of the reduced mass of the molecule, since in order that dissociation may result the ions must be vibrating as separate units, and not as a single unit about the center of mass of the molecule.

The equation for the frequency, ν, of the absorbed light which produces dissociation of the carboxyl group is, therefore,

$$\nu = \nu_e + \frac{1}{2\pi}\left(\frac{f}{m}\right)^{1/2}$$

where ν_e is the electronic frequency, f the elastic constant of the group, and m the mass of the molecular ion.

To test the validity of this equation the frequency, in wave-numbers, of the absorbed radiation was plotted against the square-root of the reciprocal of the mass of the molecular ion, and the figure shows that the linear relation exists for all substances, except cystine. The intercept of the line, $\nu_e = 27{,}419$, is the limiting frequency of the Balmer series of hydrogen, which indicates that before dissociation the electron of hydrogen occupied one of its usual atomic energy levels. The slope of the line gives the value of the elastic constant for the molecular ion as 26.2×10^8. Since this constant is approximately equal to $e^2/r_0^2 r$, under equilibrium conditions, where r_0 is the mean distance between the attracting centers, and r the amplitude of the displacement, this amplitude will be about 10^{-12} cm: the corresponding amplitude for the hydrogen ion is about 10^{-10} cm, since it is vibrating with the same frequency.

The apparent anomalous behavior of cysteine can be easily explained. The absorption of light of wave-length about 2500A was found to break the $S-S$ linkage in this molecule, and the resulting ions when in a hydrochloric acid solution combined with ions of the solution to form cysteine chloride and cysteine, and when in a water solution to form cysteine hydroxide and cysteine. The presence of these molecules in the irradiated solution was detected by a determination of the mean molecular weight of the solution from the lowering of the freezing point of the solution, according to Raoult's equation. The absorption spectra obtained must correspond, therefore, to those of cysteine chloride and cysteine hydroxide, and the points giving the relations between the molecular weights of these compounds and the observed frequencies at which dissociation was produced are included in the graph.

A full discussion of these results will probably appear in an early issue of the Journal of Biological Chemistry.

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Smith College, March 11, 1932.

New Forbidden Lines in the L Series

On several long exposures plate taken to bring out the satellites of $L\beta_2$ of the higher atomic number elements, lines whose ν/R values correspond to forbidden transitions have been found. A high vacuum x-ray spectrometer described by Siegbahn and Thoraeus[1] was used. The slit-plate distance was 54.87 cm, widths of slit 0.08 mm and 0.2 mm, with exposures of two to twelve hours at 33 k.v. and 20–25 milliamperes.

The transitions are from the N_{21}, N_{22}, O_{21}, O_{22}, and $P_{21,22}$ levels to the L_{22} level and the lines are called respectively $L\phi_3$, $L\phi_4 \cdots L\phi_8$, for convenience. The first member of each series ($L_{22}-M_{21}$ and $L_{22}-M_{22}$) has been found by Idei[2] for 82 Pb, 83 Bi, 90 Th and the $L_{22}-M_{21}$ line for 92 U. He calls them t and s respectively.

The table gives the wave-length and ν/R value of each line found and the ν/R differences between the indicated levels computed from the data of Idei as given in Siegbahn's "Spektroskopie der Röntgenstrahlen", second edition, 1931.

	Observed		Computed
Element	$\lambda\phi_3(x.u.)$	ν/R	$\nu/RL_{22}-N_{21}$
77 Ir	1162.99	783.56	783.6
78 Pt	1129.13	807.05	806.9
79 Au	1097.30	830.47	830.4
83 Bi	981.32	928.62	929.0
	$\lambda\phi_4(x.u.)$	ν/R	$\nu/R(L_{22}-N_{22})$
77 Ir	1153.6	789.94	789.8
78 Pt	1120.11	813.55	813.6
79 Au	1088.11	837.48	837.8
83 Bi	971.19	938.30	938.5
	$\lambda\phi_{5,6}(x.u.)$	ν/R	$\nu/R(L_{22}-O_{21,22})$
77 Ir	1107.96	822.48	822.2
78 Pt	1075.75	847.1	847.6
79 Au	1043.61	873.19	873.6
81 Tl	983.23	926.81	926.7
83 Bi	930.37	979.47	979.5
	928.45	981.50	981.5
	$\lambda\phi_{7,8}(x.u.)$	ν/R	$\nu/R(L_{22}-P_{21,22})$
83 Bi	922.15	988.2	987.8
90 Th	759.71	1199.50	1199.7

Work is now in progress to seek other possible lines.

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Cornell University, March 16, 1932.

[1] Thoraeus, J.O.S.A. **13,** 235 (1926).

[2] Idei, Sci. Rep. Tohoku Imp. Univ. **19,** 559 (1930).