	I.	II.	III.	IV.
A=At. Wt. of Pb	206.048	206.046	206.071	206.122
U per cent	c. 72	73.07	66.88	65.28
Th per cent	0.00	0.28	1.89	6.86
U	∞	686.75	93.12	25.04
0.38 Th				
a (Pb ²⁰⁷)	3.20	2.71	2.38	2.92
b (Pb ²⁰⁶)	96.80	97.14	96.56	93.24
c (Pb ²⁰⁸)	0.00	0.15	1.06	3.84
$\frac{100a}{b}$	3.3	2.8	2.5	3.1

I.—Pitchblende, Katanga, Belgian Congo. Analyses, See G. Kirsch: "Geologie und Radioaktivität", p. 171, 1928; At. Wt., Hönigschmid and Birckenbach: *Ber. Deutsch. Chem. Gesell.*, Berlin, p. 1837, 1923.

II.—Uraninite, Morogoro, Tanganyika Territory. Analyses, See G. Kirsch: *op. cit.*, p. 170; At. Wt., Hönigschmid and Horowitz: *Monatsh. f. Chem.*, 36, p. 355, 1915.

III.—Uraninite, Black Hills, South Dakota, U.S.A. Analyses, Davis: *Am. Jour. Sci.* (5), 11, p. 201, 1926; At. Wt., Richards and Hall: *Jour. Am. Chem. Soc.*, 48, p. 704, 1926.

IV.—Bröggerite, Raade, Moss district, S.E. Norway. Analyses, Gleditsch: *Norsk. Vidensk. Akad.*, Oslo, I Mat. Nat. Kl., No. 3, 1925; At. Wt., Richards and Wadsworth: *Jour. Am. Chem. Soc.*, 38, p. 2613, 1916.

In addition to the minerals listed there are some others of Pre-Cambrian age for which analytical and atomic weight data have been recorded. For the lead from the uraninite of Sinyaya Pala, East Karelia, Nenadkevitch gives two atomic weight determinations, 206.02 and 206.11 (*Min. Abstracts*, London, 3, p. 263; 1927). On these results, $100a/b$ is between 0.2 and 10 with an average of 5. The cleveites of the Arendal district investigated by Mlle. Gleditsch (*op. cit.*) give very low or very high results for a , probably because the minerals are altered, in which case the method of calculation is invalid. Similarly, the thorium minerals of Ceylon are unsuitable as a test. They, too, are altered, and for each of them a turns out to be negative. So far as I am aware, only the four minerals given in the table can be appealed to safely for a solution of the problem under discussion.

The ratio $100a/b$, which is the ratio of accumulated Pb²⁰⁷ to accumulated Pb²⁰⁶, is thus found to vary between 2.5 and 3.3. This clearly means that through the greater part of geological time the proportion of Pb²⁰⁷ generated in minerals has been of the same order as that generated at the present time. The adoption of a smaller value for the factor here taken as 0.38 (Kirsch favours a value near 0.25) leads to the same conclusion. There is certainly no indication that Pb²⁰⁷ was produced more rapidly 10⁹ years ago than it is now, and we may therefore conclude:

1. That Aston's estimate of 9.3 per cent for the Pb²⁰⁷ in Norwegian bröggerite is too high to be considered representative;

2. That Rutherford's resulting estimate for the period of actino-uranium is too low;

3. That the periods of both uranium I and actino-uranium are probably of the same order; and

4. That in consequence there is at present no necessity to make any correction for the actinium series in age calculations when uranium has been determined chemically.

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The University, Durham,
July 28.

Catalysis.

It is well known that only a few of the collisions between reacting molecules result in a reaction taking place, a certain 'energy of activation' being necessary to make the collision effective. The reducing factor for the case of three degrees of freedom is $\text{Exp. } (-E/RT)$ where E is the energy of

activation. The value of E appears to be of the order of some tens of thousands, say, 50,000 calories per molecule. For a reaction at 1000° Abs., the index is of the order of -24.

Any cause which reduces the degrees of freedom by unity would reduce this index by one-third part; a reduction of two degrees of freedom would reduce it by two-thirds of its value and if all degrees of freedom were removed the index would disappear entirely. With the above value of E , the exponential factor in the several cases becomes (1) 3.77×10^{-11} (2) 1.12×10^{-7} , (3) 3×10^{-4} and (4) unity, the first being the value met with in normal gas reactions.

Now an adsorbed layer of oriented polar molecules with their proper poles all pointing outwards toward a surrounding gas will tend to swing the colliding molecules round so that instead of it being a question of chance, it may become a certainty that the suitable poles for reaction to take place will be presented to one another; in this case, the rate of reaction passes from the first to the second of the above categories and it is therefore increased in a ratio of about 30,000 and we have a reasonable case of catalytic acceleration. If, further, the forces experienced by an oncoming molecule could swing it round the axis of approach so that it inevitably 'fits' its future partner, a second degree of freedom passes into the category of certainties and we have case (3) and the catalytic activity is multiplied by 10⁹; and so on.

On the other hand, catalytic 'poisoning' occurs when the wrong poles are made inevitably to present themselves. A single layer might be quite effective in stopping a reaction; and a *very much smaller* quantity might reduce the rate a few hundred or thousand times, and this, in commercial practice, is equivalent to stopping it altogether.

It is quite commonly supposed that the facts of catalysis require a reduction in the value of E , whereas the above considerations show that E may remain of its normal value. To point this out is the main object of this letter. There is still considerable mystery enshrouding E . It is taken to be energy which a molecule must acquire before it can be in a reactive state; on the other hand, in the formula, it is calculated from the energy of molecular agitation. The need for a minimum velocity of agitation becomes clearer if we think of the corresponding case of expulsion of electrons by colliding α -particles: only particles of certain minimum velocities can penetrate the atoms to the requisite levels. Something of the same kind may be conceived as taking place in atomic interchange. If so, it is unlikely that the quantity E should change and considerations such as that taken into account in this communication become all-important.

ALFRED W. PORTER.

The Electrical Properties of Active Nitrogen.

WE have recently been investigating the electrical conditions obtaining in active nitrogen, and our findings seem of sufficient interest to justify a preliminary note thereupon. They are as follows:

(1) Removal of all charged bodies from a stream of active nitrogen is without effect upon its chemical properties, or the concentration of the chemically active species. Lord Rayleigh has already found that complete removal of ions from the glowing gas does not diminish its luminosity or its ability to develop spectra of other substances, but no examination has hitherto been made of any possible effects upon the