Basic Laboratory Techniques

In the chemical laboratory a student is required to carry out from simplest operations like bending of glass tube, cutting glass tube, boring a cork, to complex process of analysing substances qualitatively and quantitatively. A general acquaintance with such operations thus becomes obvious before taking up actual experiments. As most of these processes involve heat¬ing so knowledge of using a burner is essential.

Bunsen Burner

It is a common heating device used in laboratory and consists of following parts :

1. Base, made of cast iron. It keeps the burner in a stable upright position.

2. Gas-inlet tube. It fits horizontally into the side of the base and can be connected to the gas tap through a rubber tube.

3. Nipple, made of brass rod and has a fine pin-hole running through it. At its lower end, the nipple is screwed into the base. At the upper end, it carries the burner base.

4. Burner tube, a metallic tube with two opposite air holes near its lower end. It is screwed to the nipple and carries the air regulator.

5. Air adjusting disc is a metallic ring that loosely fits on the lower end of the burner tube. It is pierced with two holes that exactly correspond to the two air holes of the burner tube. It can be rotated to regulate supply of air into the burner tube by par¬tially or wholly closing the air holes.

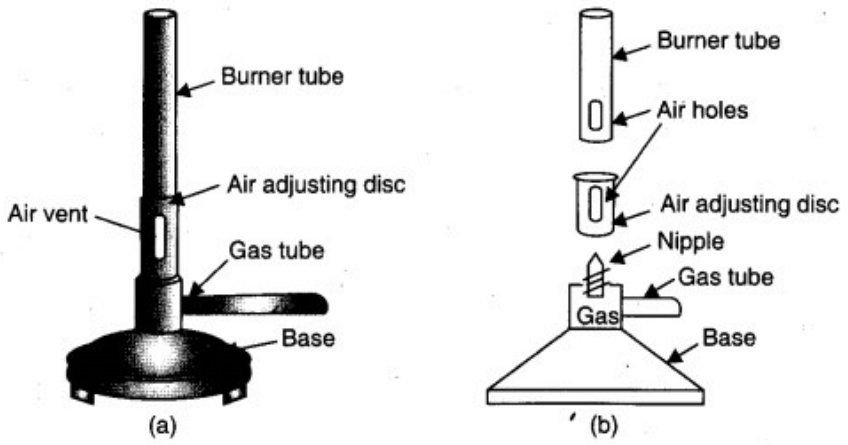


Fig. 2.1. (*a*) Bunsen burner, (*b*) Parts of Bunsen burner.

Working of Burner

The rubber tubing is connected to the gas tap and the burner is lighted. As the gas escapes through the nipple, there is a fall of pressure. As a result of which air is sucked in through the air holes. The mixture of air and combustible gas bums at the top with a flame. Depending upon the quantity of air mixed flame can be luminous or non-luminous.
Oxidising flame or non-luminous zone is hottest. It is this portion that should be used for the purpose of heating. Luminous zone is the brightest part of the flame. It is reducing in character and is used for reducing process, such as in charcoal cavity test, match stick test and borax bead test of some radicals.

Cutting a Glass Tube

Cutting a glass tube is primarily required for making U-shaped tubes, delivery tubes and other purposes. Hence a student must know how to cut glass tube of required length for specified purpose without injuring hands. For cutting a glass tubing, proceed in the following manner :
1. Select a glass tubing free of cracks.
2. Place it on the bench, hold it firmly and make a single deep scratch with triangular file. Do not apply too much pressure.
3. Place the thumbs on each side of the scratch at equal distances from it. Apply gentle pressure and give a quick bending motion towards you until it breaks smoothly (Fig. 2.2).
4. Sometimes, the ends of the tube are not smooth and might bruise your fingers (Figs. 2.2 and 2.3). These can be further smoothened by rotating the ends in a flame for 2-3 minutes. The edges will be smoothened (Fig. 2.3). Allow it to cool while holding in your hand.

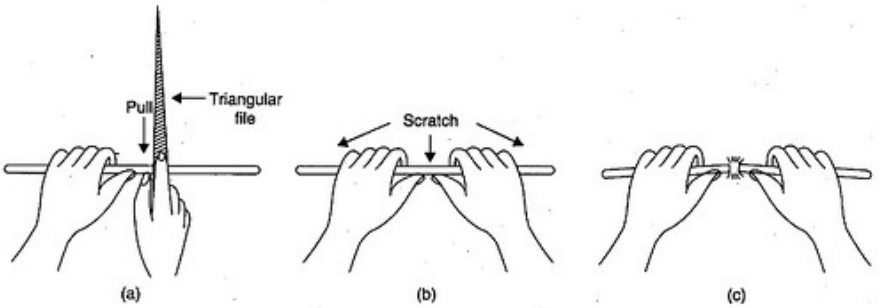


Fig. 2.2. (*a*) Making a scratch on a glass tube
(*b*) Placing the thumbs together opposite to the scratch
(*c*) Breaking the glass tube.

