Introduction to Basic Laboratory Equipment

Chemistry Laboratory

A chemistry laboratory is a workshop for chemists. Here students learn the techniques of the preparation, identification and estimation of chemical substances. Before starting experiment, a student must know from where to get the apparatus required for the given experiment and the placement of the chemicals to be used. A student must know the proper use of each equipment and the precautions to be observed while working in the laboratory. A chemistry laboratory is provided with the following fittings with which the student must become familiar.

1. Demonstration Table

Before starting experiment, the teacher gives instructions and demonstrates the concerned experiment on demonstration table. In chemistry laboratory, no seats are made available to the students, so students stand around demonstration table and note the instructions from teacher.

2. Students Working Table

A number of wooden or concrete tables are provided for working. Generally, four students (two on each side) work on one table. Each seat is provided with:

(a) Reagent shelves. Reagents or chemicals to be used are placed on the reagent shelf. These are the reagents which are commonly used. For example, all dilute and concentrated acids such as H_2S0_4, HCl, $HN0_3$, etc. and bases like NaOH, NH_4OH, etc.

(b) Sinks and water taps. A sink and a water tap is fitted between every two reagent shelves. On either side of the sink, usually two taps are fitted for supply of water.

(c) Gas taps. These taps are fitted on the seats for supply of petrol gas to the burners. Sometimes kerosene is used for producing gas in place of petrol.

3. Side Shelves

Mostly there are two big shelves fitted on the walls of the laboratory. Reagents and chemicals, which are less frequently used, are placed in these shelves. Sometimes solid chemicals are placed in a separate shelf.

4. Fume Cup-board

There is at least one fume cup-board in the comer of the laboratory. All experiments giving out poisonous gases or vapours are performed in this cup-board.

5. Balance Room

It is a small room attached to each laboratory. Here, a number of balances are kept for weighing the substances.

6. Exhaust Fans

Two exhaust fans are provided at the two comers of the laboratory for the removal of the poisonous gases and vapours from the laboratory.

Common Laboratory Apparatus

The apparatus which is commonly used by a student is described below:

