.6 m (81H57a)	☢ IT (4A57a, 81H57a); A genet (4A57a); chem, genet (81H57a); daughter Pu^{239} (4A57a, 81H57a)	γ	0.000075 (75 ev) electrostatic analyzer (105M57); 0.000023 (23 ev) spect conv (3F57)		1/2+ U^{235m} (26 m) <0.001 IT 7/2− U^{235} 0 (4A57a)
U^{235} (AcU)	7.1×10^8 y sp act (12F52); 7.1×10^8 y radiogenic Pb ratios (6N39); 6.8×10^8 y sp act (108W57); spont fission: 1.9×10^{17} y (24S52); others (144B54)	☢ α; β stable (cons energy) (68F58); A chem, mass spect (1C31); parent Th^{231} (UY); % 0.720 (57L56); 0.718 (64W56); 0.715 (1B50); I 7/2 atomic spect (21V55a, 99K56); 7/2 paramag res (111H56); μ ±0.34 paramag res (88D57); q ±4.0 paramag res (88D57); others (99K55, 21V54, 102S50, 97B56, 204B57a, 99K56)	α γ	4.559 (6.7%), 4.520 (2.7%), 4.370 (25%), 4.354 (35%), 4.333 (14%), 4.318 (8%), 4.117 (5.8%) spect (52P57); 4.58 (10%), 4.47 (?, ~3%), 4.40 (83%), 4.20 (4%) ion ch (13G51); others (15V52, 108W57, 26P58, 2C57); 0.095 (9%), 0.110 (5%), 0.143 (12%), ~0.165 (>4%), 0.185 (55%), ~0.200 (>4%, coinc with 0.143 γ and 0.185 γ) scint spect, γ-γ coinc (52P57a, 130S55); 0.146 (~13%), 0.188 (55%), 0.209 (?, 3.7%), no γ between 0.26 and 0.45 (lim 0.03%) scint spect (118M56); γ_1 0.074, γ_2 0.110, γ_3 0.184, γ_4 0.200, γ_5 0.29, γ_6 0.38 (γ_1 coinc with γ_2 and γ_4), (γ_4 coinc with γ_2 and γ_3) scint spect, γ-γ coinc (17J56); others (110H55, 20S52, 10M49, 108W57); Coulomb excitation (in U^{235}): 0.0462, 0.0567 (†6.6), 0.103 (†1.6) ion ch (30N57, 30N56)	Q_α 4.64 (68F58) (11/2−) 0.103 (9/2−) 0.046 U^{235} (7.1×10^8 y) 7/2− 0 α 5.8% 0.390 85% 2.7% 6.7% 0.186 0.041 Th^{231} 0 (52 P57, SHS)
U^{236}	2.39×10^7 y sp act (12F52); 2.46×10^7 y sp act (1J51a); spont fission: 2×10^{16} y (8H56)	☢ α (13G51a); β stable (cons energy) (68F58); A chem, n-capt, mass spect (9W45, 13G51a)	α γ	4.499 ion ch (1J51a); 4.5 ion ch (13G51a); ~0.050 (conv electrons 27%) α-conv coinc, emuls (15D52); see also gammas of Th^{232}		Q_α 4.58 (68F58); see Th^{232} U^{236} (2.4×10^7 y) 0+ ~27% α ~73% 2+ 0.050 Th^{232} 0+ 0 (SHS)

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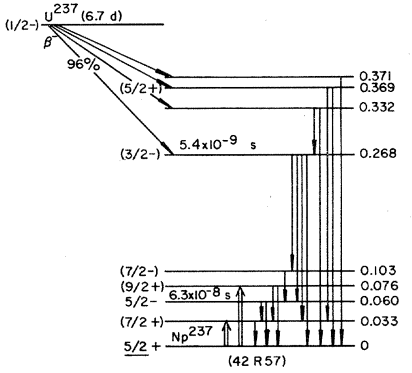
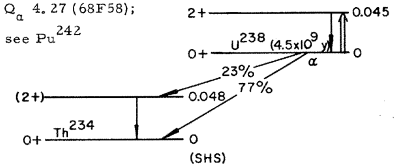
$_{92}U^{237}$	6.75 d (39W53); 6.63 d (13M48); 6.8 d (1W48); others (8J49)	☢ β^- (5N40, 12M40); A chem, excit (5N40, 12M40); parent Np^{237} (1W48); daughter Pu^{241} (13S49)	β^- 0.248, no 0.45 β^- (lim 1%) spect (42R57); 0.249 (74%), 0.084 (26%) spect (44A56, 184B56); 0.245 (>80%), ~0.09 (~12%), no 0.51 β (lim 0.1%) spect (39W53); others (13M48); γ γ_1 0.0264, γ_2 0.0332, γ_3 0.0435, γ_4 0.0596 (36%, $L_I/L_{II}/L_{III}$ = 1.6/3.2/1.0), γ_5 0.0648 (2.3%, $L_I/L_{II}/L_{III}$ ~1/1/1), γ_6 0.1139, γ_7 0.1646 (3.6%, e_K/γ ~0.13, $K/L_I/L_{II}/L_{III}$ = ~48/16/130/60), γ_8 0.2079 (24%, e_K/γ 2.3, $L_I/L_{II}/L_{III}$ = 7.7/1.0/~0.06), γ_9 0.2342, γ_{10} 0.2675 (0.86%, e_K/γ 0.63, K/L_I 3.1), γ_{11} 0.3323 (1.4%, e_K/γ 0.04, K/L_{II} 1.5), γ_{12} 0.3353 (0.2%, e_K/γ 0.2), γ_{13} 0.3685, γ_{14} 0.371, (γ_7 not coinc with γ_8), ($\gamma_4 + \gamma_5$ coinc with γ_7, γ_8, and γ_{10}), ($\gamma_4 + \gamma_5$ not coinc with γ_{14}), spect conv, γ-γ coinc, scint spect (42R57); 0.0263, 0.0332, 0.0434, 0.0596, 0.1650, 0.2084, 0.2348, 0.2680, 0.3329, 0.3359, 0.3692, 0.3715, no 0.433 γ spect conv, scint spect (2B57); 0.0264 (?), 0.0333, 0.0435 (L_I/L_{III} 1.7), 0.0597, 0.069 (?), 0.101 (?), 0.124 (?), 0.165, 0.193, 0.208 (K/L_I 3.9), 0.268, 0.332, 0.370, 0.436 spect conv (44A56, 184B56); $\gamma_4 + \gamma_5$ (↑37), γ_8 (↑21, e_K/γ 1.6, K/L_I 4.8), $\gamma_{11} + \gamma_{12}$ (↑2.5), (γ_8 coinc with γ_1, $\gamma_4 + \gamma_5$, γ_7, and 0.25 β^-) spect conv, β-γ, γ-γ coinc, scint spect (39W53); γ_8: $t_{1/2}$ 5.4 x 10^{-9} s delay coinc (2B57); others (47W52b, 13M48); see also gammas of Np^{237}, Am^{241}, and Pu^{237}	Q_α 4.24 calc (68F58); Q_{β^-} 0.516 (42R57); see Np^{237} and Am^{241} 
$\frac{U^{238}}{(U_I)}$	4.51 x 10^9 y sp act (31N55, 6N39); 4.49 x 10^9 y sp act (13K49); 4.56 x 10^9 y sp act (88L57); spont fission: 8.0 x 10^{15} y (24S52, 17S46, 78P58); 1.0 x 10^{16} y (74K56)	☢ α; β stable (cons energy) (68F58); A chem, genet, mass spect (1C31); parent Th^{234} (UX_1) (18B96); % 99.276 (64W56); 99.274 (57L56); 99.28 (1B50)	α 4.195, α_{50} ion ch (20H57); 4.18 ion ch (3A47, 2C57); 4.21 range (1S39); γ 0.048 (conv electrons 23%) α-conv coinc, emuls (5A56, 5A52a); 0.048 (conv electrons 23%) α-conv coinc, emuls (1Z52); ~0.045 (conv electrons 22%) α-conv coinc, emuls (15D52); Coulomb excitation (in U^{238}): 0.0447 ion ch (30N57, 30N56); 0.045 scint spect (45D56); 0.044 scint spect (97H54)	Q_α 4.27 (68F58); see Pu^{242} 
U^{239}	23.54 m (14M43); 23.5 m (4F47, 13M47); others (2I39, 13S49a)	☢ β^- (12M39); A n-capt (1M37); parent Np^{239} (12M40a, 22S42)	β^- 1.21 spect (3F53a); 1.20 abs (4F47, 4F47a); 1.12 spect (5S47); γ 0.0736 spect conv, scint spect (3F53a); 0.073 spect conv, abs (5S47); 0.076 abs (4F47, 4F47a); see also gammas of Am^{243}	Q_α 4.08 est, Q_{β^-} 1.28 (68F58); see Am^{243}
U^{240}	14.1 h (20K53)	☢ β^- (20K53); A chem, n-capt (4S49a); parent 7.3 m Np^{240} (20K53, 8H48b); daughter Pu^{244} (107B56, 55D56)	β^- 0.36 spect (20K53); γ no γ, scint spect (20K53)	Q_α 3.9 est, Q_{β^-} 0.47 (68F58)

