The results of measurements made at 45° have been presented in detail (in Table I). The equilibrium-constant, as given by the expression $(MnO_4^-)^2(OH^-)^4/(MnO_4^{=})^3$, these ion-concentrations being calculated under the assumption that all the substances are completely ionized (or that their ionizations compensate each other), was found to have the value 53 at 45°. The corresponding free-energy decrease attending the reaction as above written is 10,500 joules, and the electromotive force of a cell in which it takes place is +0.054 volt.

Regarding this electromotive force as having the same value at 25°, and combining it with the molal electrode-potential (—0.61 volt) of $MnO_4^{=} + \oplus = MnO_4,^-$ as determined by Sackur and Tagener, the following molal electrode-potentials at 25° were derived.

$$MnO_2(s) + 4OH^- + 2\oplus = MnO_4^{=} + 2H_2O : -0.664 \text{ volt.}$$

$$MnO_2(s) + 4OH^- + 3\oplus = MnO_4^- + 2H_2O : -0.647 \text{ volt.}$$

$$MnO_2(s) + 2H_2O + 3\oplus = MnO_4^- + 4H^+ : -1.757 \text{ volt.}$$

CAMBRIDGE 39, MASS.

NOTES.

[CONTRIBUTION FROM BEDFORD COLLEGE, UNIVERSITY OF LONDON.]

Cottrell's Ebullioscopic Apparatus.—In a recent number of this JOURNAL Cottrell[1] described a modification of the Beckmann method of determining the molecular weight of substances in solution by measuring the elevation of the boiling point. This method was used in a slightly modified form by Read and Washburn[2] for a specific purpose and found to fulfil the demands made upon its excellently. The new method has very much to recommend it, particularly in the greater ease and rapidity with which results may be obtained and also in the accuracy of those results. The apparatus is much less sensitive to small air currents than the original Beckmann apparatus. When put into the hands of students, however, if suffers from one drawback, namely its relatively complicated structure. The permanent attachment of the pump to the inner jacket, makes this portion of the apparatus very fragile in the hands of students with the consequence that breakage or considerable loss of time is the result when it requires cleaning.

Experience with the Cottrell apparatus in the hands of a junior class in experimental physical chemistry has shown that the following slight alterations in the method of fitting up the various parts of the apparatus make it more serviceable in relatively inexperienced hands, and since the changes are all in the direction of saving time and preventing breakage they may be of use to others.

[1] Cottrell, THIS JOURNAL, 41, 721–729 (1919).

[2] Read and Washburn, *ibid.*, 41, 729–741 (1919).

(1) The condenser attached to the boiling tube can, with advantage, be made separate from the jacket and attached by means of a ground joint, which allows the same piece of apparatus to be used for liquids of any boiling point, both high and low; in the former case a spiral air-condenser is used and in the latter any desired form of water condenser.

(2) The pump is made entirely loose from the inner protecting jacket and has its funnel resting on the bottom of the boiling tube, but in order that it may not touch the boiling tube at all points and so lock up a certain portion of the liquid and prevent the projection of the boiling liquid onto the stem of the thermometer, 3 small pellets of glass are fused to points equidistant from one another on the rim of the funnel. Instead of using a 2-armed pump as shown by Read and Washburn a third arm has been added in such a way that the arms are placed at an angle of 120° to one another and are connected at their junction with the funnel tube. Two pellets of glass are fused to each of the upper tubes to prevent them from touching the inner walls of the protecting jacket. This arrangement in addition to giving a more uniform spraying of the thermometer bulb with the boiling liquid also ensures that the pump is held vertically and makes the placing of the thermometer into position a much easier operation.

The apparatus as modified has been used by junior students with uniform success. As an example of the speed with which a determination can be carried out, and the nature of the results obtained by such students the following data from molecular weight determinations may be quoted.

(*a*) *Molecular Weight of Azobenzene in Chloroform Solution.*—Using 64.6199 g. of chloroform and 0.4667 g. of azobenzene, the boiling point of the solvent was obtained in 17 minutes from the time the flame was placed under the cold apparatus. The solution gave a constant boiling point 8 minutes after the flame was replaced. The molecular weight calculated from the results was 180.

(*b*) *Molecular Weight of Azobenzene in Acetone Solution.*—Using 32.4620 g. of acetone and 0.3962 g. of azobenzene, the boiling point of the solvent was obtained in 14 minutes and that of the solution in 9 minutes. The molecular weight calculated was 181.5.

JAMES FREDERICK SPENCER.

LONDON, ENGLAND.

Correction.—"A Study of the Saturated Potassium Chloride Calomel Cell."[1] The authors of the article wish to state that through error on their part certain values are incorrectly given in Table VII, p. 2452. Wherever the values 0.3007, 0.3008 or 0.3009 volt occur in this table, they should be, respectively, 0.3097, 0.3098 or 0.3099 volt. In this regard compare the values given in Tables IV and V, pp. 2443 and 2444, for Combination 8 at 25°.

HAROLD A. FALES.

[1] THIS JOURNAL, **42**, 2452 (1920).