

also the traction between the interfaces when it is divided: and the mode of calculation of the stress in a sphere of iron in a uniform magnetic field is indicated, agreeing for this case with Kirchhoff. The mutual influence of stress and magnetisation is analysed, with reference to the experimental investigations of Bidwell.

Throughout the memoir care is taken to dispense, as far as possible, with detailed algebraic processes, which are essential for special computations and verifications, but are best evaded in the discussion of general principles. Most of the discussion is also independent of the rotational æther scheme: the great advantage of an interlacing hypothesis of that kind, which remains even when it is only provisional, is that it gives an insight into the character of the formal relations that are possible or probable between the actual physical quantities involved in it.

“On a new Method of Determining the Vapour Pressures of Solutions.” By E. B. H. WADE, B.A., Scholar and Coutts-Trotter Student of Trinity College, Cambridge. Communicated by Professor J. J. THOMSON, F.R.S. Received April 26,—Read May 13, 1897.

(Abstract.)

The measurement of the vapour tension of solutions has hitherto been attended with serious errors. This is especially true of the statical methods, which have alone been capable hitherto of furnishing results at temperatures between 60° C. and 100° C.

The apparatus employed in this research was in conception similar to that described by Sakurai,\* except that it was in duplicate, a divided steam supply passing through two U-tubes placed in parallel. It differed, however, from his apparatus in several important features, which cannot adequately be described in a paper of these dimensions. Suffice it to say that the pressure on the contents of the two U-tubes, being the *same*, could be adjusted to any convenient value, and that the method of thermometry being differential,† the difference only of the boiling points of pure water and solution, in their respective U-tubes was recorded. Two series of experiments were made at a pressure of 760 mm., in one of which a small external heat supply was used to compensate the condensation in the U-tubes, and a second in which this was dispensed with, and constancy in the amount of liquid operated on (which proved to be of the first importance) was

\* ‘Chem. Soc. Journ.,’ 1892.

† Identical with that employed for many years by Mr. Griffiths.

secured by an automatic device. The latter method was much the more satisfactory and regular, and is relied upon for the numbers published.

Neither method, however, gives results differing systematically from the other. Observations were made at reduced pressures as well, and with very satisfactory results, but their publication is deferred.

The substances examined were the chloride and bromide of potassium and sodium, and chlorides of lithium, calcium, and strontium. They were for the most part obtained from Messrs. Harringtons, and their purity confirmed by analyses. As the full details both of the apparatus, observations, and calculations will be published later, the bare results are here stated.

|          | Boiling point,<br>in degrees above<br>100°. | Concentration, in<br>gram molecules<br>per litre. | Ratio. |
|----------|---|---|--------|
| NaCl.... | 0·047                                       | 0·0460  | 1·02   |
|          | 0·070                                       | 0·0685  | 1·03   |
|          | 0·074                                       | 0·0700  | 1·06   |
|          | 0·075                                       | 0·0720  | 1·04   |
|          | 0·118                                       | 0·1130  | 1·02   |
|          | 0·119                                       | 0·1140  | 1·04   |
|          | 0·129                                       | 0·1240  | 1·04   |
| KCl....  | 0·054                                       | 0·0525  | 1·02   |
|          | 0·076                                       | 0·0760  | 1·00   |
|          | 0·084                                       | 0·0820  | 1·02   |
|          | 0·115                                       | 0·1183  | 0·98   |
|          | 0·183                                       | 0·1888  | 0·97   |
|          | 0·193                                       | 0·1970  | 0·98   |
| LiCl.... | 0·057                                       | 0·0575  | 0·99   |
|          | 0·116                                       | 0·1140  | 1·02   |
|          | 0·153                                       | 0·1472  | 1·04   |
| NaBr.... | 0·046                                       | 0·0460  | 1·00   |
|          | 0·051                                       | 0·0525  | 0·97   |
|          | 0·095                                       | 0·1050  | 0·91   |
|          | 0·107                                       | 0·1185  | 0·90   |
|          | 0·160                                       | 0·1750  | 0·90   |
|          | 0·160                                       | 0·1770  | 0·90   |
| KBr....  | 0·056                                       | 0·0529  | 1·06   |
|          | 0·074                                       | 0·0738  | 1·00   |
|          | 0·076                                       | 0·0746  | 1·02   |
|          | 0·088                                       | 0·0921  | 0·95   |
|          | 0·094                                       | 0·0984  | 0·95   |
|          | 0·101                                       | 0·1070  | 0·94   |
|          | 0·139                                       | 0·1500  | 0·93   |

|                           | Boiling point,<br>in degrees above<br>100°. | Concentration, in<br>gram molecules<br>per litre. | Ratio. |
|---------------------------|---|---|--------|
| CaCl <sub>2</sub> , . . . | 0·048                                       | 0·0293  | 1·64   |
|                           | 0·054                                       | 0·0325  | 1·66   |
|                           | 0·073                                       | 0·0485  | 1·51   |
|                           | 0·079                                       | 0·0510  | 1·55   |
|                           | 0·085                                       | 0·0530  | 1·61   |
|                           | 0·102                                       | 0·0645  | 1·58   |
|                           | 0·126                                       | 0·0880  | 1·43   |
|                           | 0·155                                       | 0·1080  | 1·44   |
|                           | 0·169                                       | 0·1240  | 1·36   |
| SrCl <sub>2</sub> , . . . | 0·035                                       | 0·0215  | 1·63   |
|                           | 0·059                                       | 0·0400  | 1·48   |
|                           | 0·083                                       | 0·0565  | 1·46   |
|                           | 0·097                                       | 0·0680  | 1·43   |
|                           | 0·122                                       | 0·0890  | 1·37   |
|                           | 0·145                                       | 0·1105  | 1·31   |

A full discussion must be reserved till a later date, but here we may notice that in all cases the numbers under the heading "Ratio" will be found to be of the same order as those calculated from the theory of Arrhenius (*e.g.*, an electrolyte of type, R'Cl, when fully dissociated, should give a ratio 1·04, and of type, R'Cl<sub>2</sub>, 1·56). But the discrepancy always exceeds the experimental error, except in the case of potassium chloride, and is particularly great in the case of calcium chloride. The latter substance gave less defined boiling points than the others, for some unknown reason, and the experimental error is here certainly at its greatest, but not nearly great enough to account for the difference.

Certain other deductions will be made from these results and others which are accumulating, on a later occasion. My special thanks are due to Mr. Griffiths, for much invaluable assistance, and to Professor J. J. Thomson, for permission to use the Cavendish Laboratory.

"On the Passage of Heat between Metal Surfaces and Liquids in contact with them." By T. E. STANTON, M.Sc. Communicated by Professor OSBORNE REYNOLDS, F.R.S. Received April 7,--Read May 13, 1897.

(Abstract.)

The determination of the rate of transmission of heat from the surface of a heated metal to colder water in contact with it, or from hot water to a colder metal surface, is a problem of some importance