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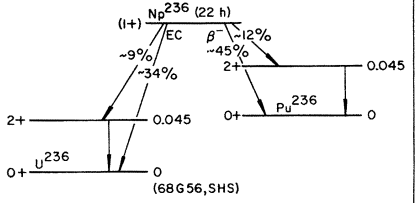
$_{93}Np^{231}$	~50 m (15M50)	☢ α (15M50); B chem, genet, excit, sep isotopes (15M50); parent Pa^{227} (15M50)	α 6.28 ion ch (15M50)	Q_α 6.39, Q_{EC} 1.83 calc (68F58)
Np^{232}	~13 m (15M50)	☢ EC (15M50); D chem (15M50)	γ hard γ (15M50)	Q_α 6.00 est, Q_{EC} 2.7 est (68F58)
Np^{233}	35 m (15M50)	☢ EC 99+%, α ~10^{-3}% (15M50); B chem, excit, sep isotopes (15M50)	α 5.53 ion ch (15M50)	Q_α 5.63, Q_{EC} 1.03 calc (68F58)
Np^{234}	4.40 d (8H49); 4.4 d (5O49)	☢ EC (L/K ~1) (7O51a); no α (lim 0.01%) (8H49); β^+ ~0.05% (45P55); A chem, excit, genet, sep isotopes (8J49); daughter Pu^{234} (13P49, 7O51a)	β^+ ~0.8 abs, spect (45P55); γ γ_1 0.043, γ_2 0.109, γ_3 0.234, γ_4 0.247, γ_5 0.449, γ_6 0.500, γ_7 0.517 (?), γ_8 0.720, γ_9 0.752, γ_{10} 0.813, γ_{11} 0.905, γ_{12} 1.01, γ_{13} 1.19, γ_{14} 1.57, (γ_6 coinc with γ_5, γ_8, γ_{11}, and γ_{12}), (γ_8 coinc with γ_5 and γ_9) spect conv, scint spect, γ-γ coinc (81H56b); others (8H49, 5O49); see also gammas of Pu^{238}, Pa^{234m} (UX_2), and Pa^{234} (UZ)	Q_α 5.43 calc, Q_{EC} 1.8 (68F58); see Pu^{238} and Pa^{234}
Np^{235}	410 d (8J52); others (8H49)	☢ EC (M/L/K = 17/37/1) (12BG58); EC (L/K 30) (74H56, 8J52); α 1.6 x 10^{-3}% (12BG58); α 1.2 x 10^{-3}% (54T57); α 3.5 x 10^{-3}% (74H56); A chem, excit, sep isotopes (8J49); not parent U^{235m} (lim 2%) (12BG58)	α 5.06 ion ch (8J52); γ with EC: no γ (74H56, 74H54, 12BG58); with α: 0.026, 0.086 (5.4% of alphas) scint spect, α-γ coinc (74H56); 0.086 γ: $t_{1/2}$ 3.7 x 10^{-8} s delay coinc (74H56); see also gammas of Th^{231} and U^{231}	Q_α 5.23, Q_{EC} 0.21 calc (68F58); Q_{EC} 0.123 calc (12BG58); see Th^{231} and U^{231}
Np^{236}	t_β >5 x 10^3 y sp act (4S55)	☢ no activity observed (4S55); B chem, mass spect (4S55)		
Np^{236}	22 h (8J49)	☢ EC (L/K ≤0.3) 43%, β^- 57% (68G56); EC (L/K ~2) ~67%, β^- ~33% (7O51b); A chem, genet, sep isotopes, excit (8J49); parent Pu^{236} (8J49, 8J49a, 8H49, 13G52)	β^- 0.52 spect (68G56); 0.51 (†~60), 0.36 (†~40) spect (7O51b); γ with EC: 0.04528 spect conv (13H56); 0.044 spect conv (68G56); with β^-: 0.0446 spect conv (13H56); 0.044, no 0.150 γ spect conv (68G56); 0.150 spect conv (7O51b)	Q_α 5.14 calc, Q_{β^-} 0.52, Q_{EC} 0.91 calc (68F58); see Pu^{240} 

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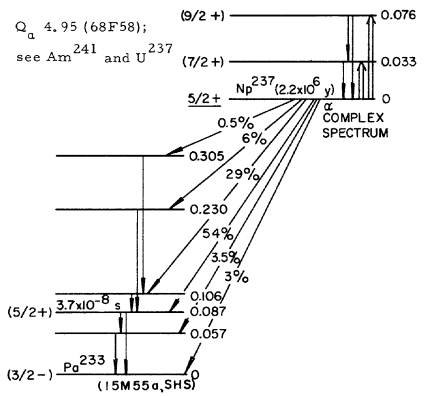
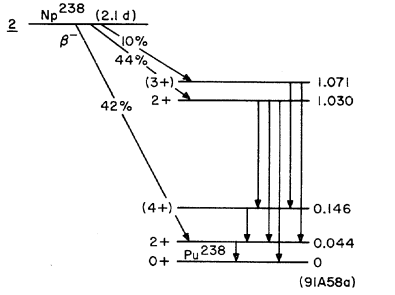
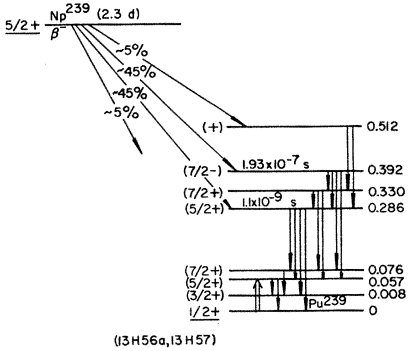
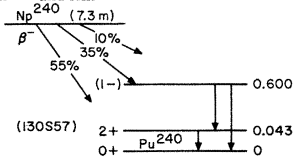
$_{93}Np^{237}$	2.20 x 10^6 y sp act (15M48)	☢ α (1W48); β stable (cons energy) (68F58); A chem, genet, excit (1W48); daughter U^{237} (1W48); parent Pa^{233} (15M47, 4H47); I 5/2 atomic spect (87M50); 5/2 paramag res (97B54); μ ground state of Np^{237}: ~±6 paramag res (97B54); μ (0.0596 level of Np^{237}, assuming I = 5/2): +2.0 ang corr attenuation (55K55a)	α 4.866 (2.5%), 4.799 (3.4%), 4.781 (54%), 4.762 (30%), 4.702 (2%), others (8%) spect (122K56a); 4.872 (3.1%), 4.816 (3.5%), 4.787 (53%), 4.767 (29%), 4.713 (1.7%), 4.674 (3.3%), 4.644 (6.0%), 4.589 (0.5%), 4.52 (0.02%) ion ch (15M55a); others (60R56); γ 0.0297 (14%) ion ch (30N57); 0.020 (?), 0.029 (14%), 0.0568, 0.0869 (14%), 0.145 (0.8%), 0.175 (0.1%), 0.200 (0.3%) ion ch, scint spect, spect conv, α-conv, α-γ, γ-γ coinc (15M55a); γ_1 0.0296 (12%), γ_2 0.087 (18%), γ_3 0.143 (~1%), γ_4 0.198 (~1%), (γ_1 coinc with γ_3 and γ_4), (γ_2 coinc with γ_3 and γ_4) ion ch, scint spect (130S55); γ_1 and γ_2: $t_{1/2}$ 3.69 x 10^{-8} s delay coinc (13E54); Coulomb excitation (in Np^{237}): 0.0332, 0.0426 (†28), 0.076 (†3) ion ch (30N57, 30N56); 0.0596 level of Np^{237}: $t_{1/2}$ 6.3 x 10^{-8} s delay coinc (103B52); 0.268 level of Np^{237}: $t_{1/2}$ 5.4 x 10^{-9} s delay coinc (2B57); others (15D52, 125S55); see also gammas of Am^{241} and U^{237}	Q_α 4.95 (68F58); see Am^{241} and U^{237} 
Np^{238}	2.10 d (3F50a); 2.0 d (13S49a); others (8J49a)	☢ β^- (13S46, 13S49a); no EC (K) (lim 1%) (42R55a); A chem, genet, n-capt, sep isotopes (13S46); parent Pu^{238} (13S46, 14K49, 1J49, 8J49, 13S46a); daughter Am^{242} (13S49, 6S50a); I 2 atomic beam (91A58)	β^- 1.24 (38%), 1.13 (?, 3%), 0.28 (20%), 0.25 (31%), 0.20 (?, 8%) spect, spect coinc (184B56a); 1.27 (47%), 0.26 (53%) spect, spect coinc (3F50a); 1.25 (45%), ~0.27 (55%) spect, scint spect, β-γ coinc (42R55a, 42R55, 5S54); others (1J49); γ 0.0440, 0.1017, 0.871 (?), 0.885, 0.925, 0.940 (K/L_I+L_{II} 3.5), 0.943, 0.986 ($K/L_I+L_{II}/L_{III}$ = 3.7/1.0/0.2), 0.988, 1.027 (K/L ~3), 1.030 (K/L ~4) spect conv (91A58a); 0.04403 (L_{II}/L_{III} 1.1), 0.1020 (L_{II}/L_{III} 1.9), 0.942 (e_K/γ ~0.010), 0.988 (e_K/γ ~0.009, K/L_{II} 3.1), 1.030 (e_K/γ 0.010), 1.032 spect conv, scint spect, ion ch (184B56a); 0.0440 (L_{II}/L_{III} 1.3), 0.1022 ($L_{II}/L_{III}/M$ = 1.6/1.0/0.8), 0.927, 0.942, 0.986 (†83, e_K/γ ~0.009, K/L 3.3), 1.029 (†100, e_K/γ ~0.008, K/L 5.0) spect, spect conv, scint spect, β-γ, γ-γ coinc (42R55a, 42R55, 5S54); 0.983 (†100), 1.03 (†100) spect, spect conv, β-γ coinc (3F50a); others (63M52a, 13S49a, 1J49); see also gammas of Cm^{242}	Q_α 4.62 calc, Q_{EC} 0.10 calc, Q_{β^-} 1.28 (68F58); see Cm^{242} 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{93}Np^{239}$	2.346 d (68W56); 2.3 d (3P46); others (13S46, 8J49)	☢ β⁻ (12M40a); A chem, n-capt, genet, excit (12M39, 12M40a); daughter U^{239} (12M40a, 22S42); parent Pu^{239} (14K46, 13S49a); daughter Am^{243} (6S50a); I 5/2 atomic beam (102H58); 1/2 atomic spect (96C54); others (65A57b)	β⁻ γ	0.715, 0.654, 0.44, 0.33 spect (7T51); 0.723, 0.655 (0.723β + 0.655 β 6%), 0.439 (16%), 0.382 (21%), 0.327 (35%), 0.070 (?, 22%) spect (184B56a); 0.705 (7%, not coinc with γ), 0.435 (46%), 0.310 (47%) spect (14G51); others (5S47, 11F49); 0.04464 ($L_I/L_{II}/L_{III}$ = 2/1/1), 0.04940 ($L_I/L_{II}/L_{III}$ = 1/1.2/1.2), 0.05725 ($L_I/L_{II}/L_{III}$ = <0.07/1.3/1.0), 0.0614, 0.06782 (L_{II}/L_{III} 1.1), 0.1061 (L_I/L_{II} 0.9), 0.1064, 0.1818, 0.2099 (K/L_I 5.4), 0.2264, 0.2284 (K/L_I 4.7), 0.2546, 0.2731, 0.2777 (K/L_I 5.7), 0.2856, 0.3161, 0.335, (~0.23 γ coinc with ~0.23 γ and ~0.28 γ) spect conv, γ-γ coinc, scint spect (13H56a); 0.1064 (†50, e_L/γ 0.062, L_I/L_{II} 0.87), 0.2097 (†9, e_K/γ 1.8, $K/L_I+L_{II}/L_{III}$ = 4.5/1.0/0.01), 0.2261, 0.2282 (†28, e_K/γ 1.6, $K/L_I+L_{II}/L_{III}$ = 4.8/1.0/0.007), 0.2547 (†0.6, e_K/γ 0.9), 0.2731, 0.2779 (†31, e_K/γ 1.2, $K/L_I+L_{II}/L_{III}$ = 4.8/1.0/0.007), 0.2855 (†1.4, e_K/γ 0.11), 0.3162 (†3.3, e_K/γ 0.027), 0.3344 (†4.4, e_K/γ 0.025) cryst spect, spect conv (26E57b); 0.012 (?), 0.0445, 0.0493, 0.0573, 0.0614, 0.0679 (L_{II}/L_{III} 1.1), 0.1061, 0.210, 0.228 (K/L 4.8), 0.278 (K/L 4.7), ~0.334 spect, spect conv (184B56a); (0.068 γ coinc with 0.210 γ), (0.435 β⁻ coinc with 0.210 γ, 0.228 γ, and 0.278 γ), (0.228 γ not coinc with 0.278 γ) spect conv, β-γ, γ-γ coinc (14G51); 0.44 (1.6 x 10^{-2}%), 0.49 (1.9 x 10^{-2}%) scint spect, ion ch (58L55); 0.065 (e_L/γ ~0.7), 0.105 (e_L/γ 0.23) scint spect, β-γ coinc (13E55); 0.0614 γ + 0.1061 γ: $t_{1/2}$ 1.93 x 10^{-7} s delay coinc (13E55); 0.2099 γ, 0.2284 γ and 0.2777 γ: $t_{1/2}$ 1.1 x 10^{-9} s delay coinc (14G51); others (11F49, 5S47, 3P46, 7T51, 26E56); see also gammas of Pu^{239}, Am^{239}, and Cm^{243}	$Q_α$ 4.57 calc, $Q_{β^-}$ 0.73 (68F58); see Cm^{243}  (13H56a, 13H57)
Np^{240}	7.3 m (20K53, 8H48b)	☢ β⁻ (8H48b); A chem, genet (8H48b, 20K53); daughter U^{240} (8H48b, 20K53); not parent 1 h Np^{240} (lim 5%) (58L56)	β⁻ γ	0.76 (6%), 1.26 (11%), 1.59 (31%), 2.16 (52%) spect (20K53); 0.0429, 0.557 (22%), 0.600 (13%), ~0.85 (6%, complex), ~1.5 (3.5%, complex) scint spect, spect conv, γ-γ coinc (13OS57, 13H57); 0.56 (†63), 0.90 (†26), 1.40 (†10) scint spect (20K53); see also gammas of Am^{240}, 1 h Np^{240}, and Cm^{244}	$Q_{β^-}$ 2.16 (20K53); see Cm^{244} and Am^{240}  (13OS57)
Np^{240}	60 m (7O51a)	☢ β⁻ (7O51a); A chem, cross bomb (7O51a); mass spect (68L57); not daughter 7.3 m Np^{240} (lim 5%) (58L56)	β⁻ γ	0.89 spect (7O51a); 0.085, 0.160, 0.245, 0.44, 0.57, 0.60, 0.92, 1.00, 1.16, (0.90 β⁻ coinc with 1.16 γ), scint spect, γ-γ, β-γ coinc (68L57); 0.15, 0.20, 0.26, 0.58 spect conv (7O51a); see also gammas of 7.3 m Np^{240m}, Am^{240}, and Cm^{244}	$Q_α$ 4.41 est, $Q_{β^-}$ 2.05 (68F58)
$_{94}Pu^{232}$	36 m (7O51a)	☢ α ⩾2%, EC ⩽98% (7O51a); B chem, sep isotopes, excit, genet (7O51a); parent U^{228} (7O51a, 8J48)	α	6.58 ion ch (7O51a)	$Q_α$ 6.70, Q_{EC} 1.0 est (68F58)
Pu^{233}	20 m (54T57a)	☢ EC 99+%, α 0.1% (54T57a); B chem, excit, genet (54T57a); parent U^{229} (54T57a)	α	6.30 ion ch (54T57a)	$Q_α$ 6.41, Q_{EC} 2.01 calc (68F58)

