

THE MEYER MOLECULAR WEIGHT CALCULATION.

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In the Victor Meyer method of determining molecular weights of vaporizable substances, as usually carried out, the material is converted into vapor at the bottom of the inner tube, the latter being kept at a constant temperature at least twenty degrees above the boiling point of the substance by keeping a suitable liquid in the outer jacket steadily boiling. When the vaporizing occurs, a quantity of air equal to the increase in volume is forced out from the upper part of the inner tube, through the lateral capillary, and collected over water in a eudiometer. It is assumed that this increase in total volume is the volume of the vapor; it would be more correct to deduct from this volume that of the original liquid, but failure to do so introduces an error of usually only one part in two hundred or more, and this may be considered negligible in view of unavoidable experimental inaccuracies.

In passing from the heated tube to the eudiometer the temperature of the air changes to that of the room, with a corresponding volume change; it is assumed that the vapor would undergo the same change in volume if reduced to the same temperature without condensation, since all gases and vapors show a nearly identical behavior with changes in temperature.

After passing into the eudiometer the air is saturated with water vapor. If the air in the inner tube at the beginning of the experiment is already saturated with moisture at room temperature no change in the degree of moistness results, and hence no change in volume due to this cause. It would therefore be incorrect in calculating the volume of air under standard conditions to deduct from the observed barometer reading the tension of aqueous vapor.

If, on the other hand, the air in the apparatus had been perfectly dry its volume is increased by its becoming saturated with moisture, and this should be allowed for by deducting the tension of aqueous vapor from the barometer reading.

If, lastly, the air in the apparatus at the beginning of the experiment

is neither saturated at room temperature nor perfectly dry, the change in the degree of moistness of the air on becoming saturated is what the air originally lacked of being saturated. The appropriate correction to introduce is that fraction of the tension of aqueous vapor for the room temperature which it lacked of saturation. Suppose the apparatus was originally filled with the air of the room, and that it was forty per cent. saturated at room temperature, sixty one-hundredths of the tension of aqueous vapor is the number to be subtracted from the observed barometer reading; the corrected reading is $B - \frac{100 - H}{100} w$, in which B is the barometer reading, H is the hygrometer reading in per cent., and w is the tension of aqueous vapor for the room temperature.

Nearly all works accessible to the author give such directions for the manipulation as involve the use of the air of the room in the inner tube, yet give for the calculation the correction B-w. The error introduced in this way would be greatest if the air were saturated with moisture, and would then amount at a room temperature of 20 deg. C. to 17 in approximately 760, or 1 in about 45, and this condition is closely approached in damp, warm weather. Omitting the correction altogether when the air used is nearly dry gives an equal error in the opposite direction, approximated in very cold weather.

A quite appreciable error, then, may be avoided and the calculation made more nearly correct theoretically by using the correction given above.

Of the works accessible to the author only H. Erdmann's *Anorganische Chemie* discusses the correction, directing that if the apparatus is filled with a dried gas the tension of aqueous vapor should be deducted; if with ordinary air, no correction should be made. All other works fail to consider the point, some deducting the tension, others not, without specifying the conditions.