Hints for Beginners

Join in the Fun of Experimenting at Home! This Article Tells How Easy It Is to Start

By RAYMOND B. WAILES

Easily made test-tube rack, with wire bracket for filtering

IF YOU have been following this series of articles for some time, you probably have already set up a more or less complete chemical workshop in which to carry on your experiments. However, there is always a new crop of beginners coming along—newcomers who would like to join the fun and who need some simple advice on equipment and working methods. Old-timers surely won't begrudge this space to help others get started in the fascinating pastime of amateur chemistry—and perhaps their own memories will be refreshed with a pointer or two.

Let's suppose, then, that you are starting from scratch—and would like to have a place where you can perform "magic" tricks with chemicals, test household preparations, and carry out a great variety of beautiful and spectacular chemical experiments. Where do you start, and how?

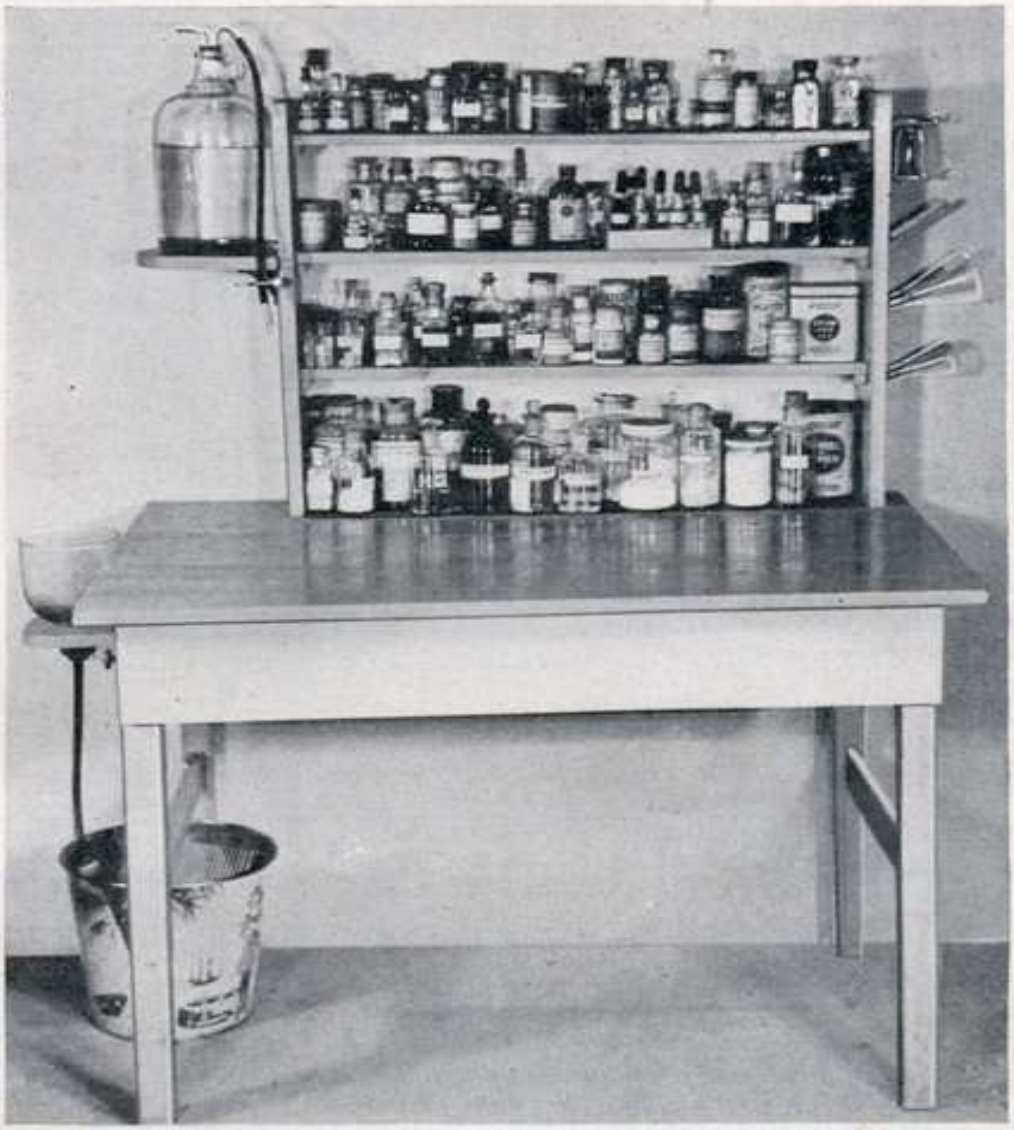
First, you will want a corner of your home where you can permanently arrange your paraphernalia, out of the way of others. You shouldn't have to put up with the inconvenience of using the bathroom or laundry as an improvised laboratory—even if the rest of the family are broad-minded enough to let you! The attic, the cellar, or a spare room will give you a place where you can work undisturbed, and leave equipment for an interesting experiment set up as long as you wish. You can also use part of the garage, but solutions will have to be protected against possible freezing in cold weather.