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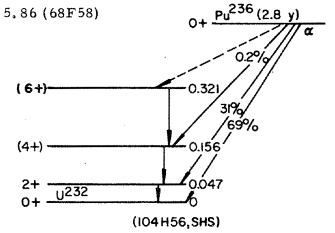
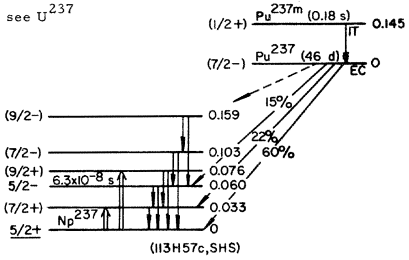
$_{94}Pu^{234}$	9.0 h (7O51a); 8.5 h (13P49); others (23H52a)	☢	EC 94% (L/K 0.3), α 6% (4A57);	α	6.19 ion ch (7O51a); 6.2 ion ch (13P49);	$Q_α$ 6.30, Q_{EC} 0.46 calc (68F58)
		A	chem, genet, sep isotopes, excit (8H49, 13P49); parent U^{230}, parent Np^{234} (13P49, 7O51a); daughter Cm^{238} (23H52a)	γ	no γ (lim 0.5%) (74H54)	
Pu^{235}	26 m (7O51a, 54T57a)	☢	EC 99+%, α 3 x 10^{-3}% (54T57a);	α	5.85 ion ch (54T57a, 7O51a)	$Q_α$ 5.95, Q_{EC} 1.09 calc (68F58)
		B	chem, excit, sep isotopes (7O51a, 54T57a)			
Pu^{236}	2.85 y (113H57); 2.7 y (8J49); spont fission: 3.5 x 10^9 y (13G52)	☢	α (8J49); β stable (cons energy) (68F58);	α	5.763 (69%), 5.716 (31%), 5.610 (0.18%) spect (104H56); 5.75 ion ch (13G53); others (8J49, 13P49);	$Q_α$ 5.86 (68F58) 
		A	chem, excit, sep isotopes, cross bomb, genet (8J49); parent U^{232} (8J49); daughter Cm^{240} (13S49b); daughter Np^{236} (8J49, 8J49a, 8H49, 13G52)	γ	0.047 (0.031%, e/γ ~1000), 0.110 (0.012%, e/γ 14), 0.165 (6.6 x 10^{-4}%) α-γ coinc, scint spect (104H56); ~0.045 (conv electrons 20%) α-conv coinc, emuls (15D52); see also gammas of Pa^{232}	
Pu^{237m}	0.18 s (130S57c)	☢	IT (130S57c);	γ	0.145 (e_L/γ 39, e_K/γ ≤0.3) scint spect (130S57c)	Q_{IT} 0.145 (130S57c)
		A	genet (130S57c); daughter Cm^{241} (130S57c)			
Pu^{237}	45.6 d (113H57a); 44 d (54T57a); 40 d (74H53); others (8J49a)	☢	EC 99+%, α 0.0033% (54T57a); EC 99+%, α 0.002% (113H57a); EC to 0.060 level of Np^{237}: L/K 2.8 (113H57c);	α	5.65 (†21), 5.36 (†79) ion ch (54T57a); 5.34 ion ch (113H57a);	$Q_α$ 5.75, Q_{EC} 0.23 calc (68F58); see U^{237} 
		A	chem, sep isotopes, cross bomb (8J49); chem, genet energy levels (113H57c); chem, mass spect (54T57a)	γ	0.0332, 0.0435, 0.0556 (?), 0.0596, 0.0764 (?), 0.0960 (?) scint spect, spect conv, γ-γ coinc (113H57c); others (8J49); see also gammas of U^{237}, Np^{237}, and Am^{241}	

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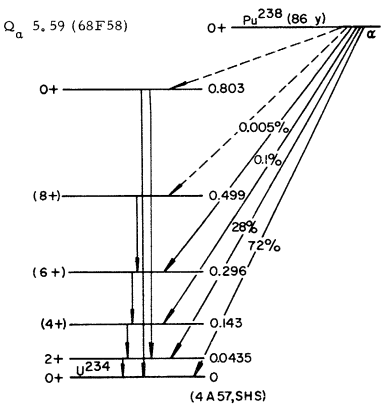
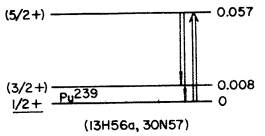
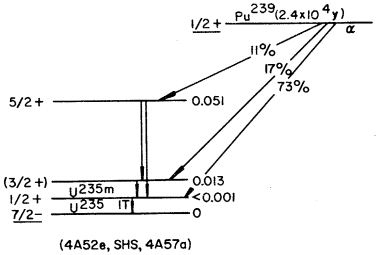
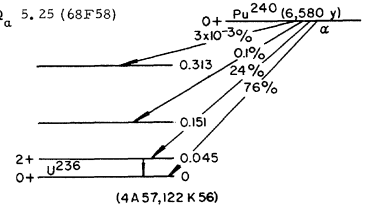
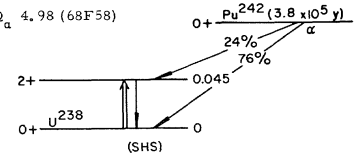
$_{94}Pu^{238}$	86.4 y genet (113H57b); 89.6 y (1J50a); 92 y genet (13S49b); 77 y genet (1J49); spont fission: 3.8×10^{10} y (24S52); 4.9×10^{10} y (8H56)	☢ α (13S46); β stable (cons energy) (68F58); A chem, sep isotopes, excit (13S46, 13S46a, 13S49a); daughter Np^{238} (8J49, 1J49, 13S46a, 14K49, 13S46); daughter Cm^{242} (13S49b)	α 5.495 (72%), 5.452 (28%), 5.352 (0.09%) spect (4A54); 5.491 (69%), 5.450 (31%), 5.352 (0.13%), 5.208 (0.005%) spect (70G55, 44A56, 122K58); others (15C47); γ 0.04350 spect conv (13H56); 0.04349 (†100), 0.0998 (†28), 0.1531 (†3) ion ch (30N56a); 0.0436, 0.1000 spect conv (97C55); 0.0438 (0.038%, e/γ 740), 0.099 (8×10^{-3}%, e/γ 11), 0.150 (1×10^{-3}%), 0.203 (4×10^{-6}%), 0.760 ($\sim 5 \times 10^{-5}$%), 0.810 (e/γ large, K/L+M 4.5), 0.875 ($\sim 2 \times 10^{-5}$%) scint spect, γ-γ coinc, ion ch, spect conv (4A54, 4A57, 13P57); others (114M54, 12W52, 15D52); see also gammas of Pa^{234m}, Pa^{234}, and Np^{234}	Q_α 5.59 (68F58) 
Pu^{239}	24,360 y sp act (10W51); 24,400 y sp act (14F54); 24,300 y sp act (16C49); 24,100 y calorimeter (96S47); spont fission: 5.5×10^{15} y (24S52)	☢ α (14K46); β stable (cons energy) (68F58); A chem, genet, mass spect (14K46); daughter Np^{239} (14K46, 13S49a); parent U^{235m} (4A57a, 81H57a); I 1/2 paramag res (97B54a); 1/2 atomic spect (145B54, 99K55, 100K55); μ 1/2 atomic beam (102H58a); ~±0.02 atomic beam (102H58a); ~±0.4 paramag res (97B54a)	α 5.147 (72.5%), 5.134 (16.8%), 5.096 (10.7%), 5.064 (0.037%), 4.999 (0.013%), 4.917 (0.005%) spect (70G55, 52N57, 44A56); 5.150 (69%), 5.137 (20%), 5.099 (11%) spect (4A52e); 5.147 (~70%), 5.097 (~30%) spect (4R50); others (10J48, 15C47, 17C51, 46A55b, 46A57); γ 0.003 (?), 0.0125, 0.0383 (very weak), 0.0508, 0.117 (very weak) spect conv (178S56); 0.0385 (2×10^{-3}%), 0.0520 (7×10^{-3}%) ion ch (12W51, 12W52); 0.037 (†130), 0.052 (†320), 0.120 (†70), 0.207 (†20), 0.34 (†30), 0.38 (†60), 0.42 (†40), (0.12 γ coinc with 0.21 γ) scint spect, γ-γ coinc (4A57); 0.039 (†80), 0.053 (†280), 0.124 (†100), 0.38 (†60) spect conv, scint spect (3F52b); Coulomb excitation (in Pu^{239}): 0.0496 (†100), 0.0575 (†160) ion ch (30N57, 30N56); 0.392 level of Pu^{239}: $t_{1/2}$ 1.93×10^{-7} s delay coinc (13E55); 0.286 level of Pu^{239}: $t_{1/2}$ 1.1×10^{-9} s delay coinc (14G51); others (5A56, 15D52, 5A51, 11I52, 77P57); see also gammas of Np^{239}, Am^{239}, and Cm^{243}	Q_α 5.24 (68F58); see Np^{239} and Cm^{243}  

