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Some Improved Laboratory Methods

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SOME IMPROVED LABORATORY METHODS.

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Three laboratory experiments for students in beginning chemistry are here submitted in the hope that they may be found useful to other teachers of chemistry as they have been helpful in the author's laboratory.

1. *Bleaching powder, potassium hypochlorite and potassium chlorate* may be prepared in one experiment by use of the apparatus illustrated in figure 167. In the flask is evolved chlorine

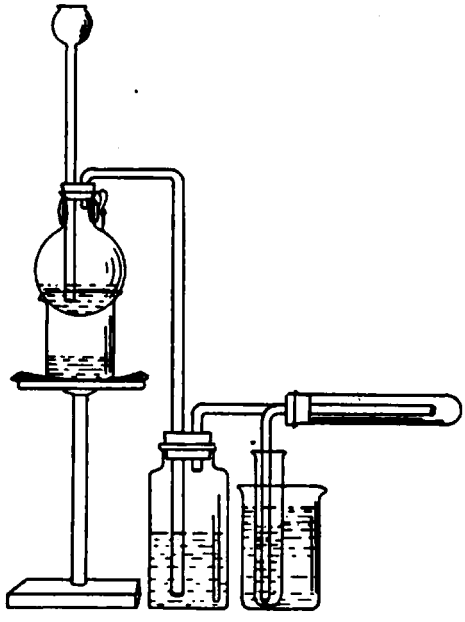

Fig. 167

in the usual way by use of manganese dioxide and hydrochloric acid. The gas passes into the bottle which contains diluted sulfuric acid, in the proportion, 1 of water to 4 of acid by volume. Acid of this concentration will absorb most of the water and gaseous hydrochloric acid. The horizontal test tube contains about three grams of lime spread evenly throughout the length. The excess of chlorine passes from this tube into the second test tube which contains a solution of five grams of potassium hydroxide in fifteen c.c. of water. This tube must be kept cool during the first part of the operation. After two to three liters of chlorine have been passed through about one-third of the con-

tents of tube two should be set aside as a solution of potassium hypochlorite. The remainder is heated to boiling and the stream of chlorine passed through it for a few moments. One to two grams of potassium chlorate will crystallize out on cooling, and it should be purified by crystallization. The characteristic reactions of both salts should be brought out by suitable tests.

2. *The preparation of Sulfuric Acid*:—Probably most teachers who have used the usual cumbersome apparatus for laboratory illustration have found it disappointing and wanting in reality. The apparatus shown in figure 168 has been successfully used in this laboratory.

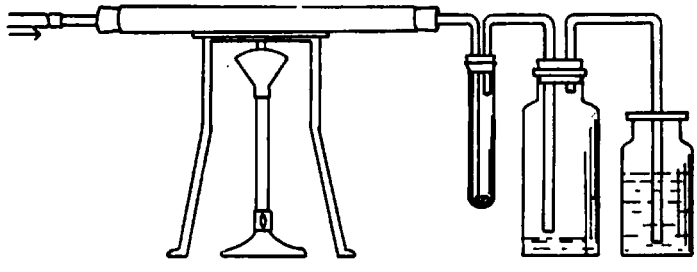

Fig. 168

The great European war has made difficult or impossible the securing of good combustion tubing. Ignition tubes of hard glass have always been expensive and hard to get ready made. For them the writer has substituted tubes made of half inch gas pipe for general use in experiments requiring high temperatures, such as in the preparation of nitrogen dioxide by heating lead nitrate, methane, oxygen from potassium chlorate alone, ammonia. In all these cases is used a piece of pipe ten inches long capped at one end while the other end is reamed to take smoothly a rubber stopper.

In the ignition tube, figure 168, is placed ten to twenty grams of granulated iron pyrite. The test tube contains about three c.c. of concentrated nitric acid. The larger bottle may be used with only its walls wet if it is desired to produce the "chamber crystals"; otherwise it should have its walls wet, and a few c.c. of water on the bottom. The second bottle has an alkaline solution to absorb the excess of gases, but is really not necessary. Air is forced through from the pressure system. If no such system is available the exhaust system or filtering pumps may be used. One lamp is sufficient. Once the combustion is started little external

heat is required, and too high a temperature drives off unburned sulfur.

At the end of about twenty minutes the contents of the larger bottle and the test tube with rinsings should be evaporated till the fumes of sulfuric acid appear. A run of even ten minutes will give three to four grams of concentrated sulfuric acid.

3. *Conductivity of Electrolytes.*—It is very desirable to have every beginning student do some work on electrical conductivity and electrolysis. Probably every teacher who has tried to have large numbers of beginners do work in this line has felt the need of a suitable conductivity cell. A cell with platinum electrodes

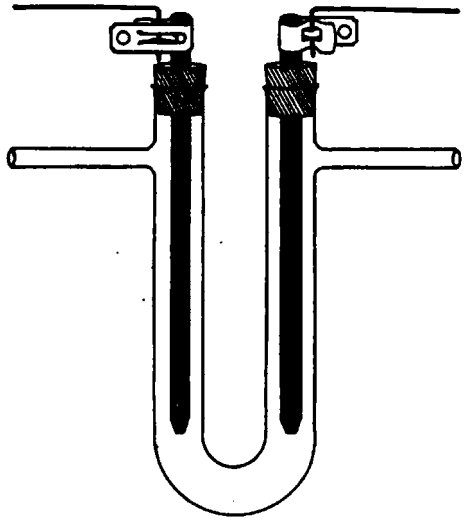

Fig. 169

at the present price of platinum is practically out of the question, and we are limited to carbon for this purpose.

A conductivity cell which the writer has used with great satisfaction is shown in figure 169. The only merit he claims is the discovery that the spring binding post or connector of the Fahnestock Electric Company, Long Island City, New York, has just the right bend to clamp firmly a three-eighth carbon rod. This connector and wire as shown makes a perfect union of the rod and the source of electricity: The cell may be used in many ways. Delivery tubes may be attached to the side arms of the U tube and the cell used to illustrate the so-called electrolysis of water, test tubes of the same diameter serving to collect the hydrogen and oxygen. Copper may be deposited on the negative electrode.

In using the cell in comparative conductivity in this laboratory several taps are provided. At each is a lamp socket so that the direct lighting current may be cut down with lamps of various resistances. The glow of the lamp itself gives a rough quantitative measurement of the strength of current transmitted by the cell, but in addition it is better to introduce ammeters reading as low as one one-hundredth of an ampere. In each test the cell is filled to the same height as indicated by some suitable mark, such as gummed paper. Tenth normal solutions are made up in quantity for general use. The following have been found instructive: hydrochloric acid, sodium chloride, acetic acid, sodium acetate, ammonia, sodium hydroxide, distilled and ordinary tap water.

The experiment offers a good opportunity for the review of electrical terms and relations. Knowing the wattage of the lamp and the electromotive force of the current the resistance of the lamp may be calculated. The current transmitted by the lamp alone may be calculated and the result verified by the ammeter. From the current transmitted by both lamp and cell the resistance and conductivity of the solution in the cell may be calculated.

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