In many ways, the basement makes the best choice. Gas, the perfect laboratory fuel, can be tapped from the pipes here and led to your chemical bench. Usually electricity will also be available. The ideal home laboratory would be one supplied with gas, electricity, and running water. If necessary, however, you can get along without them. Instead of a gas-burning Bunsen burner, for example, you can use an alcohol lamp for heating test tubes and flasks and for

Amateur-chemistry outfits like this offer the beginner a good start toward establishing a home laboratory. You can purchase either an assortment of chemicals alone, or a kit that also includes test tubes and other paraphernalia

in Amateur Chemistry

Water supply—a wash bottle for dispensing small amounts of water, and a siphon jug



Here's a typical amateur chemist's bench. The base is a kitchen table, fitted with homemade shelves, rack for siphon jug, and a drain for waste

bending glass tubing. Electric heat will also serve. Where high temperatures are called for, a gasoline or alcohol blowtorch may be used.

Even if it is nothing more than a packing case with a board nailed on for a shelf, you will need some sort of a chemical workbench. Once you have caught the "bug" of experimenting with chemicals, you will aspire to a more commodious piece of laboratory furniture, and you can easily make it for yourself. An old kitchen table, or a new one that you can buy cheaply unfinished, makes a first-class foundation for a chemical bench. On this base you can attach substantial shelves, bookcase-fashion, to hold your stock of chemicals and a few pieces of laboratory glassware that you use most frequently. It is a good plan to construct three shelves, five inches wide and of seven-eighths-inch stock, running along the back of the table. Supported by uprights of five to six-inch width, from the same stock, the shelves may be four feet long without sagging when filled with chemicals. Tallest and heaviest bottles go beneath the first shelf, which should be eight inches above the table top, while six-inch spaces suffice between the upper shelves. Two coats of battleship-gray paint will enhance the job. Pegs that may be added for holding and drying flasks, as shown at the right of the workbench illustrated, should be left unpainted.

If you lack a supply of running water, a substitute may be improvised by fitting a gallon jug as a siphon. Insert a two-hole stopper carrying a short length of glass tubing as an air vent, and a longer section of tubing that reaches to the bottom of the jug. To the latter, attach rubber tubing and a pinch clamp. Set the jug on a shelf above your bench, and you can draw off water as needed by squeezing the pinch clamp. Smaller quantities of water may be dispensed from a "wash bottle," a useful aid described in a later paragraph.

A gallon crock, or a metal pail with several

interior coats of paint, will serve as a receptacle for waste. Spent solutions, used filter papers, burnt matches, and cork borings may be thrown directly into it. An added convenience is a drain made by mounting a funnel, or the inverted top cut from a large bottle, at the side of the bench. With rubber tubing leading to the waste bucket, this makes a handy sink for pouring off liquids.

What makes a suitable assortment of chemicals and apparatus to start your experiments with? Often, a novice at stamp collecting makes a good beginning by purchasing one or more inexpensive "packets" containing a large, mixed collection of varieties. Likewise, there are excellent chemical "sets" or "kits" on the market that provide a beginner with a representative variety of materials at very low cost. You can purchase either an assortment of chemicals alone, or a kit that also includes such permanently useful laboratory accessories as test tubes, test-tube holders, an alcohol lamp, and a beaker or flask, together with a tripod for heating its contents.

