Hence the probability that for any collision the relative velocity of the molecules normal to the sphere of action shall be less than v is $(1-e^{-\frac{1}{2}hmv^2})$, since $n^2\sigma^2\sqrt{\frac{2\pi}{hm}}$ is the total number of collisions per c.c. per second. Similarly the probability that the relative velocity tangential to the sphere of action shall be greater than u is $e^{-\frac{1}{2}hmu^2}$. Therefore the probability that both these conditions are fulfilled for a particular molecule is

$$e^{-\frac{1}{2}hmu^2}(1-e^{-\frac{1}{2}hmv^2}),$$

and the number of such collisions per c.c. per second will be

$$\mathrm{N}=n^2\sigma^2\sqrt{\frac{2\pi}{hm}}\,e^{-\frac{1}{2}hmu^2}(1-e^{-\frac{1}{2}hmv^2}).$$

Experiments.—The only experimental work which has been done on this subject is by Patterson *, and by Devik †. In Patterson's work the gas was contained in an iron cylinder, and as iron usually contains some radioactive impurity, the number of ions generated per c.c. per second was quite large ($n=61$). He failed to detect any effect of temperature on the ionization up to 400° C., but it is possible that the effect might have been masked by the largeness of the currents measured. Also, as the air in the receiver was always at atmospheric pressure, its density would decrease as the temperature was raised; this decrease in density would decrease the ionization current due to the earth's penetrating radiation and also that due to a radiation of the β or γ type coming from impurities in the walls of the chamber, both of which form part of the total current measured.

In Devik's experiments the gas was momentarily heated by an adiabatic compression, and the ionization measured at the moment of greatest compression. The only gas which showed any signs of ionization caused by the high temperature (estimated at 900° C.) was antimony hydride.

In view of the methods of the above experiments, it was thought worth while to carry out another investigation in which the following conditions should be satisfied:—(1) the ionization-chamber should be airtight: (2) the residual ionization should be as low as possible so that any change would make itself more apparent; (3) the temperature should be kept constant during the time of each reading. Unfortunately, in order to fulfil these requirements the range of

* Patterson, Phil. Mag. vi. p. 231 (1903).

† Devik, *Sitz. d. Heid. Akad. Wiss.* xxiv. (1914).