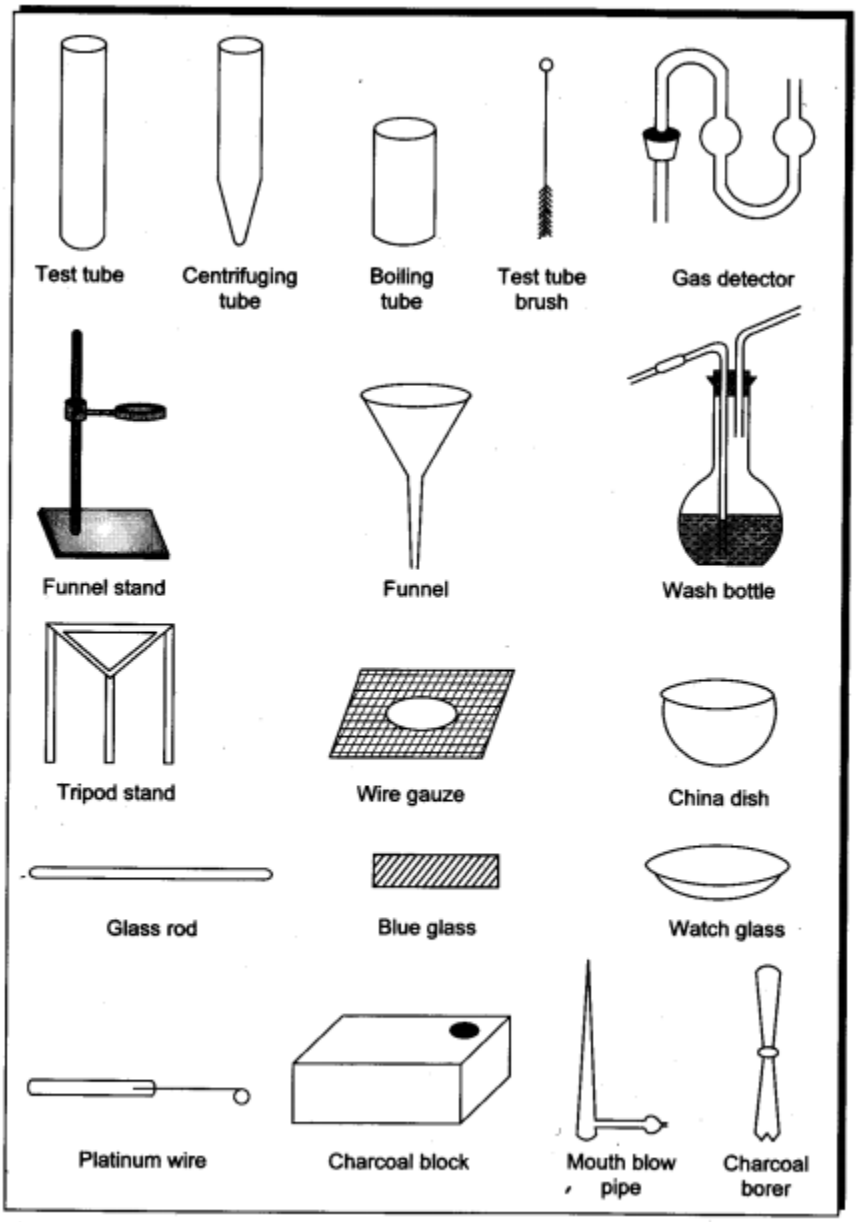


Fig. Apparatus used in chemistry laboratory.

1. Beakers. Beakers of different sizes such as 150 mis, 200 mis made of soft glass or coming glass. Beakers are used for taking various liquids.
2. Test Tubes. Test tubes of different sizes are available. Small test tubes used for salt analysis known as centrifuging tubes and boiling tubes are also available.
3. Conical Flask. It is used in volumetric analysis for carrying out titration.
4. Funnel. It is used for filtration and for pouring solutions from one container to the other.

5. Measuring Flask. It is used in quantitative analysis when we have to prepare a solution with a particular volume. There are flasks of 50 ml, 100 ml and 250 ml capacity. There is a mark on the stem of the flask up to which the liquid is taken to complete the volume.
6. Glass-Rod. It is used for stirring purposes. It is also used as an aid for transferring the liquid into the funnel.
7. China Dish. It is a small vessel made of porcelain. It is used in crystallisation, for concentrating a solution.
8. Wire Gauze. It is placed above the flame of the burner so that the glass vessel being heated does not touch the flame directly and hence is prevented from breaking.
9. Tripod Stand. It is used for supporting a china dish or a beaker so that it can be heated from below.
   Other apparatus with which a student must familiarize are test tube holder, test tube brush, crucible tongs, spatula, watch glass, clamp stand, burette, pipette, water bath, sand bath and centrifugal machine.

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.

