

Chapter 2

Equipment and Safety

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This chapter is about the equipment which is used in science laboratories and the safe practices which are necessary when using equipment and working in a laboratory.

The **science laboratory** is a specially designed room in which science activities are done. Many people work in science laboratories in places like universities and in large industrial plants and factories.

Features of a school science laboratory

Most secondary schools also have laboratories in which students learn about science. A science laboratory has many special features.

Water

There are usually several taps and sinks in a laboratory. Many experiments need water, and some equipment such as test tubes needs to be washed.

Gas

Laboratories always have a gas supply which is used for heating things and for boiling water.

Electricity

Electricity is needed to operate electronic and electrical equipment. It is used for light globes and electric motors.

Laboratory bench

The **benches** in a laboratory are higher than normal tables and desks, so that you do not have to bend over too far when you are standing at the bench doing an experiment.



Figure 2.1 A student working in a science laboratory.

Storage spaces

Laboratories usually have storage spaces such as cupboards and shelves for glassware and other equipment. Some of your experiments will be stored on shelves from one period to the next.

Safety features

Main gas and water taps

Somewhere in or near the laboratory will be a main gas tap and a main water tap so that in an emergency all of the gas and water can be turned off. There may also be a master switch to turn off all the electricity.

Exhaust fan

Chemical laboratories may have an **exhaust fan** to remove any dangerous fumes from the room.

Emergency exits

There are usually at least two exits from a laboratory which can be used in an **emergency evacuation**.

Fire extinguishers

Fire extinguishers are available in case there is a fire in the laboratory. You should learn how to use a fire extinguisher for you may have to use one in an emergency.

Fire blanket

A fire blanket is a **non-flammable** blanket which can be thrown over a fire to put it out or to wrap up a student whose clothes are on fire.

Eye protection

Safety glasses should be available for use. Your teacher will advise you when to wear them.

An **eyewash** is a bottle which can be used to squirt water into an eye to wash out any chemicals that might have accidentally splashed into it.



Figure 2.2 A fire extinguisher. This type is used for electrical fires or burning liquids. The container is a red colour. It ejects carbon dioxide gas.

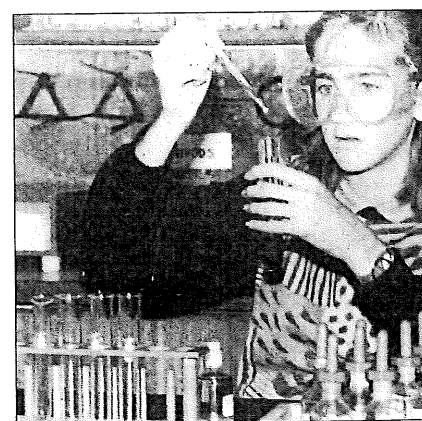


Figure 2.3 A student wearing safety glasses to protect her eyes.

Laboratory rules

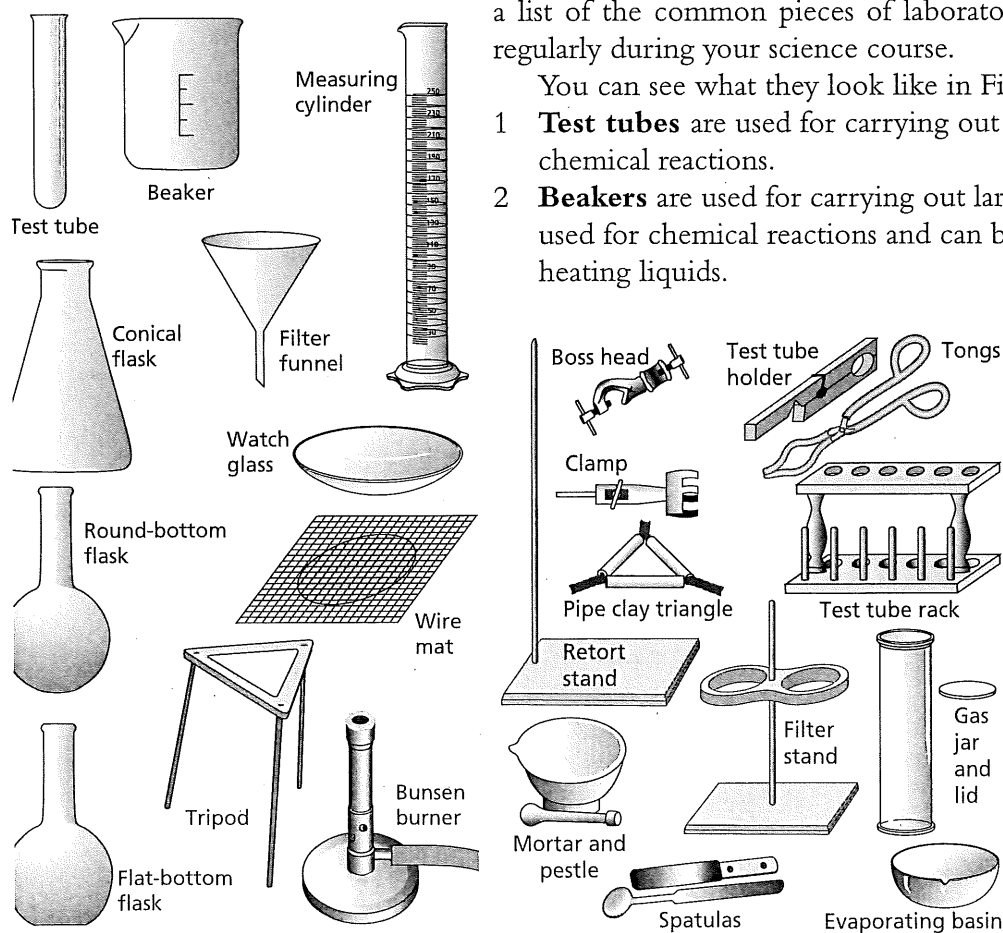
Most rules for the laboratory are common sense. They include the following:

