the chlorine ion which is generally applicable to large and small quantities of chlorine in acids olution. Of course the method should serve equally well for bromide ion.

Summary.

1. In this paper is described the direct electrometric titration of iodide with bromate and dichromate, and the indirect titration of bromate with the aid of permanganate; also the determination of nitrite and chloride ion.

2. The direct titration of iodide with bromate or dichromate can be done accurately in at least 2 N sulfuric acid solution, but much time is required to reach the true end-points, and the indirect titration, ending with permanganate, is preferred.

3. In earlier work titration of iodide with permanganate or iodate in hydrochloric acid solution was found impracticable. Accurate titration of bromate or dichromate in this medium is found impossible.

4. The method for nitrite requires solutions of known concentration of iodide and permanganate, both essentially permanent and both determinable by reference to the same standard, namely, sodium oxalate. The method eliminates error from supposed incomplete reduction of permanganate by hydriodic acid, or from the presence of any chloride or iodate in potassium iodide.

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NOTES.

A Rapid Method for Determining the Density of Air.—This method depends upon the measurement of the buoyant effect of the air upon an object of considerable volume.[1] A sealed globe of known exterior volume is weighed under accurately known conditions of temperature, pressure and humidity. From the conditions, the density of the atmosphere at the time of weighing and the buoyant effect of the air upon the globe and weights are computed. By adding the difference between the buoyant effect on the globe and on the weights to the weight of the globe in air, the weight of the globe in vacuum is found.

If the globe is weighed in the air under any conditions, the weight of air displaced by the globe in excess of that displaced by the weights is readily found by subtraction from the weight in vacuum. This difference divided by the volume of the globe less the volume of the weights yields the atmospheric density; or the desired result may be more conveniently read from a graph in which the apparent weight of the globe is plotted against atmospheric density.

[1] The buoyancy method of determining gas density has frequently been applied. See, for example, Jacquerod and Tourbaian, *J. chim. phys.*, **11**, 3, 269 (1913); Edwards, Bur. of Standards, *Tech. Paper*, **89** (1917).

If the difference between the volume of the globe and the volume of the weights is exactly 100 cc., the difference between the weight of the globe in vacuum and the weight in air is obviously the weight of 100 cc. of air under the conditions of weighing. Such a globe is conveniently adjusted by finding the volume of weights necessary to compensate for the excess in volume over 100 cc. of a globe slightly larger than this, and then, before sealing the globe, introducing a quantity of mercury or other substance sufficient to bring the weight of the globe up to that of the weights.

Since the air displaced by a 100-cc. globe weighs 0.12 gram, an accuracy of about 0.1% is attainable. The use of a larger globe, while it increases the weight of air displaced, also increases the surface of exposed glass and the uncertainty due to condensed moisture. This difficulty could be in part avoided by comparing the globe in every case with a counterpoise similar in exterior surface but open to the atmosphere.

The effect of temperature on the volume of the globe can be neglected since it amounts to only 0.003% per degree.

The following table presents data obtained by making occasional observations upon a globe left permanently in a balance case.

Volume of globe = 144.3 cc.
Volume of weights = 3.1 cc.
Difference = 141.2 cc.

$$\text{Density of air} = 0.001293 \times \frac{\text{Bar.} - {}^3/_8\text{ aq. ten.}}{760} \times \frac{273}{273 + t}.$$

Weight in air. G.	Bar. Mm.	Temp. °	Humidity.	Weight in vacuum. G.	Density of air observed.[a]	Density of air calculated.[b]
24.1521	766.0	19.6	56	24.3230	0.001210	0.001210
24.1524	766.3	20.2	55	24.3230	0.001208	0.001208
24.1493	773.2	17.8	53	24.3230	0.001230	0.001230
24.1506	767.2	17.6	52	24.3231	0.001221	0.001222
24.1493	770.1	16.6	54	24.3230	0.001230	0.001231
24.1517	762.3	17.7	53	24.3230	0.001213	0.001213
24.1507	765.3	17.0	54	24.3231	0.001220	0.001221
24.1450	776.2	12.1	50	24.3231	0.001261	0.001261
24.1548	753.4	19.2	56	24.3231	0.001191	0.001192

[a] Calculated from the average weight in vacuum, 24.3230 g.
[b] From the conditions existing at the time of weighing.

This method is of great convenience in determining the vacuum correction where objects of low density are being weighed in air. The globe is kept in the balance case and weighed immediately after completing the weighing of the object.