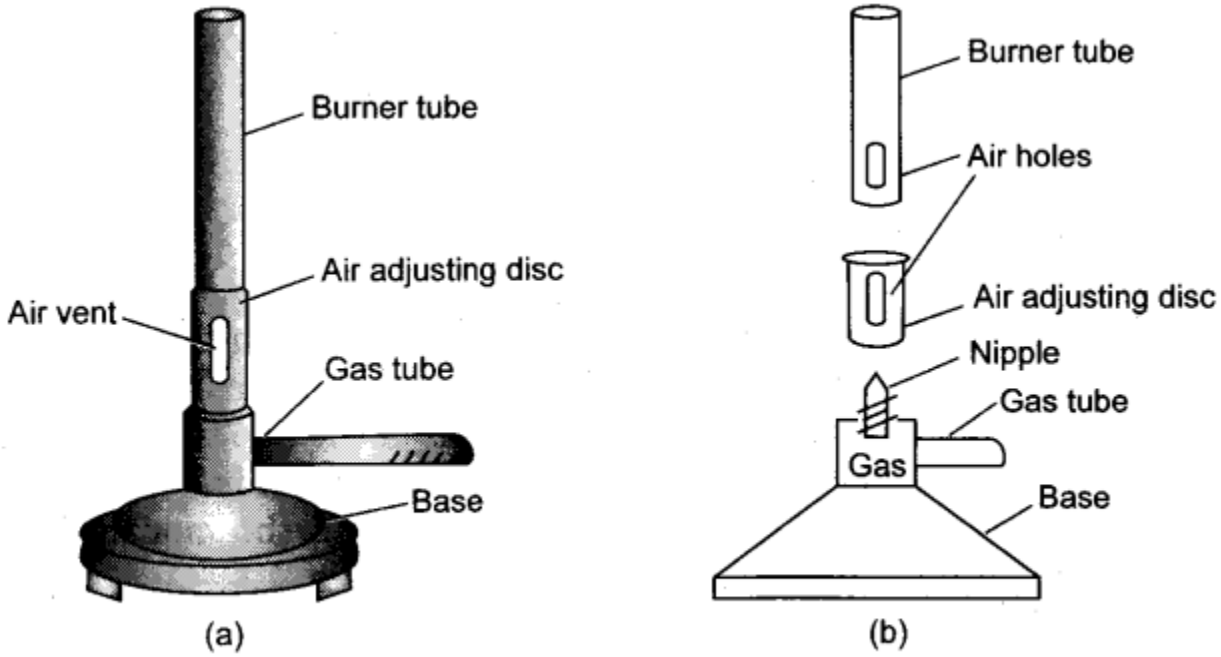


Fig. (*a*) Bunsen burner, (*b*) Parts of Bunsen burner.

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 regulator, 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 partially or wholly closing the air holes.

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.

Wash Bottle

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

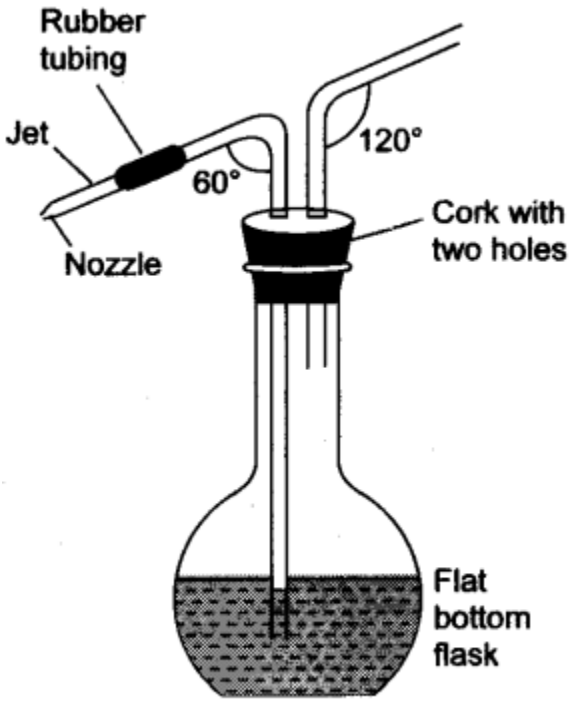
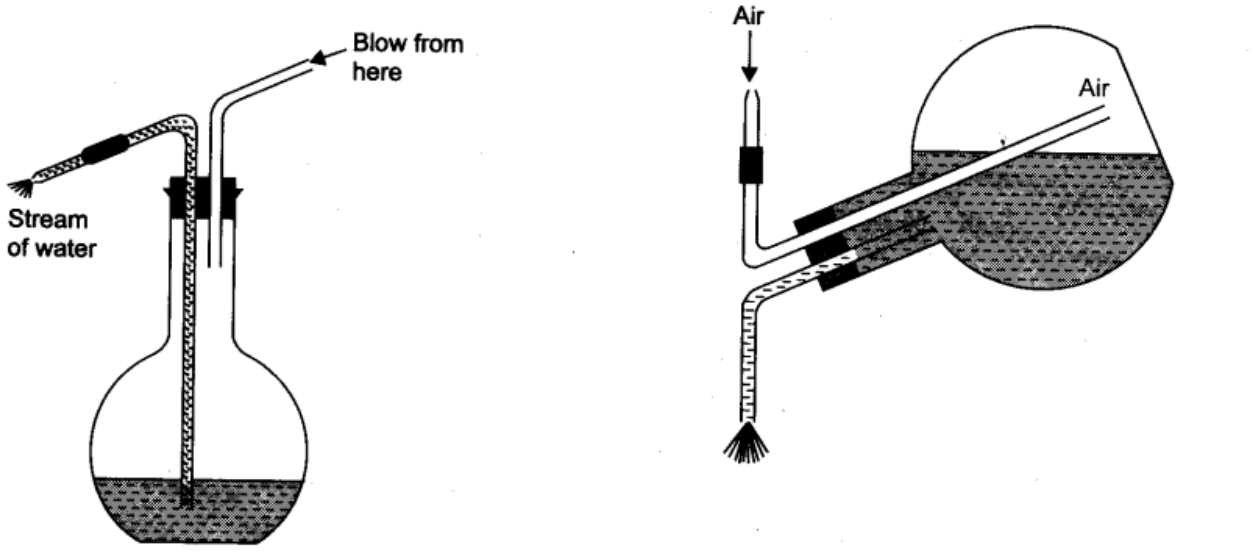


Fig. Wash bottle.

