

# CHEMISTRY:



In using the filter, which is attached to the end of the test tube rack, liquid is poured down stirring rod into funnel with mouth of flask touching the rod

## How to Set Up Your Laboratory

By RAYMOND B. WAILES

**W**ITH simple equipment requiring surprisingly little financial outlay, you can build in your home a small chemical laboratory that will provide a fascinating hobby.

Here you may amaze your friends with seemingly magical chemical tricks, as by the manufacture of paint that shines in the dark or of writing inks that disappear unless the secret of bringing them back is known. You can manufacture useful things for the home, as soap or liquid court plaster. You can test gold rings and ivory piano keys to see whether they are genuine. If you wish, you can investigate the chemical processes used in industry, with the ever-present possibility of an important discovery. To the real dyed-in-the-wool experimenter, chemicals in themselves are intriguing, and a beautifully colored precipitate or a startling formation of crystals is its own reward for the trouble of preparation.

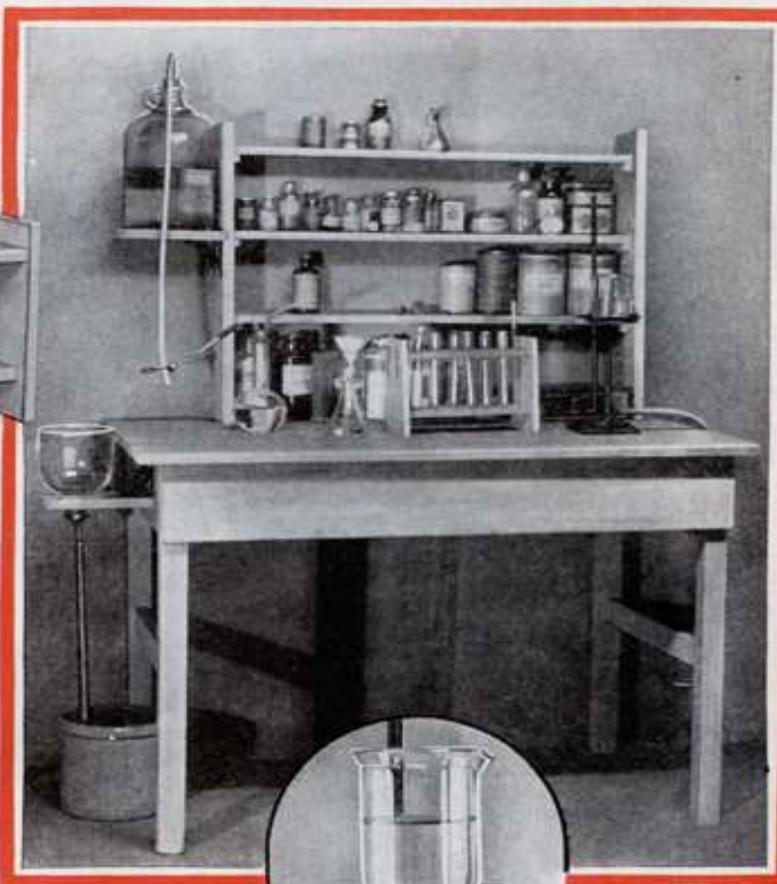
First you will need a suitable workroom—and it would be well to consult the lady of the house before usurping the bathroom or the laundry tubs. Running water is an advantage, but it is not essential. An attic, a corner of the cellar, or a spare room will do well.

You will require a chemical bench at which various chemicals and apparatus may be stored, and a working space provided for the setting up of apparatus.

In the making of a chemical bench, an

old kitchen table can be used. Shelving can be placed at the rear, with room for a gallon of water. Shelves can be made from wooden boxes, and if they are four inches deep, there will be ample room for the usual sizes of chemical bottles. The table shown in the photograph has side uprights two feet high supporting the shelves. It is well to space the first shelf nine inches above the table top. The water supply shown is necessary if running water is not available for your home laboratory. It consists of a one-gallon jug on a shelf that is fastened to the uprights by means of shelf brackets. A glass and rubber tube with pinch clamp is used to siphon the water from the jug.

The drain, or sink, is made from the cut-off top of a large bottle inserted in a hole in a shelf that is fastened to the side board of the table with shelf brackets. Fitted with a cork, a glass tube, and a rubber drainpipe that feeds into an earthenware crock below, this means of waste disposal will be found well suited to the chemical bench. If spent acids are poured into the glass sink, a copious flow of water from the water supply above can be directed into it, diluting it and washing the last traces into the crock. After diluting well with water, the crock can be emptied.