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{94}Pu^{240}$	6,580 y genet (31 51); 6,600 y sp act (107B56); 6,240 y sp act (11W51); 6,300 y sp act (14F54); spont fission: 1.22×10^{11} y (146B54); 1.2×10^{11} y (15C54)	☢ A	α (8J49); β stable (cons energy) (68F58); chem, n-capt, mass spect (15C44, 14F46, 21B44); daughter Cm^{244} (47F54)	α γ	5.162 (76%), 5.118 (24%), 5.014 (0.1%) spect (4A52e, 4A57); 5.159 (76%), 5.115 (24%), 5.014 (0.09%), 4.952 (?, 3×10^{-3}%), 4.924 (?, 3×10^{-3}%), 4.851 (3×10^{-3}%) spect (70G56, 70G55, 44A56, 122K56); 0.04528 spect conv (13H56); 0.0446 spect conv (178S56); 0.0496 spect conv, scint spect (3F52b); others (12W52); see also gammas of 22 h Np^{236}	Q_α 5.25 (68F58)  (4A57, 122K56)
Pu^{241}	13.0 y genet (112H57 calc from 61R56); 13.3 y genet (112H57 calc from 120M53); 14 y genet (3T50e)	☢ A I μ	β^- 99+%, α 4×10^{-3}% (4A57); β^- 99+%, α ~10^{-3}% (13S49, 3T50e); chem, n-capt, mass spect, excit, genet (13S49, 13S49b, 13G50); parent Am^{241} (13S49, 16C49a); parent U^{237} (13S49); daughter Cm^{245} (47F54); 5/2 paramag res (97B54a); ~±1.4 paramag res (97B54a)	α β^- γ	4.893 (α_{145}, †75), 4.848 (†25) spect (4A57); 4.91 ion ch (3T50e); 0.0208 spect (178S56, 178S56a); 0.021 spect (3F52b); ~0.02 abs (13S49); with α: 0.145 (7% of α) scint spect (3F52b)	Q_α 5.13 calc (68F58); Q_{β^-} 0.021 (178S56, ?F52b)
Pu^{242}	3.79×10^5 y sp act (107B56); 3.73×10^5 y sp act (107B56a); 3.9×10^5 y sp act (119M56a); others (3T50e); spont fission: 7.1×10^{10} y (119M56a); 6.6×10^{10} y (107B56a)	☢ A	α (3T50e); β stable (cons energy) (68F58); chem, mass spect, n-capt, genet (3T50e); daughter Am^{242m} (8O50a); daughter Cm^{246} (47F54)	α γ	4.898 (76%), 4.858 (24%) spect (104H56); 4.88 ion ch (3T50e); see gammas of U^{238}	Q_α 4.98 (68F58)  (SHS)
Pu^{243}	4.98 h (13E53); 5.0 h (25S51, 3T51)	☢ A	β^- (25S51); chem, n-capt, cross bomb (25S51); genet (3T51); parent Am^{243} (3T51)	β^- γ	0.579 (62%), 0.490 (38%) spect (13E53, 3F57b); 0.39 spect (3T51); ~0.45 abs (25S51); 0.0122 (?), 0.0297 (?), 0.0367 (?), 0.0422 (1%, e/γ 16), 0.054, 0.0840 (21%, e/γ 0.2), 0.096, 0.134 (?), 0.381 (0.7%) spect conv, scint spect (13E53, 3F57b); 0.095, 0.12 spect conv (3T51); see also gammas of Bk^{247}	Q_α 4.71 calc (68F58); Q_{β^-} 0.58 (3F57b)
Pu^{244}	~7.6×10^7 y genet (55D56); ~7.5×10^7 y genet (107B56); spont fission: 2.5×10^{10} y (13F55)	☢ A	[α] (4S54); β stable (cons energy) (68F58); chem, n-capt, mass spect, genet (4S54, 107B56, 55D56); ancestor 7.3 m Np^{240}, parent U^{240} (107B56, 55D56); daughter Am^{244} (13F55)			Q_α 4.55 est (68F58)

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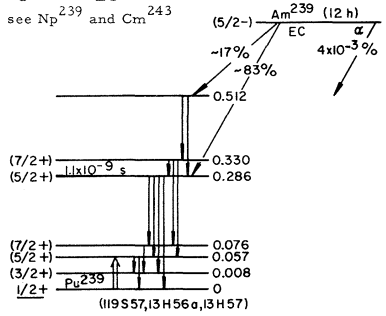
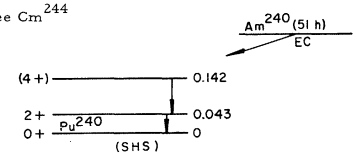
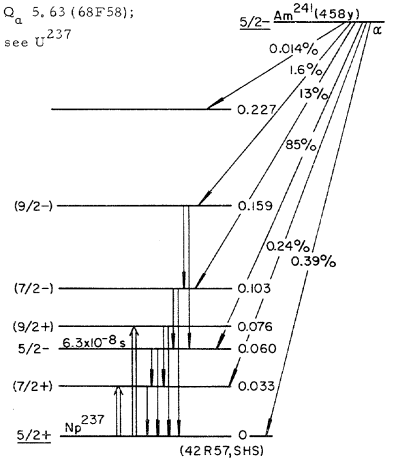
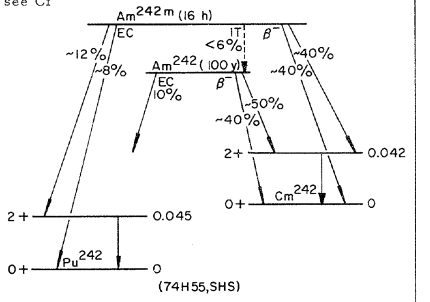
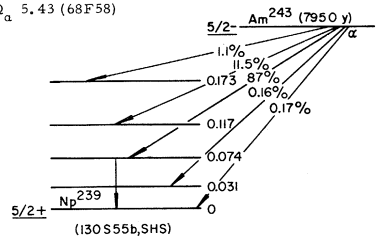
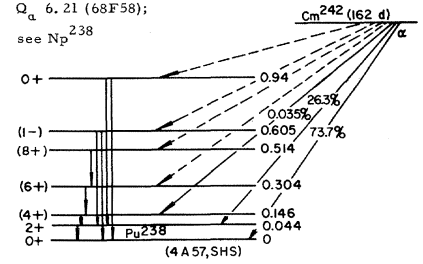
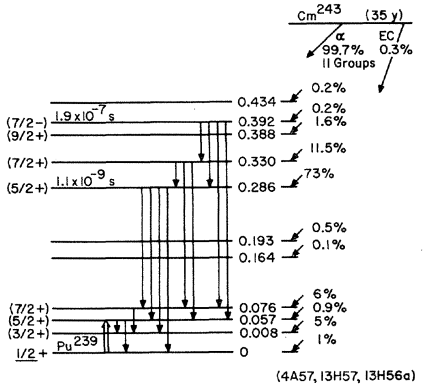
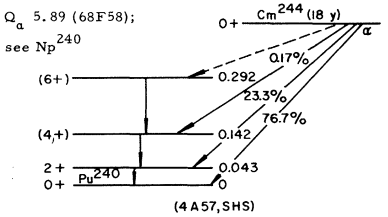
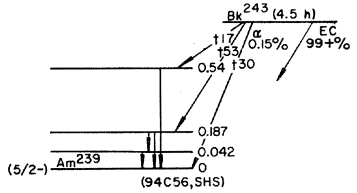
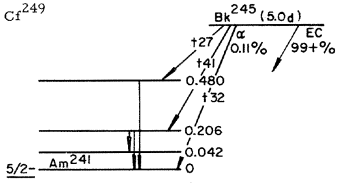
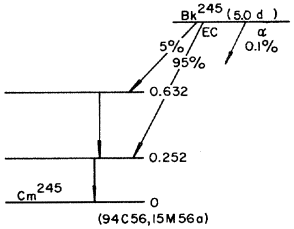
$_{94}Pu^{245}$	10.1 h (13F55a); 10.6 h genet (107B56); 12 h (88B55)	☢ β^- (13F55a); B chem, n-capt (13F55a, 88B55); parent Am^{245} (13F55a, 107B56)			Q_α 4.38 est, Q_{β^-} 1.2 est (68F58)
Pu^{246}	10.85 d (113H56); 11.2 d (13E55a)	☢ β^- (13E55a); A chem, n-capt, mass spect (13E55a); parent Am^{246} (13E55a)	β^- γ	0.15 (73%), 0.33 (27%) β-γ coinc, scint spect (113H56); 0.15 abs (13E55a); γ_1 0.027 (†330, $e/\gamma \leq 1.9$), γ_2 0.047 (†780, $e/\gamma \leq 0.23$), γ_3 ~0.08 (†90), γ_4 0.099 (?), γ_5 0.175 (†84), γ_6 0.215, (0.15 β^- coinc with γ_2 and γ_5), (0.33 β^- coinc with γ_2), (γ_5 coinc with γ_1 and γ_2), (γ_2 coinc with γ_1, γ_3, γ_4, and γ_5) β-γ, γ-γ coinc, scint spect (113H56); 0.041, 0.100 (?), 0.175 (K/L ~5), 0.225 spect conv, scint spect (136S56); 0.043, 0.103 (?), 0.175, 0.220 scint spect (13E55a)	Q_{β^-} 0.40, Q_α 4.21 est (68F58)
$_{95}Am^{237}$	~1.3 h (23H52a)	☢ EC 99+%, α 5×10^{-3}% (23H52a); B chem, excit (23H52a)	α	6.01 ion ch (23H52a)	Q_α 6.11, Q_{EC} 1.39 calc (68F58)
Am^{238}	1.9 h (75C54); 2.1 h (23H52a)	☢ EC (6S50a); no α (lim 3×10^{-4}%) (23H52a); B chem, excit (6S50a)	γ	0.58 (†20), 0.98 (†75) scint spect (75C54); see also gammas of Np^{238} and Cm^{242}	Q_α 6.01 est, Q_{EC} 2.2 est (68F58)
Am^{239}	12 h (13S49)	☢ EC 99+%, α 4×10^{-3}% (71G56); EC 99+%, α 3×10^{-3}% (23H52a); A chem, excit (13S49); genet energy levels (119S57)	α γ	5.75 ion ch (23H52a); 5.78 ion ch (71G56); with α: 0.048 (50% of α) ion ch, α-γ coinc (4A55a); with EC: 0.04470, 0.04947, 0.05731, 0.06791, 0.1818, 0.2099, 0.2265, 0.2283, 0.2776 spect conv (119S57); others (13S49); see also gammas of Np^{239}, Pu^{239}, and Cm^{243}	Q_α 5.92, Q_{EC} 0.89 calc (68F58) see Np^{239} and Cm^{243} 
Am^{240}	51 h (71G56b); 47 h (72G54); 50 h (13S49)	☢ EC (13S49); no α (lim 0.2%) (23H52a); A chem, excit (13S49); chem, excit, cross bomb (6S50a); genet energy levels (119S57)	γ	0.04287, 0.0989 spect conv (119S57); 0.92 (†14), 1.02 (†70), 1.40 (†15) scint spect (72G54); see also gammas of Np^{240} and Cm^{240}	Q_α 5.77 est, Q_{EC} 1.4 est (68F58); see Cm^{244} 