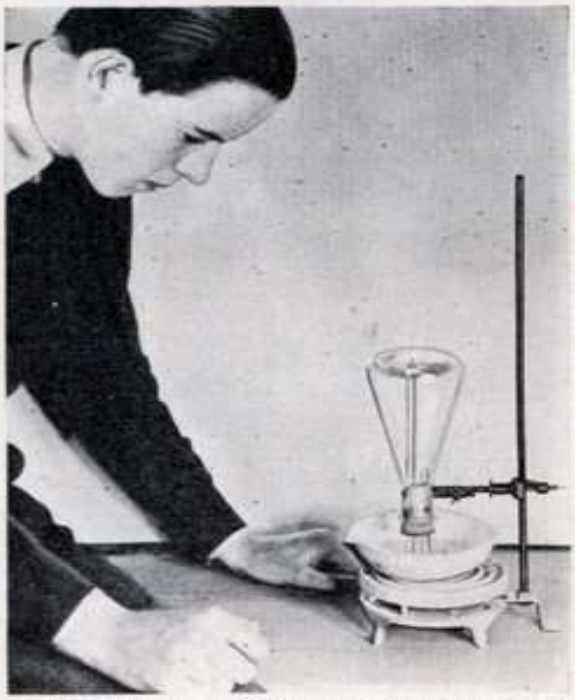
This is the proper way to heat liquids in a test tube. The alcohol lamp was made out of an empty paste jar

If you are assembling your apparatus separately, your principal needs in your first experiments will be a number of test tubes, a test-tube holder for handling them above a flame, and some kind of a heater—a Bunsen burner, alcohol lamp, or electric stove. Test tubes four to six inches long, and half to three quarters of an inch in diameter, are good standard sizes. Useful items of equipment also include beakers, flasks, glass funnels, a graduated cylinder or two, a test-tube rack, a porcelain crucible, an evaporating dish, and an assortment of cork stoppers, cork borers, and glass tubing. A small photographic balance, preferably with gram weights, will also come in handy for weighing out chemicals.

Of course you don't have to buy all this at once, but can add as you go along. Many interesting and practical experiments require only a test tube or two and a few inexpensive chemicals.

Suppose, let's say, you want to know whether the hydrogen peroxide in your medicine cabinet has lost its strength. Just add a drop or

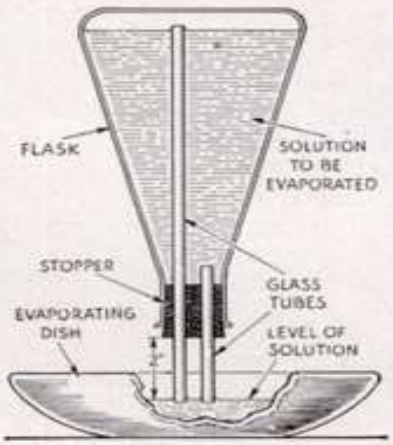
You Can Make This Handy Automatic Evaporator



Here it is in use with an electric heater

HERE is an example of a piece of laboratory apparatus easily made by the young chemist. It is an automatic evaporator. The solution to be concentrated is placed in the flask, which is equipped with a two-hole cork stopper. A glass tube passes through one hole, just entering the flask and projecting two inches on the outside. A longer glass tube projects to the bottom of the flask and also extends two inches on the outside. The whole device is inverted over an evaporating dish or beaker, which is then heated. The liquid automatically flows from the flask and is concentrated in the dish or beaker, where it is kept always at the same level.

How the evaporator is constructed. It feeds the liquid into the dish



two of hydrochloric acid to a sample of it in a test tube, then several drops of potassium dichromate solution, and heat the contents of the tube. If a blue or green color appears, the peroxide is still good.

By equally simple experiments, the presence or absence of many substances in an unknown compound may be confirmed. Moisten baking powder with water, wait until the bubbling stops, and add a drop or two of a solution made by mixing ten drops of tincture of iodine with six teaspoonfuls of water. If a blue coloration is formed, the baking powder contains starch. Carbonates, like marble or washing soda, effervesce when you add an acid. Ammonium compounds, such as sal ammoniac, can be recognized by the odor of ammonia when you heat them with an alkali.