Above, beakers can be heated on an iron plate supported over Bunsen burner. At right, correct way to hold a test tube over a flame, heating top of liquid first



Above, a typical home chemical laboratory with its water supply and sink. A kitchen table is used, and to this properly spaced shelves are added. Note drain

If gas is available at the chemical bench, many of the experimenter's troubles are over. Lacking this perfect fuel, alcohol lamps or a small electric stove can be used. The latter is not economical when test tubes are to be heated.

Beakers and flasks of liquids can be heated over the Bunsen burner by supporting them on an iron plate or a wire gauze on a tripod or a ringstand, both of which are stocked by dealers in chemical apparatus. With the ordinary Bunsen

# An Exciting and Profitable Hobby

burner, the tripod should be nine inches high. The ringstand with its ring is adjustable. If an alcohol lamp is used as the source of heat, the vessel to be heated should be placed so that its bottom is just beyond the tip of the flame.

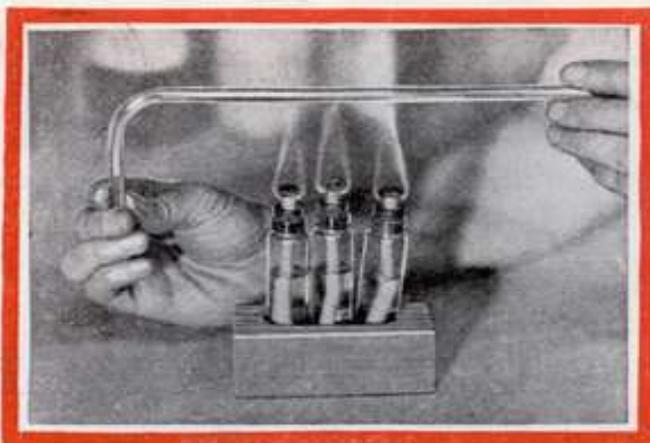
In heating test tubes containing liquids, hold the tube away from the face and heat only the upper portion of the liquid at first, slightly shaking the tube until boiling occurs. In this manner, many test tube breakages can be eliminated. The test tube can be held by a metal test tube holder or a girdle of heavy paper.

**G**LASS tubing, constantly used in chemical experiments, can be cut to length by drawing a three-cornered file across the tube once or twice and then breaking the tube as one would a stick of candy, holding the filed side away from you. If the end of a glass tube is introduced in a flame and heated slowly, the sharp edges will melt and become round, giving a "fire-polished" edge.

If glass tubing is softened and bent, using a single Bunsen flame or an alcohol lamp, the tube will flatten and constrict itself at the bend. By equipping a Bunsen burner with a flame spreader, glass tubing can be heated and softened for two or three inches so that a perfect bend is possible.



To pour powder hold lip of bottle over rim of beaker, and turn bottle as you pour



Perfect bends in glass tubing can be made if the tube is heated over three homemade alcohol lamps in row. One lamp gives flattened bend

string about the filed line, soaking the string in alcohol, and lighting. When the flame goes out, hold the bottle under running water and usually it will crack along the filed line. Carborundum stone or emery cloth is then used to rub down the sharp edges. In this manner the sink for the chemical bench was made.

**A**SUPPORT for test tubes can be easily made from wooden boxes. The one shown here will take six tubes in the upright position and five tubes in an inverted position. In this latter position, tubes are dried after they have been washed and cleaned with a bottle brush. The test tubes most commonly used are six inches by three quarters of an inch. Three holes are also placed in the test tube rack for supporting stirring rods, which can be tubing with the ends closed by holding in a flame.

A useful attachment to the tube rack is a filtering support. This is made of heavy wire twisted as shown and attached to the test tube rack by inserting the prongs through screw eyes carried on one end of the rack.

Cork borers can be purchased from laboratory supply houses, or metal tubes of various diameters can be used as borers. Such tubes—as bean blowers, curtain rod tubes, and so on—can be sharpened at one end with a file, and with a pushing and rotating motion the sharpened tube passed through corks, leaving a clean hole. The cork plug should then be removed from the borer. When passing

glass tubing through holes in corks, protect the hands from injury, for the glass may break if the hole is too small or if too much force is used.

You will require a wash bottle in many chemical manipulations. The sketch shows how this item can be made. A flask or bottle can be used.