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The Repair of Crystallized Glass Apparatus.—Ever since Germann's timely article[1] on "The Devitrification of Glass" appeared, I have been expecting to see a note calling attention to the very simple method used by the Johns Hopkins University glass-blower for curing devitrified glass. This consists of merely holding the nearly melted glass in a sodium flame for a few seconds until the frosted appearance disappears. All that is necessary is a piece of Pyrex tubing wrapped with a few layers of asbestos paper saturated with salt solution. If one will hold this swab in his blast-lamp flame in such a position that the sodium vapors envelope the devitrified glass the crystallization will usually disappear by the time the glass is soft enough to work. With very badly devitrified tubing the above procedure sometimes fails, but as a general thing it is entirely satisfactory.

I lay no claim to this as a discovery of mine, as it was shown me by one of my former assistants, Dr. T. C. Whitner, who, I understand, picked it up while at Johns Hopkins. It has been found such a great help, however, in working old glass and repairing apparatus that I feel it should be passed on for the benefit of others who may be affected with the glass-blowing disease.

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The Use of Acetylene in Glassblowing.—My laboratory being beyond the reach of city gas, I have been using acetylene, at the suggestion of Professor G. P. Baxter, and have found it so satisfactory for glassblowing work with Pyrex glass that I wish to suggest its use for that purpose even where illuminating gas is on tap. The gas comes in small cylinders for automobile use which may be purchased and exchanged at almost any garage or supply house at any time, evenings and Sundays included. Each tank has its own pressure gage and needle valve, and no extra regulating appliance is needed. When several burners are used at once, however, it would be better to obtain one of the larger tanks used for welding, and to equip it with a regulating valve.

The great advantage of acetylene over coal gas is that no accessory supply of oxygen is required. An ordinary glassblower's torch fed with acetylene and compressed air gives a flame in which Pyrex glass can be worked rapidly and easily. The torch is much more easily controlled than when fed with illuminating gas, air, and oxygen, each of which requires a separate cock, and there is no possibility of forcing oxygen back into the air line. Owing to the high pressure of the gas, a small torch can be made to give an enormous flame when required.

[1] THIS JOURNAL, **43,** 11 (1921).

For many operations not requiring a finely pointed flame, even the compressed air may be eliminated. A small torch on the principle of the Bunsen burner is made commercially with which joints, bulbs, and constrictions can be readily made. This is very useful in work on apparatus already set up, as the torch is much smaller and more easily manoeuvered than a 2-pipe torch, and is fed by a single small tube from the tank, which may be placed in any convenient position, while the high pressure prevents the gas from being cut off suddenly by the kinking of the tube.

The only disadvantage of acetylene is that if the air supply is cut off even for a few seconds a very disagreeable flocculent smoke is produced. For this reason it is necessary always to turn on the air before lighting the gas, and to turn off the gas first when extinguishing the torch.

For soft glass acetylene is not suitable, as the flame is too hot, and it is not possible to produce a smoky flame for warming up and annealing without filling the room with soot.

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[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF MIAMI UNIVERSITY.]

ESTERS OF AMINOBENZOIC ACIDS.

BY HARVEY C. BRILL.

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One of the simplest members of this class of compounds, namely, ethyl *p*-amino-benzoate[1] has been known for some time, possesses marked anesthetic properties and is used as a dusting powder on wounds.[1] A whole series of this class of pharmaceuticals has been prepared and their properties described by Einhorn and Heinz.[2] These investigators found all the compounds studied by them to have anesthetic properties to various degrees.

Apothesin and procaine,[3] two of the most powerful local anesthetics on the market, have structures related to this series.

To learn more of the series, the *n*-butyl esters of *p*-aminobenzoic acid,[4] *m*-aminobenzoic acid, *o*-aminobenzoic acid, 2,4-diaminobenzoic acid, and 3,5-diaminobenzoic acid; the allyl ester of *p*-aminobenzoic acid;[5] the *iso*-propyl ester of *p*-aminobenzoic acid; the ethyl ester of 3,5-diaminobenzoic

[1] D. R. P. 147,580 and 147,790.

[2] Einhorn and Heinz, *Münch. med. Wochschr.*, **44**, 931 (1897).

[3] Wildman and Thorp, U. S. pat. 1,193,649; Kamm, THIS JOURNAL, **42**, 1030 (1920).

[4] Brit. pat. 148,743. Announcement in C. A., **15**, 240 (1921).

[5] Adams and Volwiler, U. S. pat. 1,360,994. Announcement in *C.A.*, **15**, 575 (1921). The notice of Brit. pat. 148,743 appeared after this article was in the hands of the typist, while notice of U. S. pat. 1,360,994 appeared after it was sent to the Editor.