Apparatus for more complicated experiments need not necessarily be purchased ready-made. You will be surprised to find the variety of equipment that you can put together from odds and ends.

An empty paste jar makes a fine alcohol lamp, when you solder a metal tube to the screw top and pass a round cotton wick through it. Transformed as shown in one of the illustrations, a half-dollar electric stove becomes a highly serviceable laboratory heater. A bent metal clamp, drilled with two holes, attaches an iron rod or laboratory support to the base. The same illustration shows a tricky way of using this heater in evaporating a large quantity of a solution, with an inverted flask arranged to give an automatic feed.

A piece of wire with loops twisted in its ends will hold a test tube, for heating its contents over a flame. Always apply the heat near the surface of the liquid in the tube, which should be held nearly horizontal and with the mouth pointing away from you. This will prevent cracked test tubes, and keep any liquid that spatters from striking you or your clothing.

Bore holes in one of a pair of thin boards, mount them one above the other in a wooden stand with the bored one uppermost, and you will have a serviceable rack for your test tubes. Small bottle brushes, from the five-and-ten-cent store, will help clean them after use.

The siphon jug is handy if you don't have running water in your laboratory. Just pinch the clamp and water runs out of the tube

If you have never tried cutting and bending glass tubing, you will be surprised to find how easy it is to make pieces to order for connecting your apparatus. Nick one side crosswise with the edge of a three-cornered file, press with your thumbs on the opposite side of the tubing while you hold it in your hands, and it will break cleanly in two. Twirl the cut end in a flame and it will be smoothed or "fire-polished." To bend glass tubing, roll it in the flame until it is softened, and it will then take any desired form. A wide flame will avoid a flattened, constricted bend; use a flame spreader with your Bunsen burner, or make three miniature alcohol lamps from medicine vials, by fitting the corks with metal or glass tubes and wicks, and mount them side by side in a wooden block. To form a small nozzle from tubing, heat it glowing hot and draw it out like taffy as you remove it from the flame, cutting off the tip at the *(Continued on page 234)*

Hints for Beginners in Amateur Chemistry

(Continued from page 197)

point desired. Connections between pieces of glass tubing may be made with short lengths of rubber tubing.

For your wash bottle, mentioned earlier, fit a good-size jar or chemical flask with a two-hole stopper carrying two bent pieces of glass tubing. The longer, reaching to the bottom of the water-filled flask, should have a small nozzle for a tip. When you blow into the other, which reaches only to the bottom of the cork, water will squirt from the nozzle into a test tube or other vessel.

To store your laboratory apparatus, you can press into service a discarded kitchen cabinet, a chest of drawers, or an old wardrobe fitted with wooden shelves. An ideal storage cabinet would be a double-size steel locker, or kitchen cabinet, of a type sold widely in department stores.

Chemicals and apparatus may be purchased according to your requirements, as you progress with your hobby, from a number of chemical-supply houses that handle mail orders. Some drug stores in large towns also specialize in stocking a wide variety of laboratory supplies, and even the nearest corner pharmacy will be able to provide a number of the chemicals that you may need.

A list of some of the chemicals most frequently used in home experiments might read as follows (the strong acids listed are to be handled with particular care):

Ammonium chloride; ammonium hydroxide (household ammonia can be used); barium chloride; calcium carbonate (marble); calcium oxide (lime); cobalt chloride; cupric chloride; cupric oxide (black copper oxide); cupric sulphate; ferric chloride; ferrous sulphate; ferrous sulphide; hydrochloric acid; lead acetate; magnesium metal (in ribbon form); magnesium sulphate (Epsom salts); manganese dioxide; manganese sulphate; nickel ammonium sulphate; nitric acid; phenolphthalein (one-percent alcoholic solution); potassium chlorate; potassium dichromate; potassium iodide; potassium nitrate; potassium permanganate; potassium thiocyanate; silver nitrate; sodium bicarbonate (baking soda); sodium bisulphate; sodium carbonate (washing soda); sodium ferrocyanide; sodium hydroxide (lye); sodium silicate (water glass solution); sodium thiosulphate; sulphur; sulphuric acid; zinc metal.

In coming articles, some of the fascinating experiments that you can perform with these and other items of your chemical equipment will be described.