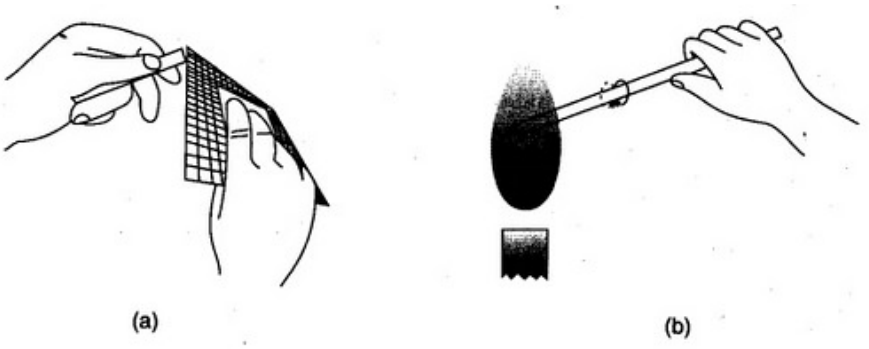


Fig. 2.3. (*a*) Trimming the jagged edges
(*b*) Rounding the edges.

Precautions

1. Make a single deep scratch at the desired length with one stroke of the file.
2. To avoid injury hold the glass tube with the help of a thick piece of cloth.
3. Do not heat the end for long time. It may seal the end or make it narrower.

Bending a Glass Tube

For bending a glass tube proceed as follows :

Hold the glass tubing between the thumb and fingers, introduce it lengthwise in the luminous flame of burner. Keep the tube rotating till it softens.

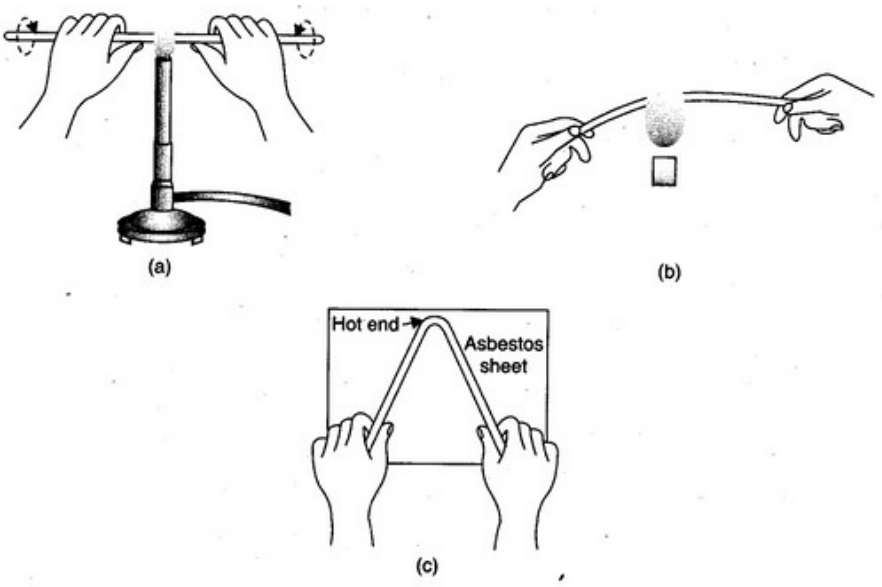


Fig. 2.4. (*a*) Heating the tube
(*b*) The tube softens and starts bending under its own weight
(*c*) Making the bend coplanar.

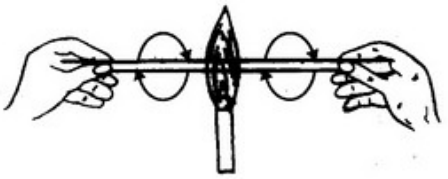
2. Now apply gentle pressure so that it bends by its own weight. When the desired angle is formed, remove the tubing from the flame.
3. Place the bent limb on the asbestos sheet. Press it gently so as to make it coplanar.
Allow the tubing to cool.

Precautions

1. Select a glass tube of sufficient length to keep your hands safe from heat. Do not try to bend very small glass tubes of the lengths less than 20 cm.
2. While heating, the glass tube should be rotated in order to ensure uniform heating.
3. Never bend the glass tubing by force. By doing so, the tubing may break.

