$\pm$ 0.0011 from (1) and 2.0116 $\pm$ 0.0013 from (2); mean *2.0113* $\pm$ *0.0012* (mass spectrograph scale). The agreement is satisfactory. This gives $4.3 \pm 1.2 \times 10^{-3}$ m. u. for the binding energy of the H(2) nucleus.

The chemical atomic weight of beryllium determined by Hönigschmid [*Ber.*, **55B,** 4 (1922)] is 9.018 $\pm$ 0.002. This is almost certainly too high, for while beryllium exists to 99.95% as Be(9) and to about 0.05% as Be(8) [Watson and Parker, *Phys. Rev.*, **37,** 167 (1931)], no isotope of mass number greater than 9 has been reported. Assuming the nucleus of Be(9) to contain 2 α particles, 1 proton and 1 electron, an upper limit for its atomic weight is 9.011 (chemical scale). This value has neglected the binding occurring between the constituents of the nucleus, which from disintegration experiments [Chadwick, *Proc. Roy. Soc.* (London), **A130,** 463 (1931)] has a value $5 \pm 2 \times 10^{-3}$ m. u., which is about that expected from the differences in mass defects of corresponding members of the $4N + 1$ and $4N$ series. Assuming this as a mass defect for Be(9), its atomic weight becomes 9.006 $\pm$ 0.002, and correcting for 1 part in 2000 of Be(8) gives *9.005* $\pm$ *0.002* for the atomic weight of beryllium. Since this is 0.013 m. u. less than the present chemical value a redetermination is necessary.

From the probable value of the mass of Be(9) and Chadwick's disintegration experiments we can make a rough estimate of the mass of the neutron(1), which indicates that it is little different from that of its isobar, H(1). If neutrons are formed exothermically from protons and electrons, it would seem highly probable that their formation could be effected in the laboratory and the energy change detected as radiation. The existence of H(2) nuclei [Urey, Brickwedde and Murphy, *Phys. Rev.*, **39,** 164 (1932)] and neutrons(1) suggests that all known atomic nuclei could originate from protons and electrons through a succession of *two body collisions*, *e. g.*, 2H(2) nuclei $\longrightarrow$ 1 α particle, etc.

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KINETICS OF THE THERMAL DISSOCIATION OF GASEOUS ETHYL BROMIDE

Sir:

More exact experimental data on simple reactions are urgently needed for testing theories of unimolecular reactions, particularly with reference to the falling-off of the rate-constant at low pressures. The reaction

$$C_2H_5Br = C_2H_4 + HBr$$

has been studied for several years in this Laboratory, and a preliminary

report by E. T. Lessig is now in press. With improved technique and proper allowance for the reverse reaction, this reaction now appears to be as satisfactory a unimolecular reaction as any yet reported.

The data at pressures above 100 mm. in the range 390 to 420° are well expressed by the formula

$$k = 3.85 \times 10^{14} e^{-54,800/RT}$$

Below 120 mm. k falls off, and at 20 mm. it has only about one-third of its high pressure value. In this low pressure region the reaction appears to be purely second order. Calculations indicate 22 squared terms on the basis of present theories. Theory I of Rice and Ramsperger [THIS JOURNAL, **49,** 1617 (1927)] is not adequate to explain the facts. Temperature coefficients at the low pressures suggest that Kassel's Theory III [*J. Phys. Chem.*, **32,** 225 (1928)] may fit better than Theories II or I.

The addition of nitrogen, and of hydrogen, causes the value of k at low pressures to *decrease*. According to present accepted theories the addition of foreign gases should increase the value of k. Unless some unexpected specific chemical effect exists, the results suggest that certain aspects of present theories of unimolecular reactions should be critically reassessed.

The influence of other foreign gases of increasing complexity is now being investigated.

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THE EINSTEIN RELATION AND TEMPERATURE COEFFICIENT IN THE PHOTOBROMINATION OF CINNAMIC ACID

Sir:

Exact measurements on the photobromination of cinnamic acid, now in progress, show clearly that it is possible to obtain a quantum efficiency of 1 and a temperature effect of zero in agreement with simple photochemical theory, when accompanying thermal reactions are suppressed. They show, too, how the temperature coefficient of the total reaction can vary with the concentration.

The experiments were carried out in a quartz cell of 15-cc. capacity. Light of 4358 Å. was isolated from the spectrum of a capillary quartz mercury arc by means of a monochromator. The change in bromine concentration after fifteen minutes' illumination was measured and compared with the change in the control kept in the dark. The concentration of cinnamic acid was the same in all cases.