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{95}Am^{241}$	458 y sp act (112H57, 10W58, 112H56); 470 y sp act (20H52a)	☢	α (13S49); β stable (cons energy) (68F58);	α	5.534 (0.35%), 5.500 (0.23%), 5.477 (85%), 5.435 (12.6%), 5.378 (1.7%), 5.311 (1.2×10^{-2}%) spect (4R57); 5.535 (0.42%), 5.503 (0.24%), 5.476 (84.3%), 5.433 (13.6%), 5.379 (1.4%) spect (4A52, 4A54a); 5.541 (0.39%), 5.508 (0.24%), 5.482 (85%), 5.439 (12.8%), 5.386 (1.7%), 5.321 (1.5×10^{-2}%), 5.241 (?, 2×10^{-3}%) spect (70G55, 44A56);	Q$_\alpha$ 5.63 (68F58); see U^{237} 
		A	chem, n-capt, excit, mass spect (13S49); daughter Pu^{241} (13S49, 16C49a);			
		I	5/2 atomic spect (38F53a, 47T56);			
		μ	+1.4 atomic spect (122M56);	γ	γ_1 0.02636 (†3.3), γ_2 0.03320 (†0.2), γ_3 0.04346 (†0.24), γ_5 0.05957 (†40), 0.103 (†0.04), 0.113 (†3×10^{-3}), 0.130 (†5×10^{-3}), 0.159 (†4×10^{-4}), 0.210 (†8×10^{-4}), 0.27 (†10^{-4}), 0.33 (†3×10^{-4}), 0.37 (†2×10^{-4}) cryst spect, scint spect (56D55);	
		μ	(0.0596 level of Np^{237}) +2.0 (see Np^{237}):		γ_1 0.02634, γ_2 0.03314 ($L_I/L_{II}/L_{III}$ = 3/1/1), γ_3 0.04334 ($L_I/L_{II}/L_{III}$ = 1.0/1.0/0.8), γ_4 0.05546 (L_I/L_{II} 1), γ_5 0.05954 ($L_I/L_{II}/L_{III}$ = 1.7/3.3/1.0), 0.067 (?), 0.09885 (L_{II}/L_{III} 1.5) spect conv, cryst spect, scint spect (4R57, 121M54);	
		q	+4.9 atomic spect (122M56)		γ_1 0.02638 ($L_I/L_{II}/L_{III}$ = 0.7/1.5/1.0), γ_2 0.03322 ($L_I/L_{II}/L_{III}$ = 4.1/1/1), γ_3 0.04343 ($L_I/L_{II}/L_{III}$ = 1.5/1.3/1.0), γ_4 0.05552 (L_I/L_{II} 1.3), γ_5 0.05962 ($L_I/L_{II}/L_{III}$ = 2.2/4.7/1.0), 0.0988 spect conv (184B55);	
					γ_2 ($M_I/M_{II}/M_{III}$ ~4/1/1), γ_3 ($L_I/L_{II}/L_{III}$ = 1/1/1), γ_4 (L_I/L_{II} ~1), γ_5 ($L_I/L_{II}/L_{III}$ = 1.5/3.3/1.0), 0.0990 (L_{II}/L_{III} >1) spect conv (13H56b);	
					γ_1 0.02638 (†4), γ_2 0.0332, γ_3 0.0434, γ_4 0.056, γ_5 0.05962 (†40, e/γ ~0.9, e_L/γ 0.7, L_I+L_{II}/L_{III} ~4.4), 0.100 (†0.06, L_{II}/L_{III} 1.7), 0.128 (?, †6×10^{-3}), 0.168 (?), 0.207 (weak) cryst spect, scint spect, spect conv (26J55);	
					γ_1 (e_L/γ ~7), γ_2 (e_L/γ >240), (γ_3 coinc with γ_1 and γ_5), (γ_1 coinc with γ_2), (γ_4 coinc with γ_3 and γ_5) conv-conv coinc, spect conv (15T55);	
					γ_1 (2.5%), γ_3 (0.073%), γ_5 (36%), 0.099 (0.023%), 0.103 (0.019%) scint spect, ion ch, α-γ, γ-γ coinc (15M57);	
					γ_1 (2.8%, e/γ ≤20), γ_5 (40%, e/γ ≤1.5) ion ch (103B52);	
					γ_5: $t_{1/2}$ 6.3×10^{-8} s delay coinc (103B52);	
					$t_{1/2}$ 6×10^{-8} s delay coinc (15T55);	
					others (55K57, 30N53, 1N54, 3F52b, 13S49, 15D52);	
					see also gammas of U^{237} and Np^{237}	
Am^{242m}	16.01 h (44K53); 16 h (16M49, 184B55); others (13S49)	☢	β⁻ 81%, EC 19%, no IT (lim 6%) (74H55); β⁻ 82%, EC 18%, IT (?) (184B55);	β⁻	0.625 (~49%), 0.667 (~33%) spect (184B55); 0.628 spect (8O50a); others (15G50, 74H55);	see Cf^{246} 
		A	chem, n-capt, genet (16M49, 13S49b); parent Cm^{242} (16M49, 13S49b); parent Pu^{242} (8O52a)	γ	with β⁻: 0.04212 spect conv (13H56); 0.0422 (L_{II}/L_{III} 1.4) spect conv, β-γ coinc, scint spect (74H55, 97C57); 0.0422 (L_I+L_{II}/L_{III} 1.4) spect conv (184B55); see also gammas of Cf^{246} with EC: 0.04450 spect conv (13H56); 0.0446 (L_{II}/L_{III} 1.4) spect conv, γ-γ coinc, scint spect (74H55, 97C57); 0.0445 (L_I+L_{II}/L_{III} 2.0) spect conv (184B55); with IT (?): 0.0451 (weak) spect conv (184B55)	
Am^{242}	~100 y genet (6S50a)	☢	β⁻ 90%, EC 10% (74H55); α/β⁻ 0.01 (6S50a);	β⁻	0.59 spect (74H55); ~0.5 abs (13S49)	Q$_\alpha$ 5.52 calc, Q$_{\beta^-}$ 0.59, Q$_{EC}$ 0.64 calc (68F58)
		A	chem, genet, mass spect, n-capt (13S49, 6S50a); parent Cm^{242}, parent Np^{238} (13S49, 6S50a, 13S49b)			