- 1 Take care when moving around the laboratory.
- 2 Tie back long hair and wear protective glasses.
- 3 Thongs are not acceptable footwear in a laboratory.
- 4 Only do experiments directed by your teacher.
- 5 Report accidents, breakages and damaged equipment.
- 6 Clean up and return equipment when finished.
- 7 Do not wash solids down the sink.
- 8 Listen carefully to your teacher's instructions.

These rules are to protect everyone, including you and your friends.

Laboratory equipment

Figure 2.4 Some science equipment used in secondary school laboratories.



You will get to know the names and uses of the different pieces of equipment in the laboratory as your study of science continues. Below is a list of the common pieces of laboratory equipment that you will use regularly during your science course.

You can see what they look like in Figure 2.4.

- 1 **Test tubes** are used for carrying out small experiments such as chemical reactions.
- 2 **Beakers** are used for carrying out larger experiments. They can be used for chemical reactions and can be used over a Bunsen burner for heating liquids.
- 3 **Measuring cylinders** are tall glass vessels that can be used to measure out certain volumes of liquids accurately.
- 4 **Filter funnels** are used for pouring liquids into narrow containers and for filtering solid particles out of liquids.
- 5 **Flasks** are used for certain experiments using liquids. There are round-bottomed and conical flasks.
- 6 **Watch glasses** are small dishes used for holding

small specimens or for helping liquids to evaporate quickly.

- 7 **Bunsen burners** burn gas to provide a source of heat.
- 8 **Tripods** have **wire mats** placed on top of them to support beakers being heated by Bunsen burners. The wire mat spreads the heat evenly.
- 9 **Bench protection mats** are placed under the equipment to protect the bench.
- 10 **Retort stands** and **clamps** are used for holding some equipment rigidly up off the bench. The boss head holds the clamp to the retort stand.
- 11 **Tongs** and **test tube holders** are used for holding hot objects such as test tubes being heated over Bunsen burners.
- 12 **Test tube racks** are for holding test tubes.
- 13 The **pipeclay triangle** is used for holding containers such as a crucible when it is being heated by a Bunsen burner.
- 14 **Spatulas** are used for picking up solids and putting them into containers.
- 15 **Gas jars** are for holding gases produced in experiments.
- 16 A **mortar and pestle** is used to grind-up solids into a powder.
- 17 A **filter stand** is used for holding filter funnels.
- 18 An **evaporating basin** is used to evaporate liquid quickly.

There are, of course, many specialised pieces of equipment that are used only for special activities. These include electrical meters, stethoscopes, indicators, scalpels, telescopes, magnets, thermometers and manometers, to mention a few of the more common ones you are likely to use.

Sketching equipment

Not everyone finds it easy to draw pieces of laboratory equipment. To help make it easier you always draw a piece of laboratory equipment as though it was sliced from top to bottom through the middle and as though you are looking at it from the side view. This is called a vertical transverse section.

Figure 2.5 shows you how to sketch some laboratory equipment.

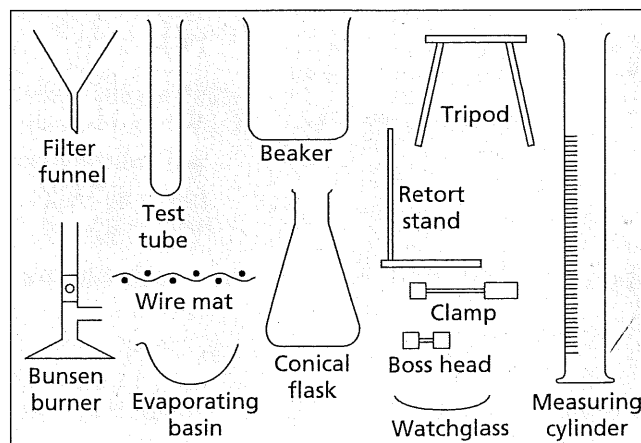


Figure 2.5 How to sketch laboratory equipment.