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. 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.



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

Fig. 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

washing's or to remove the precipitates from a beaker etc.

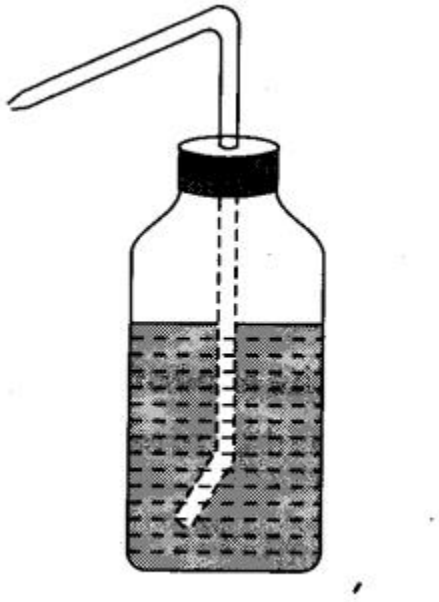


Fig. 1.5. Polythene wash bottle.

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 $HN0_3$ is recommended. It is then freely washed with water under the tap. Chromic acid, prepared by dissolving 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.

Instructions to Work in Laboratory

To work in the laboratory, a student must follow the following rules:

1. A student must have a practical note-book, rough note-book for instructions, a pen or pencil, a laboratory coat or apron and other equipment such as a platinum wire, fractional weights as required.
2. Always come prepared for the experiment. This will help to understand the experiment better.
3. Always listen to the teacher's instructions carefully and note down the important points and precautions to be followed.
4. After the instructions, collect the apparatus from the laboratory assistant in queue.
5. Thoroughly clean the apparatus to be used.
6. Do only the experiments assigned, unallotted experiments should not be done.

7. Do your experiment honestly without caring for the final result. Record the observations on a rough note-book instead of writing on the pieces of paper.
8. Plan your work so as to finish in the stipulated time.
9. Be economical with the reagents. Only small quantities of the reagents are to be used. Use of reagents in excess not only leads to wastage of chemicals but also causes damage to the environment by polluting soil, water and air.
10. Handle the glass apparatus very carefully. In case of any breakage, report it to your teacher at once.
11. Dispose of all waste liquids in the sink and allow water to run for sometime by opening the water tap.
12. Keep your seat clean. If an acid or other corrosive chemical is spilled, wash it off with water.
13. Clean your apparatus after the experiment and return it to the laboratory assistant.
14. In case of any injury or accident or breakage of the apparatus, report it to the teacher immediately.
15. Wash your hands with soap after the completion of the laboratory work.

Some Important Precautions

To avoid unnecessary risk or injury during laboratory work, the students are advised to observe the following precautions:

1. Always use an apron, an eye protector and hand gloves while working in the chemistry laboratory.
2. Do not touch any chemical with hand as some of them may be corrosive.
3. Before using any reagent or a chemical, read the label on the bottle carefully. Never use unlabelled reagent.
4. Do not put any object into the reagent bottle.
5. Do not bring inflammable liquids such as alcohol, ether near the flame.
6. Always pour acid into water for dilution. Never add water to acid.
7. Do not use cracked glass apparatus such as beakers for heating purposes.
8. Be careful while heating the test tube. The test tube should never point towards yourself or towards your neighbours while heating or adding a reagent.
9. Do not heat beakers or china dish directly on flame. Always make use of wire gauge.

10. Be careful in smelling chemicals or vapours. Always fan the vapours gently towards your nose (Fig.).

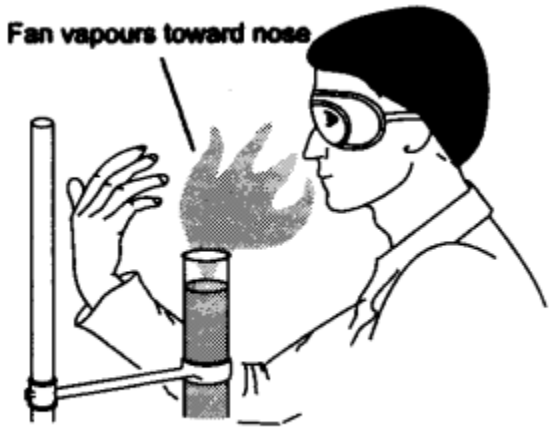


Fig. Testing odors. Fan the vapour gently towards the nose.