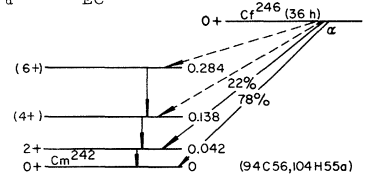
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{95}Am^{243}$	7.95×10^3 y sp act (10W58); others (107B57, 25H57, 104H56, 4A54a, 55D53)	☢ α (6S50a); β stable (cons energy) (68F58); A chem, mass spect (6S50a); parent Np^{239} (6S50a); daughter Pu^{243} (3T51); I 5/2 atomic spect (96C54a); μ +1.4 atomic spect (122M56); q +4.9 atomic spect (122M56)	α 5.339 (0.17%), 5.308 (0.16%), 5.266 (87%), 5.224 (11.5%), 5.169 (1.1%) spect (130S55b, 4A54a, 4A57); γ 0.0746 ($L_I/L_{II}/L_{III}$ ~1.2/1/1) spect conv (13H57); 0.075 ($e/\gamma \leq 0.3$) scint spect, α-γ coinc (4A54a); others (125S55); see also gammas of U^{239}	Q_α 5.43 (68F58) 
Am^{244}	26 m (13G54)	☢ β⁻ 99+%, EC 0.039% (13F55); A chem, n-capt (6S50a); chem, genet (13F55); parent Pu^{244}, parent Cm^{244} (13F55); parent Cm^{244} (10R50)	β⁻ 1.5 scint spect (13G54); γ no γ, scint spect (13G54)	Q_α 5.34 calc, Q_{β^-} 1.50, Q_{EC} 0.32 est (68F58)
Am^{245}	1.98 h (13F55a); 2.07 h (107B56); 2.08 h (88B55)	☢ β⁻ (88B55, 13F55a); B chem, genet (88B55, 13F55a); daughter Pu^{245} (13F55a, 107B56)	β⁻ 0.91 spect (88B55); 0.88 abs (107B56); 0.86 abs (13F55a); γ γ_1 0.036, γ_2 0.06 (?), γ_3 0.078 (?), γ_4 0.140, γ_5 0.153, γ_6 0.230, γ_7 0.255 (e_K/γ 0.19, K/L 5), (γ_7 coinc with γ_1, γ_2, γ_3, and γ_5), (γ_6 coinc with γ_1, γ_2, γ_3, and γ_4) scint spect, spect conv, γ-γ coinc (88B55); 0.26 scint spect (13F55a); 0.245 scint spect (107B56); see also gammas of Bk^{245} and Cf^{249}	Q_α 5.16 est, Q_{β^-} 0.86 (68F58); see Bk^{245}
Am^{246}	25.0 m (13E55a); 25 m (88B55)	☢ β⁻ (13E55a, 88B55); A chem, genet (88B55, 13E55a); parent Cm^{246} (88B55); daughter Pu^{246} (13E55a)	β⁻ 1.31 (79%), 1.60 (14%), 2.10 (7%) spect, scint spect (136S56, 13E55a); γ 0.035, 0.245, 0.78 (complex), 1.06 (complex) γ-γ coinc, scint spect (136S56, 13E55a); see also gammas of Bk^{246} and Cf^{250}	Q_α 4.99 est, Q_{β^-} 2.41 (68F58)
$_{96}Cm^{238}$	2.5 h (6S48a)	☢ EC <90%, α >10% (75C52); B chem (6S48a); chem, genet (23H52a); parent Pu^{234} (23H52a)	α 6.50 ion ch (6S48a)	Q_α 6.63, Q_{EC} 1.08 est (68F58)
Cm^{239}	2.9 h (34V58); ~3 h (75C52)	☢ EC, no α (lim 0.1%) (75C52); B chem, excit (75C52); chem, genet energy levels (34V58)	γ 0.188 scint spect (34V58); see also gammas of Bk^{243}	Q_α 6.51 est, Q_{EC} 1.7 est (68F58); see Bk^{243}
Cm^{240}	26.8 d (13S49b); spont fission: 7.9×10^5 y (13G52)	☢ α (13S49b); no EC (lim 0.5%) (23H52); A chem, genet (13S49b); parent Pu^{236} (13S49b); daughter Cf^{244} (94C56a)	α 6.25 ion ch (23H52); α_0 (~70%), α_{46} (~30%) spect (4A57); 6.3 range air (13S49b)	Q_α 6.38, Q_{EC} 0.09 est (68F58)

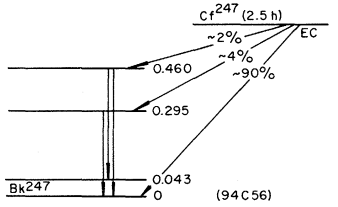
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{96}Cm^{241}$	35 d (23H52)	☢ EC 99+%, α 0.96% (72G56);	α	5.95 ion ch (31C54); 5.90 ion ch (23H52a); α_{145} (†89), α_{202} (†11) spect (4A57);	Q_α 6.20, Q_{EC} 0.80 calc (68F58); see Bk^{245}
		A chem, excit, cross bomb (13S49b, 23H52, 72G56);	γ	~0.47, ~0.60 scint spect (4A57);	
		parent Pu^{237m} (130S57c)		with Pu^{237m}: 0.145 (130S57c); see also gammas of Bk^{245} and Pu^{237m}	
Cm^{242}	162.5 d (73G54, 24H50); 163 d (114H54); spont fission: 7.2×10^6 y (24H51)	☢ α (13S49b); β stable (cons energy) (68F58);	α	6.110 (73.7%), 6.066 (26.3%), 5.965 (0.035%) spect (4A53a, 4A52);	Q_α 6.21 (68F58); see Np^{238}
		A chem, genet (13S49b); mass spect (10R50);	γ	0.04411 (L_{II}/L_{III} 1.2), 0.1019 ($L_I/L_{II}/L_{III}$ = ~0.2/1.4/1.0), 0.1577 spect conv (119S56a);	
		daughter Am^{242} (13S49b, 13G50, 13S49, 6S50a);		0.04403 (0.039%), 0.1018 (3.5×10^{-3}%), 0.1576 (2.3×10^{-3}%) ion ch (30N56a); 0.04410 (L_{II}/L_{III} 1.2) spect conv (184B56a);	
		daughter Am^{242m} (16M49, 13S49b); daughter Cf^{246} (25H51);		0.044 (0.041%, e_L/γ ~520), 0.100 (6×10^{-3}%, e/γ 5), 0.157 (2.7×10^{-3}%), 0.210 (~2×10^{-5}%, coinc with 0.157 γ), 0.562 (1.8×10^{-4}%), 0.605 (1.4×10^{-4}%), 0.89 (0.9×10^{-5}%), 0.935 ($e_K/\gamma \geq 0.5$, K/L+M 4.5), 1.01 (~10^{-5}%), γ-γ coinc, scint spect (4A53a, 130S55a, 4A57, 13P57); others (15D52);	
		parent Pu^{238} (13S49b)		see also gammas of Np^{238}	
Cm^{243}	35 y sp act + mass spect (4A57); ~100 y genet (3T50b)	☢ α (10R50); EC (0.26%) (99C58);	α	6.061 (1%), 6.054 (5%), 6.005 (0.9%), 5.987 (6%), 5.900 (0.1%), 5.872 (0.5%), 5.780 (73%), 5.736 (11.5%), 5.680 (1.6%), 5.676 (0.2%), 5.634 (0.15%) spect (4A57, 4A53a, 4A57b); 5.89 (15%), 5.79 (85%) ion ch (3T50b);	Q_α 6.16, Q_{EC} 0.00 calc (68F58); see Np^{239}
		A chem, mass spect, genet (10R50);	γ	0.210 (†50), 0.228 (†65), 0.277 (†100) ion ch, scint spect (30N56a); 0.106, 0.210 (e_K/γ 2.1), 0.228 (e_K/γ 2.6), 0.278 (e_K/γ 1.2) scint spect, α-γ, γ-γ coinc (4A57, 4A53a);	
		daughter Bk^{243} (3T50b)		see also gammas of Np^{239}, Am^{239}, and Pu^{239}	

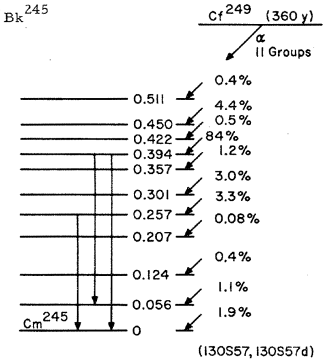
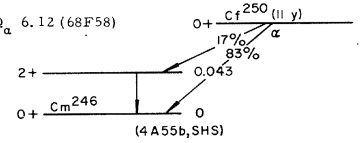
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{96}Cm^{244}$	17.9 y genet (47F54); 19.2 y sp act + mass spect (138S54); spont fission: 1.4×10^7 y (13G52)	☢	α (10R50); β stable (cons energy) (68F58);	α	5.801 (76.7%), 5.759 (23.3%), 5.661 (0.017%) spect (4A57, 4A53a); 5.803, 5.759 spect (64W58); 5.7 ion ch (89G56);	Q_α 5.89 (68F58); see Np^{240}  (4A57, SHS)
		A	chem, mass spect (10R50); daughter Am^{244} (10R50, 13F55); daughter Bk^{244} (89G56, 94C56); parent Pu^{240} (47F54); daughter Cf^{248} (25H54)	γ	0.04288 (L_{II}/L_{III} 1.1) spect conv (119S56a); 0.043 (2.1×10^{-2}%, e_L/γ 760), 0.100 (1.5×10^{-3}%, e/γ 11), 0.150 (1.3×10^{-3}%) scint spect (4A57); see also gammas of Am^{240} and Np^{240} (7 m)	
Cm^{245}	8×10^3 y (81H57b); 1.4×10^4 y genet (88B55); 1.2×10^4 y genet (47F54)	☢	α (25H51); β stable (cons energy) (68F58);	α	5.36 (90%), 5.45 (10%) ion ch (25H54, 13P56, 25H51, 25H57a);	Q_α 5.62 (68F58)
		A	chem, decay charac, genet (25H51); chem, mass spect (138S54, 25H54); daughter Bk^{245} (25H54, 25H51); parent Pu^{241} (47F54)	γ	0.173 (14%), ~0.13 (5%) scint spect (4A57)	
Cm^{246}	6600 y sp act (107B56b); 2300 y sp act (88B55); 4000 y genet (47F54); spont fission: 2.0×10^7 y (30F56)	☢	α (47F54, 138S54); β stable (cons energy) (68F58);	α	5.37 ion ch (107B56b); 5.4 ion ch (13F56, 138S54)	Q_α 5.46 (68F58)
		A	chem, mass spect (138S54, 13F56); parent Pu^{242} (47F54); daughter Am^{246} (88B55); daughter Cf^{250} (107B56b)			
Cm^{247}	$t_\alpha > 4 \times 10^7$ y genet + mass spect (55D57, 138S54)	☢	[α] (55D57, 138S54);			Q_α 5.29 est, Q_{β^-} 0.00 est (68F58)
		A	chem, mass spect (138S54, 55D57); daughter Cf^{251} (44E57)			
Cm^{248}	4.7×10^5 y sp act (107B56b); spont fission: 4.6×10^6 y (107B56b)	☢	α 89%, spont fission 11% (107B56b); β stable (cons energy) (68F58);	α	5.05 ion ch (107B56b)	Q_α 5.14 (68F58)
		B	chem, genet (107B56b); daughter Cf^{252} (106B56b)			
Cm^{249}	64 m (44E58); 65 m (13F56)	☢	β^- (13F56);	β^-	0.9 abs (13F56); 0.86 (44E58)	Q_α 5.17 est, Q_{β^-} 0.86 (68F58)
		B	n-capt, chem (13F56)			
Cm^{250}	spont fission: 2×10^4 y (81H57b); others (13F56)	☢	spont fission (81H57b); [α] (68F58);			Q_α 5.21 est, Q_{β^-} 0.00 est (68F58)
		E	chem, decay charac (81H57b)			

