I argued against this interpretation in my paper, but a little consideration showed me that the initial electronic level is the $A\ ^3\Sigma$ level. I hesitated to make the major correction on the proof that this change would require, and it is for that reason that I present the alternative arguments here. Furthermore, it will be of interest to compare the arguments given here with that presented in my paper.

If we use Herzberg's formula and extrapolate the vibrational levels of the upper state by the method of Birge and Sponer we obtain a value of 10.4 volts for the total energy. If we use my formula, the value is 9.3 volts. In either case the values obtained by extrapolation are too high if our experience with this method is a good criterion. If we assume that the initial level is the $A\ ^3\Sigma$ level, then Sponer's value of 8.18 volts for this level must be lowered to 6.14 volts and, as I pointed out in a paper in this journal,[1] the heat of dissociation of 9.4 volts which was obtained in that paper has to be lowered by the same amount, thus making the heat of dissociation 7.4 volts. Since $A\ ^3\Sigma$ dissociates into a ^4S and a ^4D atom, its total energy should be 9.8 volts. This is less than the calculated value of 10.4 volts, but that is what one would expect. If we assume that $D(N_2)$ is 7.9 volts then the total energy should be 10.3 volts, and this agrees entirely too well with the 10.4 volt value obtained by extrapolation.

If we assume that the initial level is a new triplet level which dissociates into two ^4S atoms, then its total vibrational energy should be either 1.2 or 1.7 volts depending on the choice of 7.4 or 7.9 volts for $D(N_2)$. The extrapolation yields 3.1 volts for this energy, and it is seen that this is more than twice as large as 1.2 and about 80 percent larger than the 1.8 volt value. In either case, the error seems to be unusually large even for the extrapolation method. It seems therefore that the initial level is the $A\ ^3\Sigma$ level.

Another argument leads to the same conclusion. This new band system in gaseous N_2 corresponds to the ϵ-system observed by Vegard in the luminescence of solid N_2.[2] In this system many more bands have been observed than in the gaseous system, and it was possible to calculate the average separations between the vibrational levels of the upper state. Nine pairs of bands originating on $v'=5$ and 6 gave an average difference of 1293 cm^{-1} for these two vibrational levels. The average of the observed differences as taken from the first-positive band system for which the $A\ ^3\Sigma$ level is the lower level is 1292 cm^{-1}. The difference obtained from the formula given in my paper is 1229 cm^{-1}. A similar argument for the difference between $v'=4$ and 5 gives an average of 1323 cm^{-1} from 11 pairs of bands of the ϵ-system, and an average of 1323 cm^{-1} for this difference from the observed first-positive bands, and a calculated value of 1271 cm^{-1} from my formula. It must be concluded therefore that the initial level is the $A\ ^3\Sigma$ level and that the heat of dissociation of nitrogen is 7.4 volts. A discussion of the connection between this new value and the electron impact measurements of Lozier and of Tate, Smith and Vaughan has been given in a letter in these columns by Dr. Lozier.

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May 18, 1934.

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[1] Kaplan, Phys. Rev. **42**, 100 (1932).

[2] Vegard, Zeits. f. Physik **75**, 44 (1932).

The Absorption Spectrum of Diatomic Arsenic

A new system of some eighty absorption bands has been discovered in the spectrum of arsenic between 2200A, and 2750A, which can be definitely assigned to the diatomic molecule. This includes the five faint fluorescence bands observed by Rosen[1] and tentatively ascribed to As_2. The whole system bears a striking resemblance to that of P_2, investigated by Herzberg,[2] where $\Delta G''$ is about 750 cm^{-1} and $\Delta G'$ 470 cm^{-1}. A preliminary analysis gives for arsenic ΔG values that are about 420 cm^{-1} for the lower and 270 cm^{-1} for the upper state. The vibrational levels of both states converge very slowly.

The emission spectrum of phosphorus is attributed by Herzberg to a $^1\Sigma_g^+ \leftarrow {}^1\Sigma_u^+$ transition, in which the upper potential curve is crossed by another, possessing a flat minimum and a lower heat of dissociation, which is either a $^3\Sigma_u^+$ or a $^3\Pi_u$ state. This causes predissociation in the upper and perturbation of the lower vibrational levels of the $^1\Sigma_u^+$ state. The plot of the $\Delta G'$ values of our arsenic bands shows a discontinuity at $v'=4$, which appears to represent perturbation similar to that observed by Herzberg.

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[1] Rosen, Zeits. f. Physik **43**, 69 (1927).

[2] Herzberg, Nature **126**, 239 (1930); Ann. d. Physik (5), **15**, 677 (1932).

[3] Commonwealth Fellow.

Note on the Thermal History of the Earth

In a previous paper[1] the problem of the cooling of the earth has been treated under the simplifying assumption that the surface of the earth is either permanently at 0° or that it radiates into a medium at 0°.

The object of the present note is to amplify the treatment of the previous paper by taking into account the heat received from the sun.

If λ designates the average value of the solar constant, defined as the amount of heat received from the sun at the surface of the earth per unit area per unit time during normal incidence, then the total average rate of heat from

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[1] Lowan, *On the Cooling of a Radioactive Sphere*, Phys. Rev. **44**, 769 (1933). This paper will be referred to as A.N.L.