The Laboratory

Some Suggestions for Home Experiment

Some Simple Catalytic Experiments

By Philip Edelman

THE following are but a few of the countless experiments which may be performed in catalysis, and will be found within the means of the home experimenter.

There are certain substances called catalysts which, although they may appear inert in a container, have the power, without themselves undergoing any permanent change, to regulate the actions which may take place in it. For this and other reasons catalysts are very interesting. Like a general controlling a large army, a small portion of a catalyst can control the chemical changes of large quantities of substances.

1. Put a few violet chromic chloride crystals into a test tube half filled with water. The crystals being insoluble will not dissolve, even if left in the water for some time. Now introduce a catalyst into the tube in the form of a minute particle of chromous chloride, and the violet crystals at once dissolve, forming a dark blue solution. The particle of the chromous chloride used is exceedingly small (0.00003 of one gramme being sufficient) yet it makes the insoluble crystals at once soluble. This illustrates physical catalysis, the chromic chloride merely passing into solution.

2. Put a few small pieces of tin into a test tube half filled with hydrochloric acid. There should be no action apparent. Now put a drop of a solution of platinum (see experiments under 3, for the preparation) into the tube, and the catalyst, in the form of platinum this time, at once causes the acid and tin to interact vigorously. The merest trace of platinum controls this action. This experiment illustrates chemical catalysis.

Catalytic substances are ever working throughout all animal and vegetable life. Common yeast is a good example of an organic catalyst, a small quantity being able to change a large amount of sugar into alcohol.

This brings us to the catalytic agents known as colloids. Colloidal suspensions remain distributed in liquids like true solutions without settling to the bottom of the container. They consist of very finely divided particles mechanically suspended in the liquid, from which they cannot be separated by filtering.

3. Metallic colloids can be prepared as follows: Into a clean evaporating dish or similar container put some distilled water. For colloidal platinum some pieces of wire or scrap will do. Fasten these platinum wires to the terminals of a battery or generator, as shown in the cut. Adjust the rheostat so that a flow of ten amperes at forty or forty-five volts is available at the terminals. Dip the platinum terminals into the pure water with your hands. Now bring the wires very near to each other, so that an arc forms beneath the surface of the liquid. You may have a little difficulty in starting the arc, but after the platinum points get heated, the arc can be intermittently maintained. Little clouds emerge into the liquid at each flash until the liquid becomes colored with the finely divided platinum particles. The preparation is complete when the liquid becomes a dark brown-black shade, and should not be continued further.

For gold, the colloidal gold is prepared in a similar manner. Pieces of gold from old spectacles, etc., are suitable and should be preferably 14-carat or more. The gold gives a pleasing ruby-colored solution.

Silver, aluminium, copper, and other metals can be treated in the same way. In each case finely divided particles of the metal are emitted into the water from the arc and held suspended in it. The resulting liquids in each case are not true solutions, but are colloidal suspensions.

4. Peroxide of hydrogen is a compound of water and oxygen. This compound is unstable and gradually de-

Preparation of colloidal platinum.

composes. The decomposition is very suddenly accelerated by the addition of a minute drop of the colloidal platinum. In this respect the colloidal platinum acts very much like a drop of blood. You can try this with a drop of your own blood. The resulting effervescence is caused by the catalyst called "hæmase," which is a colloidal suspension in the blood.

5. Vary experiments under 4 by increasing the temperature, by cooling, etc., using both the blood and the colloidal platinum. Certain substances commonly called poisons have the property of retarding or stopping the action of colloids.

6. Pour a few drops of mercury into a clean test tube and pour a little of the peroxide (diluted) over it. The mercury is the catalyst in this experiment, and it causes the peroxide to decompose by its presence. But this is not all. The decomposition occurs intermittently. First a brown film gathers on the surface of the mercury. Then the oxygen is liberated. This action is repeated periodically.

Home-made Chemical Fire Extinguisher

By W. J. C.

THE fire extinguisher made from the following directions will be found to be not only remarkably efficient in preventing the spread of a fire, but simple of construction and inexpensive. The material required

Details of the home-made fire extinguisher.

is a piece of 3-inch O. D. brass tubing 13 inches long, A; a piece of 2 1/2-inch O. D. tubing about three inches long, B; a piece of brass about one-thirty-second inch thick, and 2 11/16 inches in diameter, K; two 3-inch caps, E and D, to fit 3-inch tubing; a 1/8-inch pet cock, F; a 1/8-inch plug, G; an old bicycle pump, C, and a valve, J, similar to an inlet valve on a tire.

