

Quinolinium Mercuric Iodide, $2C_9H_7NH.I.HgI_2$.—Quinoline like pyridine forms this type of salt and is obtained as a yellow precipitate, which was washed and dried in the desiccator.

0.3050 gave 0.0706; $Hg = 19.95$; $2C_9H_7NH.I.HgI_2$ requires $Hg = 20.66\%$.

Trimethylsulfonium Mercuric Iodide (a), $2S(CH_3)_3.I.HgI_2$.—This is obtained as a white precipitate by adding potassium mercuric iodide to an excess of a strong solution of trimethylsulfonium iodide. The salt is sucked to free it from the adhering mother liquor.

0.2907 gave 0.0773 HgS ; $Hg = 22.92$; $2SC_3HgI.HgI_2$ requires $Hg = 22.83\%$.

Trimethylsulfonium Mercuric Iodide (b), $2S(CH_3)_3.I.HgI_2$.—To a dilute solution of trimethylsulfonium iodide, a solution of potassium mercuric iodide is added, when a white flocculent precipitate is first formed, which turns faintly yellow by adding more of the potassium mercuric iodide solution. Finally, an excess of the reagent was added. The salt is dried at 100° and had a faint yellow tinge.

0.1949 gave 0.0747 HgS ; $Hg = 33.01$; $2SC_3HgI_3.HgI_2$ requires $Hg = 32.79\%$.

Smiles obtained a salt of the type $S(CH_3)_3.I.HgI_2$, as pointed out before. So trimethylsulfonium iodide altogether forms three types of salts: (1) $2S(CH_3)_3.I.HgI_2$, (2) $S(CH_3)_3.I.HgI_2$ and (3) $2S(CH_3)_3.I_3.HgI_2$. Of these the salt No. 3 is the most stable, since the first salt is transformed into the third with excess of water and the salt No. 2 has to be prepared from acetone solutions.

Now ammonium iodide forms a salt of the type $2NH_4.I.HgI_2$ ¹, but this and also the salts with the alkali metals are decomposed by water into pure mercuric iodide. The same type of salt is also formed with the substituted ammonium bases but on treatment with water, they pass into the more stable type, *viz.*, $2NR_4.I_3.HgI_2$. In the case of very heavily substituted bases, the stability of the type $2NR_4.I.HgI_2$ is so great that they do not pass into the other variety when treated with water. So there is noticeable a remarkable transition of the stability of the double salts.

Investigations on similar lines are being continued.

My thanks are due to Prof. P. C. Ray for the interest he has taken in the above investigation.

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A COMBINATION SPECIFIC GRAVITY BOTTLE AND DILATOMETER.

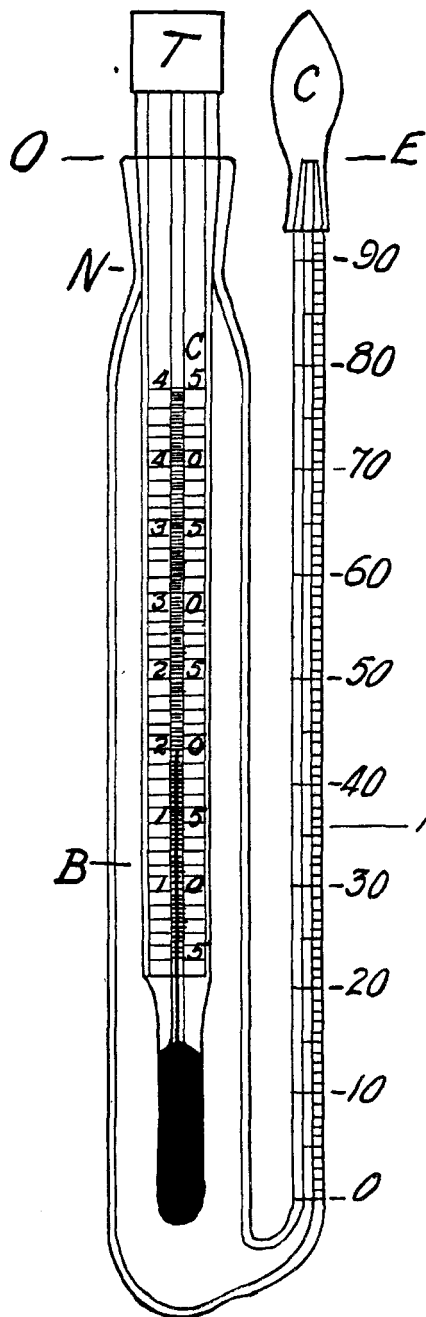
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For determining the changes in specific gravity and volume which sugar solutions exhibit under varying conditions, the writer has made use of a combination specific gravity bottle and dilatometer. As the instrument

