May 7, 1885.

THE PRESIDENT in the Chair.

The Presents received were laid on the table and thanks ordered for them.

In pursuance of the Statutes, the names of the Candidates recommended for election into the Society were read from the Chair, as follows:—

Baird, A. W., Major, R.E.
Carpenter, Philip Herbert, D.Sc.
Clark, Sir Andrew, Bart., M.D.
Common, Andrew Ainslie, F.R.A.S.
Creak, Ettrick William, Staff Commander, R.N.
Divers, Prof. Edward.
Hicks, Henry, M.D.
Hicks, Prof. William Mitchison, M.A.
Japp, F. R., Ph.D.
Marshall, Prof. Arthur Milnes, M.D.
Martin, Prof. Henry Newell, D.Sc.
O'Sullivan, Cornelius.
Perry, Prof. John.
Ringer, Prof. Sydney.
Vines, Sidney Howard, D.Sc.

The following Papers were read:—

I. "A Study of the Thermal Properties of Ethyl Alcohol." By WILLIAM RAMSAY, Ph.D., and SYDNEY YOUNG, D.Sc. Communicated by Professor G. G. STOKES, Sec. R.S. Received April 18, 1885.

(Abstract.)

The abnormal vapour-density of many compounds has been ascribed to their dissociating to a greater or less degree while in the gaseous state. The compound molecule yields, with increase of temperature, a constantly increasing amount of those simpler molecules into which it dissociates; and as this dissociation is attended with increase of volume, the vapour-density of the mixture of gaseous molecules decreases with rise of temperature.

But this phenomenon is not confined to dissociating compounds alone. It is known that many, if not all, liquids acquire an abnormal vapour-density in proximity to their point of saturation. In studying

the dissociation of a compound, observations regarding its vapour-density, which would apparently lead to a correct estimate of the amount of dissociation under any given constant temperature and pressure, are complicated by the phenomena exhibited by liquids as such; and it still admits of question whether bodies with such abnormal vapour-densities as are displayed by acetic and homologous acids, should have their abnormality ascribed to dissociation; or, less exclusively, it may be asked, how much of this abnormality is to be attributed to the one cause and how much to the other?

To reach a conclusion on this point, it was necessary to study and compare the behaviour of substances belonging to the four types:—(*a*) liquids, the vapours of which are not known to dissociate under the conditions of temperature of the experiment; (*b*) liquids, the vapours of which probably dissociate into like molecules; (*c*) bodies which dissociate gradually in the gaseous state into unlike molecules; (*d*) bodies which dissociate completely on passage into the gaseous state.

The liquid ethyl alcohol has been chosen as a typical representative of the first class, and its behaviour has been fully studied. Numerous measurements have been made which establish relations:—(*a*) between volume of liquid alcohol and temperature at various pressures; (*b*) between volume of liquid alcohol and pressure (compressibility) at various temperatures; (*c*) between volume of unsaturated and of saturated vapour, temperature, and pressure; and (*d*) the heats of volatilisation have been calculated from these data. The limits of temperature extended from 13° to 246°; and the limits of pressure from 10 mm. to 60,000 mm.

The point of chemical importance deduced from this research is that alcohol vapour in contact with liquid acquires its normal density, 23, at about 50°; and that at lower temperatures no tendency towards a rise in vapour-density could be detected; as it will be shown in a subsequent memoir that the vapour of acetic acid, in contact with its liquid, acquires increased density on lowering temperature and pressure, the probable conclusion may be drawn that complex molecular groups are produced in larger number, or exhibiting greater complexity with decrease of temperature. The vapour of alcohol, on the other hand, shows no such tendency.

This research has also shown that the critical point of ethyl alcohol lies at a temperature differing not more than 0·5° from 243·6°, and at a pressure of nearly 48,900 mm., while the volume of 1 gram of the critical fluid is approximately 3·5 c.c.