A small photographer's balance with gram weights will be found handy in carrying out experiments where substances are called for in "parts." It should be sufficient to say that many formulas call for parts by weight, as sulphur two parts, iron one part. Here, two grams or twenty grams of sulphur can be weighed out and mixed with one (Continued on page 133)

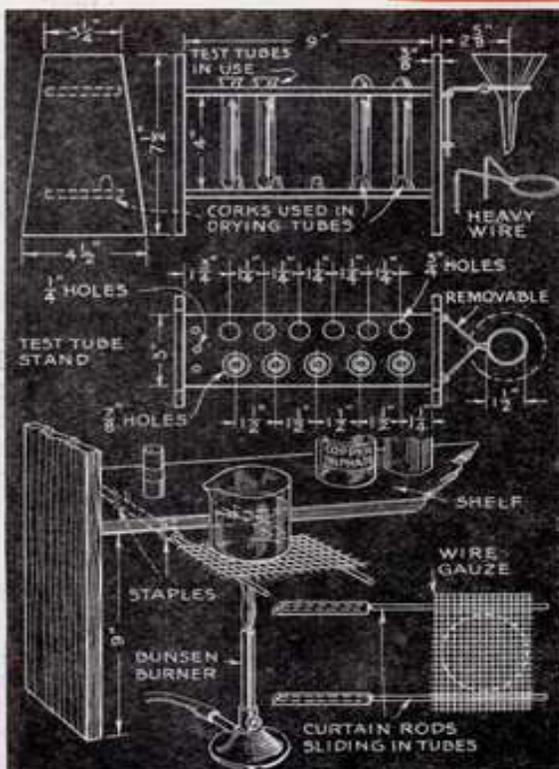
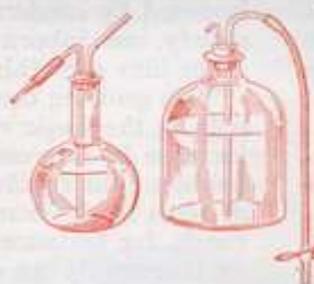


Diagram above will serve as a blueprint to give you right dimensions for tube rack and shelves



At left, bottles and retorts are fitted with corks having two holes, one for air intake, if it is intended to siphon out their contents

Those home laboratories without gas should be equipped with three little alcohol lamps inserted in a wooden block, for glass bending. Small medicine vials fitted with corks, metal or glass tubes, and round wicks make excellent alcohol lamps. They are arranged side by side, and the glass to be bent is placed at the tips of the flames, rotated until the glass has softened, and then bent to shape, reheating at times if necessary. The writer has produced perfect bends with three lamps set up as shown at the top of this page.

Bottles and large sizes of glass tubing may be cut in two by means of an electrically heated resistance wire or by filing a line around the bottle, wrapping a



HOW TO CUT TOP FROM BOTTOM FOR SINK

Top cut from bottle by filing and burning, as described in text, can be fitted at end of work bench to serve as sink, as shown in upper photo. Rubber tube runs to drainage vessel

## IS THE IRON HORSE DOOMED?

(Continued from page 132)

Here, however, the matter of cost steps in. Although the final operation and maintenance of an electric road may be considerably cheaper than that of a steam road hauling similar traffic, the roadside equipment requires a large initial outlay. If the traffic over the road is not sufficiently heavy, or if there is not some other saving condition such as cheap electricity from water power, the original outlay might take far too many years to pay for itself. It is on the long single- and double-tracked lines, with little grade and through sparsely settled areas, that the Iron Horse, for the present at least, is comparatively safe.

In twenty-nine countries, electric giants now race along rails once ruled entirely by steam. With heavy grades and a meager supply of coal, but with abundant water power, it is not surprising to learn that in the percentage of electrified to steam-operated railroad, Switzerland leads the world. Fully eighty-five percent of the ton-miles of its trains is today hauled by electricity.

However, if the vast scheme proposed to the British House of Commons by Lord Weir's committee on railroad electrification should be accepted, the leadership would turn to Great Britain. According to this proposal all the main line track in Great Britain would be changed over to electric operation. The project would give continuous employment to 60,000 men for fifteen years, and would cost \$2,000,000,000.

## HOW TO SET UP YOUR LABORATORY

(Continued from page 69)

gram or ten grams of iron, the proportions being two to one by weight.

In pouring powders of chemicals into the balance pan, place a sheet of paper on each pan, and with the mouth of the bottle over the pan, rotate the bottle, holding its bottom upward at an angle sufficient to cause the substance to flow from the bottle in a gentle stream.

Many substances and chemicals used in your experiments will be found about the house or shop. Zinc can be obtained from dry cells, copper from wire. Epsom salts is magnesium sulphate; baking soda, sodium bicarbonate; alum, potassium aluminum sulphate. These substances should be bottled and labeled as such. Chemical handbooks and formula and recipe books give many other synonyms.

In experimenting, one should not taste chemicals. Care should be taken in handling acids. Concentrated sulphuric and nitric acids are the most dangerous. If acids are spilled on the skin or clothing, deluge the spot with water. A rubber apron will help protect your clothes, in performing chemical experiments.

*THIS series on chemistry for the home laboratory will be continued as a regular monthly feature, conducted by Mr. Wailes. In March, practical experiments of interest and profit will be presented by him and he will be glad to receive any suggestions you care to make or to answer any questions you care to ask him.*

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