Practical Notebook

All the experiments that are conducted in the laboratory are recorded in a practical notebook. It is compilation of whole work done by the student, so it must be well maintained, protected from mechanical and chemical damage. For keeping up to date record of experiments, following points should be kept in mind:

1. The name of the experiment should be entered along with the date of carrying out that experiment.
2. Requirements should be mentioned next to the title given.
3. Theory and principle of the experiment should be given in precise manner.
4. This should be followed by procedure in which experiment is to be conducted. Then a
   summary of precautions to be taken care are mentioned. Finally mention the general calculations for the experiment.

If we make a table of the points to be written on left hand and right hand side of the notebook, it will look somewhat like the one given as follows.

Left hand side	*Right hand side*
Date	Date
Name of experiment	Name of experiment
Diagram	Theory
Chemical equation	Procedure
Observations	General calculations
Calculations	Precautions

Keep following points in consideration regarding your practical notebook:

1. Do not tear pages from notebook.
2. Do not over write if a mistake has been committed in recording, put a line over it and write the correct word or figure.
3. Page mark your notebook.
4. Complete the index, indicating the experiment, its serial number, page number on which it is written.
5. Keep your notebook neat and tidy and covered with brown paper.

First Aid Emergency Treatment in the Laboratory

A chemistry laboratory encompasses different types of chemicals, apparatus. Any lack of attention on the part of student may cause accident. Accidents may occur by chance also. In any case prompt action should be taken to give first aid to the victim and then should be hospitalised if the need be. The probable accidents and their first aid emergency treatment are given below:

Type of accident	***First aid emergency treatment***
1. ***Burns***:	
(*i*) Burn by dry heat (*i.e.*, flame, hot object etc.)	(*i*) Apply burnol or sarson (mustard) oil.
(*ii*) Burns causing blisters. **Caution.** Heat burns should never be washed.	(*ii*) Apply burnol at once.
(*iii*) Acid burns	(*iii*) Wash freely with water, then with 1% acetic acid and again with water. Dry the skin and apply burnol.
(*iv*) Bromine burns	(*iv*) Wash liberally with 2% NH_3 solution and then rub glycerine. Wipe off glycerine after some time and apply burnol.
2. ***Cuts:***	
(*i*) Minor cuts	(*i*) Allow to bleed for a few seconds. Remove the glass piece if any. Apply a little methylated spirit and cover with a piece of cotton. Alternatively apply $FeCl_3$ solution to stop bleeding.

Type of accident	*First aid emergency treatment*
(*ii*) Serious cuts	(*ii*) Apply pressure above the cut to stop bleeding. Call for the doctor.
3. *Eye Accidents:*	
(*i*) Acid in eye	(*i*) Wash thoroughly with water, then with 1% sodium bicarbonate (Na_2CO_3) solution and then with water again.
(*ii*) Alkali in eye	(*ii*) Wash thoroughly with water then with 1% boric acid solution.
4. *Poisons:*	
(*i*) Poisons not swallowed	(*i*) Spit out immediately. Wash the mouth with water.
(*ii*) Acid swallowed	(*ii*) Drink lot of water. Drink lime water. No emetic should be taken.
(*iii*) Caustic alkalies swallowed	(*iii*) Drink lot of water. Drink a glass of lemon or orange juice. No emetic should be taken.
(*iv*) Inhalation of gases like Cl_2, SO_2, Br_2 etc. causing suffocation.	(*iv*) Loosen the clothes at the neck. Go in the open air. Inhale dilute vapours of ammonia or gargle with sodium bicarbonate solution.
5. *Fire:*	
(*i*) Clothes catch fire	(*i*) Do not run. Wrap with a blanket. Lie down on the floor and roll.
(*ii*) Beaker containing inflammable liquid catches fire	(*ii*) Cover the beaker with duster or damp cloth.

Go to the doctor after getting first aid.