The brass plate or disk K is soldered into B to form a bottom, and the whole is wrapped with lamp wick so as to form a tight fit in the larger tube. The cap E is tapped for a 1/8-inch pet cock F, the opening in which should not be over one-thirty-second inch; the cap is then screwed or soldered on the tube A. The other cap D has the bicycle pump soldered into the center, extending about four inches beyond the cap. A plug G is also tapped into cap D. The small tire valve is soldered to the pump at J, so as to act as a non-return valve. The cap carrying the pump is screwed or soldered to the tube A, and the apparatus is complete. In order to fill the machine, proceed as follows: Remove the plug G, which acts as a vent. Remove the pet cock F, and with a stick push the sliding tube B to about 8 1/2 inches from the opening. Now replace the plug G, and with a funnel fill the front part of A with the extinguishing chemical, after which replace F and close the pet cock. Now pump up a pressure in the end of tube A until the pump works hard and the machine is ready for use.

If all joints have been made tight the extinguisher will hold its pressure indefinitely, and will always be ready for instant use. It should be kept in a vertical position, the pump being on top.

When occasion arises to use it, all that is necessary is to open the pet cock F, when a stream of the extinguishing fluid will issue with pressure enough to carry a distance of 30 feet. As there is no pumping to be done, the device may be held steady and aimed accurately. The entire thing can be held in one hand, allowing the use of the other to pull down curtains and remove obstructions. The best solution for this extinguisher is tetrachloride.

Maintaining a Constant Level in Batteries

By William D. Munger

THE difficulty of maintaining a constant level of electrolyte in the wet type batteries, especially storage batteries, may be obviated in a very simple manner.

Secure a bottle with a large long neck, fill with water, hold your finger or a piece of iron shaped like a hoe over the mouth, and invert, placing the mouth well under the top of the electrolyte in the battery. Now withdraw the bottle so that the mouth is 1/16 inch or so above the desired level of the electrolyte, and fasten the bottle in that position.

When the level of the electrolyte is reduced by evaporation, 1/16 inch or so, air will be let into the bottle and water will run into the battery till the level is restored.

A New Method for the Determination of Sulphur in Pyrites and Pyrrhotite

By L. Shumacher

BY common consent Prof. Lunge's method for the determination of sulphur in pyrites and pyrrhotite is considered the best. While it gives the most exact results, it is also the most tedious of all methods.

Lunge states that the silica must be filtered out and washed, and also the iron precipitate, before separating the sulphur. This operation requires a very long time.

In his experience extending over a number of years, the author has found that by the method described below the results, equalling those of the standard method, can be obtained in one-third the time. The washing of the silica and iron precipitate can be dispensed with completely, and at the same time the danger of cracking the filter during the hot lixiviation is avoided. In acid factories, at mines, and in other places where analyses have to be performed daily, a great saving of time will be effected by the use of the shortened method.

Place one-half gramme of finely powdered pyrites in a porcelain casserole and add 10 cubic centimeters of aqua regia (three-quarters nitric acid and one-quarter hydrochloric acid). Allow to stand for about fifteen minutes in a warm place, evaporate to dryness, add six cubic centimeters of concentrated hydrochloric acid, and evaporate again. When the residue is cold add 90 to 100 cubic centimeters of hot five per cent hydrochloric acid solution, and let the liquid stand until it is dark green. Then pour into a 250 cubic centimeter flask, wash off the funnel, and precipitate the iron with 6 cubic centimeters of ammonia. Make up the solution in the flask to 250 cubic centimeters with water, and mix well by shaking. Filter off 100 cubic centimeters and place it in a beaker. Add 2 cubic centimeters of concentrated hydrochloric acid, boil and precipitate with 10 cubic centimeters of hot ten per cent solution of barium chloride. Filter, dry, ignite, and weigh.

Factor and Multiples for Computation.

1.....	0.0687	6.....	0.4122
2.....	0.1374	7.....	0.4809
3.....	0.2061	8.....	0.5496
4.....	0.2748	9.....	0.6183
5.....	0.3435		

Example:

Found 247 grammes barium sulphate..	13.74
	2.748
	0.4089

Sulphur 16.8969

By this method one man can easily make fifty analyses in a day, and these, if carefully made, agree with the results obtained by Prof. Lunge's method.

It may be added that there is no need of adding one or two drops of nitric acid in the ignition. This precaution, which is often recommended, does not bring any advantage.

Simple Lifter for the Laboratory

By George A. James

A VERY convenient little device for the home laboratory is illustrated herewith. It consists of a detachable handle for lifting receptacles such as evaporating dishes and the like. The lifter is made of a heavy piece of wire bent to the shape indicated in the drawing. One end is curved to fit against the outside of the

Lifter for an evaporating dish.

dish, while the other end fits over the rim inside. The parts that come in contact with the dish are rubber covered, two short pieces of rubber tubing being slipped over the wire. The device is so useful, and can be made so quickly and cheaply, that it should find a place in every amateur's laboratory.