¹ Doubin, *Compt. rend.*, **141**, 385 (1905).

can be employed for various laboratory purposes, the following description may be of interest:



The accompanying sketch, which is drawn to exact size, shows a narrow tubular body, B, holding about 30 cc., connected at the bottom with a graduated capillary tube, A, and contracted at the top to an opening at O. The latter is made slightly funnel-shaped and is carefully ground on its inner surface so as to receive the thermometer T, which is also ground above its scale so as to fit perfectly tight after insertion. The displacement of the thermometer is about 7 cc., which leaves a capacity of about 23 cc. for the instrument after stoppering.

The end of the capillary tube at E is ground and fitted to a small cap, C. The scale, upon which the changes of volume are measured, is graduated so that 1 division equals 0.001 cc.: by means of a magnifying glass, readings can be made to 0.0001 cc. Capillary tubing is manufactured of very uniform calibre so that the graduation can be made with accuracy.

A few weighings of the instrument, after filling with air-free distilled water to different points of the scale at different temperatures, are sufficient for constructing a table of water constants for each scale division and temperature. The ground-glass surfaces should be lightly coated with vaseline to prevent all possibility of loss from evaporation. The instrument, when filled with water and stoppered, should show no loss in weight after a week's standing. In making weigh-

ings the bottle may be placed in a support, or it may be attached to the hook of the balance beam by means of a loop of wire wound about the neck at N.

For determining specific gravities the method of operation is the same as with an ordinary pycnometer. If it is desired to determine the specific gravities of a solution at different temperatures, one filling of the instrument and one weighing only are required. After filling the apparatus the meniscus in the capillary tube is adjusted by means of a thin, tightly wound strip of filter paper to a convenient position upon the scale and the whole is weighed. The instrument is then placed in a constant temperature chamber (such as an incubator) and as soon as the thermometer and meniscus readings remain constant the observations are noted. By raising or lowering the temperature and noting the changes in position of the meniscus, the specific gravities and coefficients of expansion or contraction may be readily calculated. The position of the meniscus is easily affected by very slight changes in temperature, so that the instrument is best handled by placing it in a stoppered glass cylinder.

The writer has found the above apparatus to be very convenient for measuring the contraction which sugar solutions undergo during hydrolysis or inversion. The instrument is filled with the freshly prepared solution of sugar and hydrolyzing agent (such as acid, invertase or other enzyme) at the desired temperature of the experiment, the meniscus is set at some division high upon the scale and the whole is weighed. After placing in the constant temperature chamber the progressive changes in volume and specific gravity are easily followed. Since 100 cc. of a 1% sucrose solution undergoes a contraction during inversion of very closely 0.02 cc., the approximate percentage of sucrose may be estimated by noting the change in volume which a solution undergoes upon treatment with invertase or mineral acids. While this method of estimating sucrose has not the same degree of accuracy as calculations based upon determinations of polarizing or copper-reducing power before and after inversion, the method may be used in certain cases as a confirmatory one.

The instrument has also been employed by the writer to demonstrate the contraction in volume which sugar solutions and water undergo when mixed together. The evidences of such a contraction have rested mainly upon theoretical grounds, Olizy,¹ among other chemists, claiming that no change in volume can be detected by actual experiment. That the phenomenon does occur, however, is easily shown by pouring a concentrated sugar solution into the apparatus, above described, to a depth of one or two inches, filling carefully with distilled water without mixing, stoppering, setting the meniscus, and, when temperature equilibrium is

¹ *Bull. assoc. chim. suc. dist.*, 27, 60.

reached, reversing. As the sucrose solution and water mingle a very pronounced contraction in volume is noted.

In case it should be desired to increase the capacity of the instrument, the thermometer may be replaced by a ground glass stopper. It is more convenient for purposes of reading to keep the apparatus always in an upright position. The instrument may, however, be placed in a horizontal position or may even be reversed without disturbing the position of the meniscus.

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NOTE.

The Meyer Molecular Weight Calculation.—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 20° 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 pressure of the aqueous vapor.

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

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