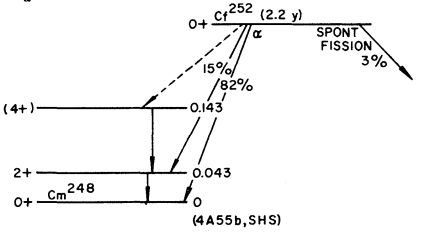
Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{97}Bk^{243}$	4.5 h (94C56); 4.6 h (3T50b, 13G54a); others (25H51)	☢	EC 99+%, α 0.15% (3T50b, 94C56);	α	6.72 (†30), 6.55 (†53), 6.20 (†17) ion ch (3T50b);	$Q_α$ 6.83, Q_{EC} 1.56 calc (68F58)
		A	chem, n-capt, genet (3T50, 3T50b); parent Cm^{243} (3T50b)	γ	with EC: 0.74 (†10), 0.84 (†30), 0.96 (†30) scint spect (94C56); with α: 0.042 (γ/α 0.04), 0.146 (γ/α 0.08), 0.187 (γ/α 0.34), 0.54 (γ/α 0.10) α-γ, γ-γ coinc, scint spect (94C56); see also gammas of Cm^{239}	
Bk^{244}	4.4 h (94C56)	☢	EC 99+%, α 6 x 10^{-3}% (94C56);	α	6.67 ion ch (94C56);	$Q_α$ 6.78, Q_{EC} 2.3 est (68F58)
		B	chem, excit, genet (94C56); parent Cm^{244} (94C56, 89G56)	γ	with EC: 0.200 (coinc with 0.90 γ), 0.90 (†100), 1.06 (†7), 1.16 (†5), 1.23 (†5), 1.37 (†0.7), 1.50 (†2), 1.72 (†0.2) γ-γ coinc, scint spect (94C56)	
Bk^{245}	4.98 d (15M56a); 4.95 d (25H51)	☢	EC 99+%, α 0.11% (15M56a); EC to 0.252 level of Cm^{245}: L+M/K 0.33 (15M56a);	α	6.37 (†33), 6.17 (†41), 5.89 (†26) ion ch (15M56a); 6.33 (†18), 6.15 (†48), 5.90 (†34) ion ch (25H51);	$Q_α$ 6.48, Q_{EC} 0.84 calc (68F58); see Cf^{249}  
		A	chem, excit, decay charac (25H51); daughter Cf^{245} (94C56a); parent Cm^{245} (25H51, 25H54)	γ	with EC: 0.250 (31%, $e_K/γ$ 1.8, K/L+M 4), 0.380 (5.1%, $e_K/γ$ 0.2, coinc with 0.250 γ) spect conv, γ-γ coinc, scint spect (15M56a, 15M57a); 0.252 (†31, $e_K/γ$ 1.9, e/γ 2.3), 0.380 (†4.4, coinc with 0.252 γ) scint spect, γ-γ coinc (94C56); with α: 0.164 (γ/α 0.07), 0.206 (γ/α 0.28), 0.480 (γ/α 0.18) scint spect, α-γ coinc (94C56); see also gammas of Cf^{249} and Am^{245}	
Bk^{246}	1.8 d (25H54)	☢	EC (25H54);	γ	0.82 (~40%) scint spect (25H54); 0.80, 1.09 (complex) scint spect, γ-γ coinc (94C56); see also gammas of Am^{246}	$Q_α$ 6.16 est, Q_{EC} 1.34 est (68F58)
		B	chem, decay charac, excit (25H54, 94C56)			
Bk^{247}	~10^4 y yield (94C56)	☢	α, no EC (94C56);	α	5.30 (5%), 5.51 (58%), 5.67 (37%) ion ch (94C56);	$Q_α$ 5.85, Q_{EC} 0.00 est (68F58)
		B	chem, decay charac (94C56)	γ	0.084 (40%), 0.27 (30%) scint spect, α-γ coinc (94C56); see also gammas of Pu^{243}	
Bk^{248}	16 h (94C56); 23 h genet (25H56)	☢	$β^-$ 70%, EC 30% (L+M/K ~1) (94C56);	$β^-$	0.65 scint spect (94C56)	$Q_α$ 5.51 calc, $Q_{β^-}$ 0.65, Q_{EC} 0.69 est (68F58)
		B	n-capt, chem, genet (25H56, 94C56); parent Cf^{248} (25H56, 94C56)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{97}Bk^{249}$	314 d (44E57); 290 d (15M54, 55D54); spont fission: 6×10^8 y (8H56); $>1.5 \times 10^9$ y (44E57)	☢	β^- 99+%, α 2.2×10^{-3}% (44E57); β^- 99+%, α $\sim 10^{-3}$% (15M54, 55D54);	α	5.42, 5.03 ion ch (44E57); 5.40 ion ch (15M54, 55D54);
		A	chem, genet (3T54, 13G54, 55D54); chem, mass spect (13F56); parent Cf^{249} (13G54, 15M54)	β^-	0.11 abs (44E57); 0.08 abs (15M54, 55D54);
				γ	with β^-: no γ (lim 1%) β-γ coinc, scint spect (94C56); with α: 0.32 (4% of α) α-γ coinc, scint spect (94C56)
Bk^{250}	3.13 h (13G54); others (15M54)	☢	β^- (13G54);	β^-	0.9, 1.9 scint spect (13G54);
		A	n-capt, chem, genet (13G54); parent Cf^{250} (13G54); daughter 480 d E^{254} (20H55, 44J56)	γ	~0.9 (coinc with 0.9 β^-) scint spect, β-γ coinc (13G54); 0.98 (?) (coinc with β^-) scint spect, β-γ coinc (44J56); 0.062 level of Bk^{250}: $t_{1/2}$ 3.9×10^{-8} s delay coinc (130S57)
$_{98}Cf^{244}$	25 m (94C56a); others (3T50d, 3T50c, 13G51c, 13G54a, 89G56)	☢	α (94C56a);	α	7.17 ion ch (94C56a)
		A	chem, excit, genet (3T50c, 94C56a); parent Cm^{240} (94C56a); daughter $Fm^{248, 249}$ (89G56)		
Cf^{245}	44 m (3T50d); others (3T50c, 13G51c, 13G54a)	☢	EC 70%, α 30% (94C56a);	α	7.11 ion ch (94C56a); others (3T50d, 89G56)
		B	chem, excit, genet (94C56a); parent Bk^{245} (94C56a); not parent Cm^{240} (94C56a); daughter $Fm^{248, 249}$ (89G56)		
Cf^{246}	35.7 h (25H51); spont fission: 2100 y (25H53)	☢	α (13G51c);	α	6.753 (78%), 6.711 (22%) spect (104H55a); 6.75 ion ch (13G51c, 13G54a);
		A	chem, genet (13G51c); parent Cm^{242} (25H51); daughter E^{246} (13G54a)	γ	0.042 (1.4×10^{-2}%), 0.096 (1.2×10^{-2}%), 0.146 (3.5×10^{-3}%) scint spect, α-γ coinc (94C56, 104H55a); see also gammas of Am^{242m}
Cf^{247}	2.5 h (25H54, 94C56); others (13G54a)	☢	EC (25H54); EC to ground state: L+M/K ~0.3 (94C56); EC to 0.295 level: L+M/K ~1.3 (94C56); EC to 0.460 level: L+M/K ~10 (94C56);	γ	0.295 (†20, $e_{K/\gamma} \sim 1.3$) 0.417 (†13), 0.460 (†9) scint spect, γ-γ coinc (94C56)
		B	chem (25H54); chem, excit (94C56)		