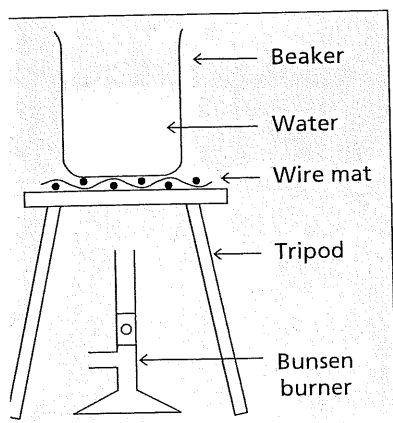


Figure 2.6 How to sketch an experiment and label it.

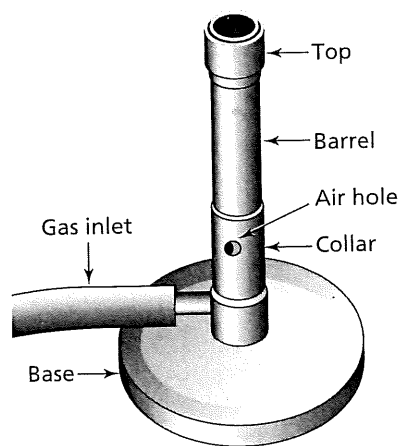


Figure 2.7 The parts of a Bunsen burner.

Figure 2.6 is a sketch of equipment for an experiment. You must label the diagrams. This means you must write the name of each piece of equipment next to it and join it to the diagram with an arrow or line.

Using a Bunsen burner

Lighting

Figure 2.7 shows a Bunsen burner.

When using a Bunsen burner the following steps should be followed:

- 1 Clear the work area and place a bench protector under the Bunsen burner.
- 2 Close the air hole of the burner by turning the collar.
- 3 Light a match and hold it at the top of the burner but not directly over the hole.
- 4 Turn on the gas.
- 5 Leave the collar closed and the yellow luminous flame burning until a hot flame is needed.
- 6 Slowly turn the collar around to open the air hole if you need a hotter flame. If the burner flame goes out, turn off the gas and start again.

Safety

There are some very important safety rules to follow when using a Bunsen burner. These rules are:

- 1 Always follow the steps described above when lighting a burner.
- 2 Do not lean over a burner—otherwise your hair or clothes could catch alight or you may be burned.
- 3 When not using the burner for heating, close the collar to produce the yellow luminous flame because it is easier to see and there are less likely to be accidents.
- 4 When heating a test tube over a burner, make sure that the open end is not pointing at anyone in case some of the contents spit out of the test tube.

Summary

- The science laboratory is a special room used for doing science.
- The science laboratory has special features such as water, gas, electricity, storage space and benches; and safety features such as fire extinguishers, safety glasses and emergency exits.
- Each laboratory has a set of safety rules which must be obeyed.

- Basic equipment for a laboratory includes Bunsen burners, beakers, test tubes, tripods and gauze mats, measuring cylinders, tongs, retort stands and clamps.
- When sketching scientific equipment draw it as though it was sliced from top to bottom and viewed from the side.
- Bunsen burners must be lit using a series of steps in the correct order.
- Safety rules must be followed when using a Bunsen burner.



Questions

- 1 List five features of a science laboratory that an ordinary classroom would not have.
- 2 Where in your laboratory is the main gas tap and the main water tap?
- 3 How many exits are there from your laboratory that could be used in an emergency?
- 4 What instructions are written on the side of the fire extinguisher in your laboratory?
- 5 What would you do if you splashed some acid in your eye?
- 6 Use Figure 2.4 to answer the following questions.
 - a Name six containers made of glass which can be used to hold liquids.
 - b Name a piece of equipment which can be used to measure the volume of a liquid.
 - c What would you use to hold a clamp to a retort stand?
 - d What would you use to hold a hot test tube?
 - e What would you use for pouring water from a beaker into a narrow container?
- 7 Sketch and label a diagram showing a flat-bottom flask clamped to a retort stand and being heated by a Bunsen burner. The bottom of the flat bottom flask is just touching a wire mat which is on a tripod stand.
- 8 Give the uses of the following pieces of equipment: wire mat, spatula, tongs, evaporating basin.
- 9 Why should the Bunsen burner be left burning with a yellow luminous flame when it is not being used for heating?
- 10 Why should you light the match before turning the gas on when using a Bunsen burner?
- 11 Why must you tie back long hair and not lean over a Bunsen burner when it is burning?
- 12 If you were doing an experiment and you broke some glassware, what should you do?
- 13 If you had a test tube containing a solid and some liquid, what should you do to clean it?
- 14 What is the important rule to follow when heating liquid in a test tube?