Drawing a Glass Jet

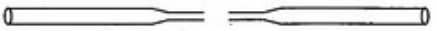
1. Take a delivery tube of required length and diameter. Hold it with both hands and place it lengthwise in flame (Fig. 2.5).



1. Heat the tubing in the bunsen flame while rotating between fingers.

2. Continue heating and rotating with inward pressure till the tube in the centre becomes very soft.

3. Remove the tubing from the flame and after a moment pull the ends apart to get the narrow capillary in the middle.



4. Cut to length and fire-polish the two ends of droppers

Fig. 2.5. Drawing a jet.

2. Keep rotating the tube so as to ensure uniform heating, continue heating till it softens.
3. Take the tubing out of the flame and gently pull the two ends apart. The middle portion is drawn out to a thickness of about 2 mm.
4. Cool and cut the narrow portion with a triangular file and two jets will be obtained. Finally round the ends of the jets by heating in a flame for a short while.

Precautions

1. While drawing a jet, pull apart the two ends of the red-hot tube slowly so that it becomes thin unformly.

Boring a cork

Boring a cork is required for setting up an apparatus for the preparation of gas and for carrying / out distillation etc. Above all, it is required for fitting up a wash bottle. For perfect boring of the cork, the following steps are involved :

1. Softening of the Cork. It is essential as a cork gets hard on keeping. In order to soften a cork, wet it with water. When it becomes more flexible and does not crack readily, then press it in a cork-presser which is a mechanical device and if it is not available, simply press the wetted cork under your shoes after wrapping the cork in a piece of paper.

Fig. 2.6. Pressing the cork with shoe.

2. Selection of the Borer. Choose a borer slightly smaller in diameter than that of the tube to be fitted in the cork. This will ensure tight fitting of the tube.

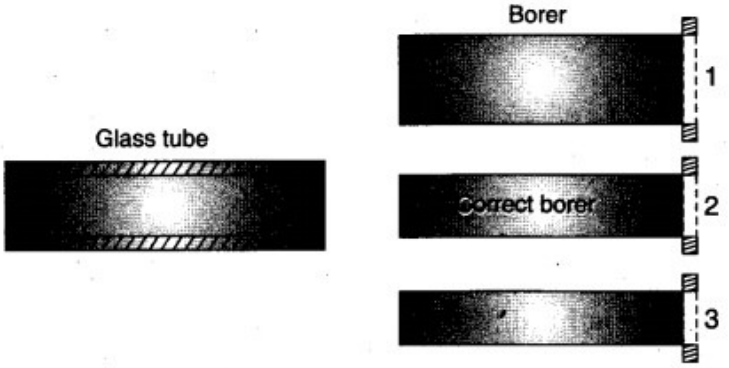


Fig. 2.7. Proper selection of the borer.

3. Boring of the Cork. Place the cork on the table with its narrow end upward. Mark the position of the borer on both the sides of the cork to ensure straight hole. Holding the cork 'tightly with left hand, apply force on the borer with a twisting motion. Apply some glycerine to the borer if it is a rubber cork. Glycerine acts as lubricant for the hard rubber cork. When half of the cork has been bored, take the borer out and reverse the cork. Start the process of boring taking care that the borer remains vertical throughout. Remove the borer after the cork has been bored from one face to the other. Remove the pieces of the cork inside by inserting the needle.

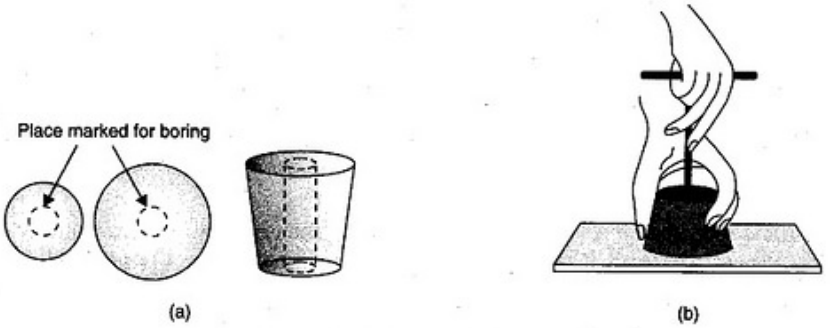


Fig. 2.8. (*a*) Marked cork, (*b*) Boring process.

Note. For fitting up a wash bottle, it is necessary to bore two holes in the cork. The two holes are bored in the same way as done for single hole but with a precaution that the two holes should not be very close to each other. If the distance is very small, then the thin cork layer may break.