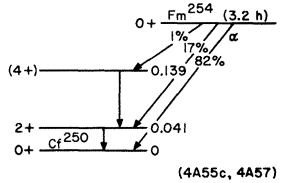




Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{98}Cf^{248}$	350 d genet (25H57a); 340 d (25H57a); 225 d (13G54a); spont fission: $\geq 1.5 \times 10^4$ y (25H57a)	☢	α (13G54a, 25H54); β stable (cons energy) (68F58);	α	6.26 ion ch (25H54, 13G54a); α_0 (82%), $\alpha_{\sim 45}$ (18%) α-γ coinc (25H57a)	Q_α 6.36 (68F58)
		A	chem, genet (13G54a, 25H54); parent Cm^{244} (25H54); daughter Bk^{248} (25H56, 94C56); daughter Fm^{252} (47F56); daughter E^{248} (94C56b)			
Cf^{249}	360 y genet (44E57); 470 y sp act (15M54); ~400 y sp act (13G54); spont fission: 1.5×10^9 y (8H56); others (55D54, 15M54)	☢	α (3T54); β stable (cons energy) (68F58);	α	5.687 (0.4%), 5.749 (4.4%), 5.778 (?, 0.5%), 5.806 (84%), 5.842 (3.0%), 5.898 (1.2%), 5.941 (3.3%), 5.990 (?, 0.08%), 6.072 (0.4%), 6.139 (1.1%), 6.194 (1.9%) spect (4A57, 130S57d); 5.69 (?, 0.5%), 5.761 (7.4%), 5.807 (81.2%), 5.901 (3.4%), 5.935 (3.4%), 6.005 (?, 0.3%), 6.066 (0.4%), 6.133 (1.2%), 6.185 (2.3%) ion ch, α-γ coinc (15M57a, 15M54, 55D54); 5.81 (92%), 5.93 (5%), 6.20 (3%) ion ch (44E57); 5.82 (90%), 6.0 (10%) ion ch (13G54);	Q_α 6.30 (68F58); see Bk^{245}  (130S57, 130S57d)
		A	chem, genet (3T54, 13G54); chem, genet, mass spect (55D54, 15M54, 13F56); daughter Bk^{249} (13G54, 15M54)	γ	0.255 (3%), 0.340 (15%), 0.394 (72%) scint spect, γ-γ, α-γ coinc (130S55, 4A55b, 130S57d); 0.406, 0.107 (?), 0.050 (?) scint spect, α-γ coinc (44E57); see also gammas of Am^{245} and Bk^{245}	
Cf^{250}	10.9 y sp act + mass spect (44E57); 9.3 y (107B56a); 10 y sp act + mass spect (15M54); ~12 y sp act (13G54); spont fission: ~1.5×10^4 y (15M54); others (55D54, 13G54)	☢	α (13G54); β stable (cons energy) (68F58);	α	6.024 (83%), 5.980 (17%) spect (4A55b); 6.03 (90%), 5.99 (10%) ion ch (15M54, 55D54, 4S54a); 6.05 ion ch (13G54);	Q_α 6.12 (68F58)  (4A55b, SHS)
		A	chem, genet (3T54, 13G54); chem, mass spect (55D54, 15M54); daughter Bk^{250} (13G54); parent Cm^{246} (107B56b)	γ	0.0429 spect conv (13H56); see also gammas of Am^{246} and Bk^{246}	
Cf^{251}	~800 y genet (44E57); long (15M54)	☢	α (44E57); β stable (cons energy) (68F58);	γ	(4A55b)	Q_α 6.17 est (68F58)
		A	chem, mass spect (55D54, 15M54); parent Cm^{247} (44E57)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)	Energy of Radiation in Mev	Disintegration Energy and Scheme
$_{98}Cf^{252}$	2.2 y (15M54); 2.6 y (44E57); 2.1 y (13F56); ~2 y (13G54); spont fission: 66 y (15M54); others (13G54, 44E57)	☢ α 97%, spont fission 3% (44J55); α 98%, spont fission 2% (13G54); β stable (cons energy) (68F58); A chem (3T54, 13G54); chem, mass spect (4S54a, 15M54, 55D54); parent Cm^{248} (107B56b)	α 6.112 (82%), 6.069 (15%) spect (4A55b); 6.12 (87%), 6.08 (10%) ion ch, α-γ coinc (15M54); 6.11 ion ch (44J55, 44E57); γ 0.0434 spect conv (13H56); 0.042 (1.4×10^{-2}%), 0.100 (1×10^{-2}%) scint spect, α-γ coinc (4A55b)	Q_α 6.21 (68F58) 
Cf^{253}	17 d genet (44E57); 18 d (55D54, 15M54); ~20 d genet (99C54)	☢ β^- (55D54); A chem, genet (99C54, 55D54, 15M54); chem, mass spect (13F56); parent E^{253} (99C54, 15M54)	β^- 0.27, 0.17 (?) spect (108G57a); γ no γ between 0.10 and 0.70 (lim 1%) scint spect (4A57)	Q_α 6.15 calc, Q_{β^-} 0.27 (68F58)
Cf^{254}	spont fission: 56 d (81H57b); 55 d (13F56); 85 d (20H55)	☢ spont fission (20H55, 13F56); β stable (cons energy) (68F58); A chem, genet (20H55); chem, mass spect (13F56); daughter 37 h E^{254} (20H55, 13F56)		Q_α 5.89 est (68F58)
Supernova (IC 4182-Type I)	55 nights (234B56)			
$_{99}E^{246}$	7.3 m (13G54a); ~7 m (89G56)	☢ EC (?), α (13G54a); D chem, decay charac, genet (13G54a)	α 7.35 ion ch (13G54a); 7.35 ion ch, range emuls (89G56)	Q_α 7.47, Q_{EC} 3.5 est (68F58)
E^{248}	25 m (94C56b)	☢ EC 99+%, α ~0.3% (94C56b); B chem, excit, genet (94C56b); parent Cf^{248} (94C56b)	α 6.87 ion ch (94C56b)	Q_α 6.98, Q_{EC} 2.9 est (68F58)
E^{249}	2 h (20H56)	☢ EC 99+%, α 0.13% (20H56); B chem, excit (20H56)	α 6.76 ion ch (20H56)	Q_α 6.87, Q_{EC} 1.41 calc (68F58)
E^{250}	8 h (20H56)	☢ EC (20H56); B chem, excit (20H56)		Q_α 6.72 est, Q_{EC} 1.94 est (68F58)
E^{251}	1.5 d (20H56)	☢ EC 99+%, α 0.53% (20H56); B chem, excit (20H56)	α 6.48 ion ch (20H56)	Q_α 6.58, Q_{EC} 0.41 est (68F58)
E^{252}	~140 d (20H56)	☢ α, no β^- (lim 3%), no EC (20H56); B chem, excit (20H56)	α 6.64 ion ch (20H56)	Q_α 6.75, Q_{β^-} 0.24 calc, Q_{EC} 1.23 est (68F58)

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{99}E^{253}$	20.03 d (44J56); 19.3 d (13F54); 20 d (99C54); spont fission: 7×10^5 y (44J56); others (13F54, 4S54a)	☢	α (3T54); β stable (cons energy) (68F58);	α	6.633 (90%), 6.592 (7.7%), 6.552 (0.8%), 6.540 (0.9%), 6.497 (0.25%), 6.479 (0.1%), 6.429 (0.1%), 6.249 (0.04%), 6.209 (0.05%), 6.176 (0.02%) spect (4A57, 104H56); 6.636 (99+%), 6.24 (~0.08%) ion ch (44J56); 6.61 ion ch (4S54a); 6.63 ion ch (99C54, 3T54);	Q_α 6.74 (68F58)
		A	chem, genet (3T54, 99C54, 4S54a); daughter Cf^{253} (99C54, 15M54); daughter Fm^{253} (63A57a)	γ	0.0417, 0.051, 0.385 (0.03%), 0.427 (0.005%) ion ch, scint spect, x-γ coinc (4A57); 0.042 (0.038%, e_L/γ ~34), 0.393 (0.055%, e_K/γ ~0.7, coinc with 6.24 α) scint spect, α-γ coinc (44J56)	
E^{254}	480 d (44J56, 53S58); >2 y (20H55)	☢	α, no β^- (lim 1%) (20H55);	α	6.42 ion ch (44J56); 6.44 ion ch (20H55);	Q_α 6.52, Q_{β^-} 1.10 calc, Q_{EC} 0.63 est (68F58)
		A	chem, genet (20H55, 44J56); parent Bk^{250} (20H55, 44J56); not parent Fm^{254} (lim 1%) (20H55)	γ	0.062 scint spect (130S57); 0.062 γ: $t_{1/2}$ 3.9×10^{-8} s delay coinc (130S57)	
E^{254}	37 h (13F54); 39 h (44J56); 36 h genet (99C54); spont fission: >10 y (13F54)	☢	β^- 99+%, EC ~0.1% (20H55);	β^-	1.04 abs (44J56); 1.1 scint spect (99C54); ~0.5 (coinc with 0.66 γ) scint spect, β-γ coinc (130S55);	
		A	n-capt, chem, decay charac (13F54, 99C54, 20H55); parent Fm^{254} (13F54, 99C54); parent Cf^{254} (20H55, 13F56)	γ	0.66 (40%) scint spect, β-γ coinc (130S55); 0.66 (~70%) scint spect, β-γ coinc (44J56)	
E^{255}	24 d (44J56); ~30 d genet (99C54)	☢	β^- (99C54);			Q_α 6.35 est, Q_{β^-} 0.38 est (68F58)
		B	chem, genet (99C54, 44J56); parent Fm^{255} (99C54, 44J56)			
E^{256}	short (99C55)	☢	[β^-] (99C55);			
		F	(99C55)			
$_{100}Fm^{248,249}$	short (89G56)	☢	α (89G56);			
		F	chem, genet (89G56); parent Cf^{244} or Cf^{245} (89G56)			
Fm^{250}	30 m (63A57, 34A54)	☢	α, EC (63A57);	α	7.43 ion ch (63A57); 7.7 ion ch (34A54); ion ch, range emuls (89G56)	Q_α 7.55, Q_{EC} 0.94 est (68F58)
		B	chem, excit (34A54, 63A57); daughter 102^{254} (13G58)			
Fm^{251}	7 h (63A57)	☢	EC ~99%, α ~1% (63A57);	α	6.89 ion ch (63A57)	Q_α 7.35 est, Q_{EC} 1.5 est (68F58)
		B	chem, excit (63A57)			
Fm^{252}	22.7 h (47F56); 30 h (63A57); spont fission: >8 y (47F56)	☢	α (47F56); β stable (cons energy) (68F58);	α	7.04 ion ch (47F56); 7.05 ion ch (63A57); others (4S54a)	Q_α 7.16 (68F58)
		B	chem, genet (47F56); chem, excit (63A57); parent Cf^{248} (47F56)			
Fm^{253}	~4.5 d (63A57a); >10 d (47F56)	☢	EC 89%, α 11% (63A57a);	α	6.85 ion ch (47F56); 6.94 ion ch (63A57a)	Q_α 7.24 est, Q_{EC} 0.4 est (68F58)
		B	chem (47F56); chem, genet (63A57a); parent E^{253} (63A57a)			

Isotope Z A	Half-life	Type of Decay (☢); Class, Genetic Relationships; % Abundance; Nuclear Moments (Spin I, Magnetic μ, Quadrupole q)		Energy of Radiation in Mev		Disintegration Energy and Scheme
$_{100}Fm^{254}$	3.24 h (44J56); 3.3 h (13F54, 4S54a); 3.2 h (99C54, 20H54); spont fission: 246 d (44J56); 220 d (13F54); 200 d (99C54)	☢	α (20H54, 13F54); β stable (cons energy) (68F58);	α	α_0 (82%), α_{41} (17%), α_{139} (1%) spect (4A57); 7.20 ion ch (44J56); 7.17 ion ch (13F54, 4S54a); 7.22 ion ch (99C54, 20H54);	Q_α 7.32 (68F58)  (4A55c, 4A57)
		A	chem, genet (20H54, 99C54, 13F54, 4S54a); daughter 37 h E^{254} (99C54, 13F54); not daughter 480 d E^{254} (lim 1%) (20H55)	γ	0.041 (0.02%, e/γ 900), 0.098 (0.028%) scint spect, α-γ coinc (4A55c, 4A57)	
Fm^{255}	21.5 h (44J56); ~15 h (99C54); spont fission: >60 y (8H56)	☢	α (99C54); β stable (cons energy) (68F58);	α	7.03 (not complex), no α >7.03 (lim 3%) spect (4A57); 7.08 (complex) ion ch (44J56); 7.1 ion ch (99C54);	Q_α 7.19 (68F58)
		B	chem, genet (99C54); daughter E^{255} (99C54, 44J56)	γ	~0.055 (1%), ~0.082 (1%) scint spect (130S57)	
Fm^{256}	spont fission: ~3-4 h (99C55)	☢	spont fission (99C55); β stable (cons energy), (68F58);			Q_α 6.94 est (68F58)
		D	chem, decay charac (99C55)			
$_{101}Mv^{256}$	~30 m (13G55)	☢	[EC] (13G55);			Q_α 7.7 est, Q_{EC} 2.0 est (68F58)
		D	chem (13G55)			
$_{102}254$	3 s genet (13G58)	☢	α (13G58);			Q_α ~8.7 est (13G58)
		B	genet, chem (13G58); parent Fm^{250} (13G58); others (13F57)			

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