Fitting the Glass Tube in the Bore. Wet the cork with water. Wet the end of the tube also with water. Hold the cork in one hand say left hand and tube in the right hand. It should be noted that the tube should be held closely from the wetted end. Insert the tube into the bore giving a rotatory motion as shown in Fig. 2.9.

(a) Correct holding of the tube. (b) Wrong holding of the tube.

Fig. 2.9. Inserting the tube into the hole of the cork.

Precautions

1. Select bores of diameter slightly smaller in size than that of the tube to be inserted in the hole.
2. Make a mark on both sides of the cork.
3. To obtain a smooth hole, drill half the hole from one side and another half from the other side of the cork.
4. Since the rubber is hard, the end of the tube' to be inserted is usually dipped in caustic soda solution or glycerine before fitting in the hole.

Wash Bottle

A wash bottle is a container in which distilled water is taken. With the help, of wash bottle a fine stream of water can be obtained for washing the precipitate and for other purposes. It has the shape as shown in Fig. 2.10.

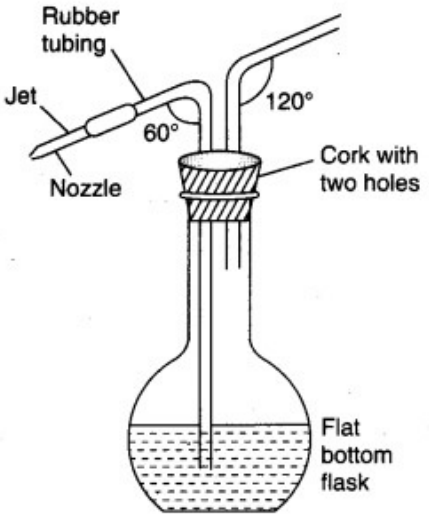
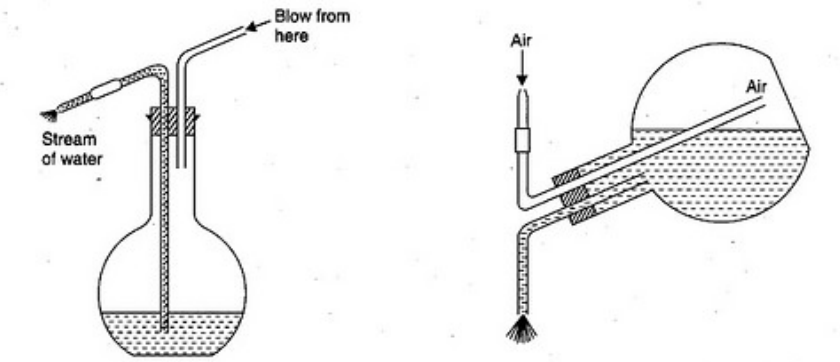


Fig. 2.10. Wash bottle.

A flat-bottom flask of 500 ml is taken. Appropriate cork with two bores is fitted into it. The two tubes, one bent at an angle of 120° and second at 60°, are passed through the two bores. This is done in a manner so that the upper portions of the two tubes lie in a straight line as shown in the Fig. 2.10. The upper portion of the 120° angled tube is held in mouth whereas a jet is fitted

to the tube angled at 60°. On blowing out air with the mouth through one tube, water comes out from the other tube with force as shown in Fig. 2.11.



(a) For getting stream of water. (b) For getting a little larger amount of water.

Fig. 2.11. Use of a wash bottle.

Precautions

1. The edges must be rounded off.
2. The longer arm of the tube bent at 60° should be only very slightly above the bottom of the flask so that it can be used even when it contains only a small amount of water.
3. All connections must be air tight.

Polythene Wash Bottle

Now-a-days polythene wash bottles are preferably used in the laboratory. It consists of flexible plastic material bottle, fitted with a plastic tubing having a jet at its outer end. On squeezing the bottle fine stream of water comes out of the jet. It can be used to give washings or to remove the precipitates from a beaker etc.

Fig. 2.12. Polythene wash bottle.

Cleaning Of Glass Apparatus

In order to get good results, apparatus must be cleaned properly before use. Sometimes washing with simple water serves the purpose but if the apparatus is greasy etc. then rinsing with cone. HCl or $HNO_3$is recommended. It is then freely washed with water under the tap. Chromic acid, prepared by dissolved 5 g of potassium dichromate in 100 ml of cone. H_2S0_4, is another reagent which can be used for removing grease and dirt from the apparatus.

Caution. Chromic acid is very corrosive, therefore, physical contact with it should be avoided.