

Unit 1.2

Equipment

context

As a scientist, you will use a lot of different pieces of equipment. You need to know the name of each piece and how to use it safely and accurately.

Everyday laboratory equipment

Equipment is used in science to help carry out experiments and to make observations more accurate. Chemistry experiments, for example, are commonly run in beakers and conical flasks. Measuring cylinders are used to accurately measure volumes of liquid and thermometers are used to measure temperature. Stopwatches and electronic timers are more accurate than normal watches and clocks, and can be used for better timing. Other equipment magnifies very small objects that might normally be difficult to measure. Microscopes magnify extremely small objects, whereas telescopes magnify objects that are far away. Microphones and electronic amplifiers allow you to hear sounds that otherwise cannot be heard.

You will use a lot of different pieces of equipment in the school science laboratory. As with all equipment, there are special rules for using each piece. Your teacher will instruct you on how to safely use each one.

Fig 1.2.1 The Bunsen burner is one of the most important pieces of equipment you will use in science.

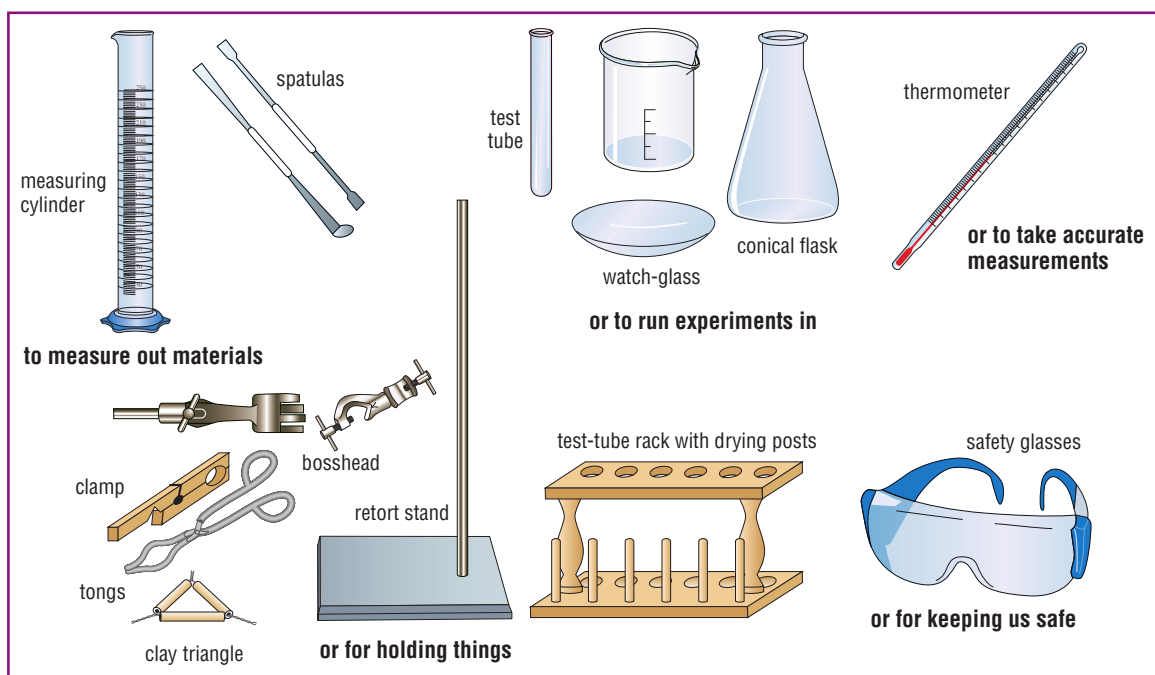


Fig 1.2.2 Commonly used laboratory equipment.

Scientific drawing

Diagrams of scientific equipment must be easy to draw and easy to read. You don't need to be an artist, but you do need to follow certain rules so that your diagrams can be understood by another scientist.

Scientists draw their equipment as a **cross-section**—they 'split' the equipment down the middle. The drawings are simple lines and curves, normally without any shading or colouring. These diagrams are known as two-dimensional (2D) **scientific diagrams** and are used by scientists all around the world.

Worksheet 1.2 Laboratory equipment

Worksheet 1.3 Wordfind

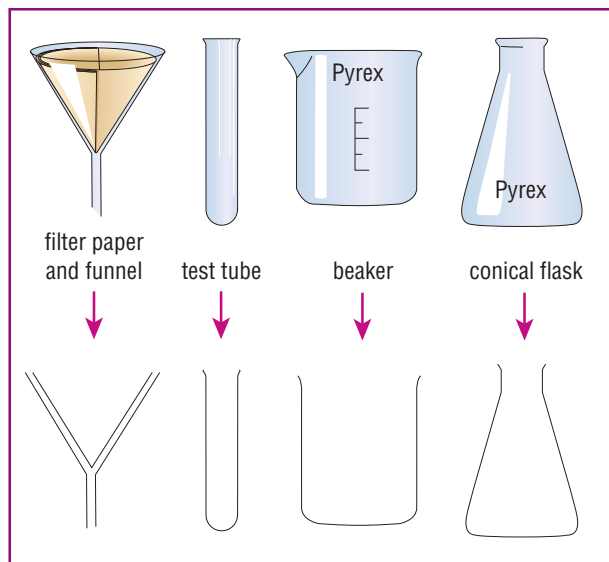


Fig 1.2.3 Always draw scientific equipment as a simple 2D cross-section.

Worksheet 1.4 Scientific apparatus



The Bunsen burner

A potentially dangerous piece of equipment you will use in the laboratory is the **Bunsen burner**. It is used to heat chemicals. Your safety depends upon using it correctly.

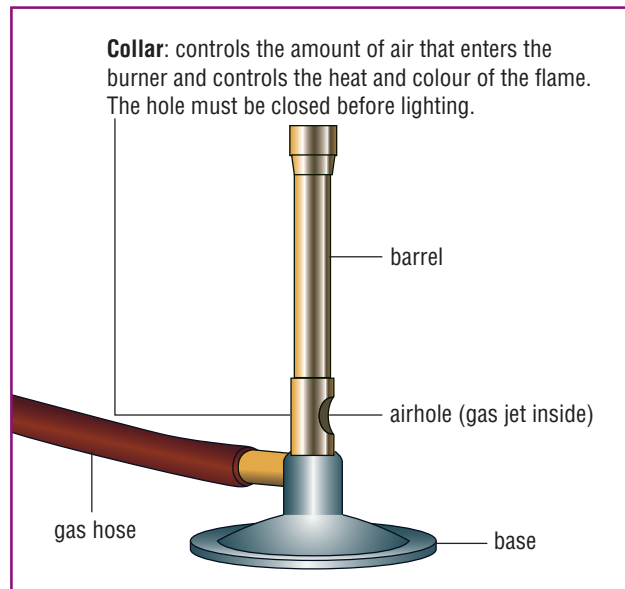


Fig 1.2.4 Parts of the Bunsen burner

Worksheet 1.5 The Bunsen burner

Using the Bunsen burner

The **collar** controls the amount of air that enters the burner and controls the heat and colour of the flame.

The collar must be turned so that the **airhole** is *closed* whenever a Bunsen burner is lit. Very little air is then able to mix with the gas and so the gas will not burn well. It produces an easily visible, pale yellow flame that is relatively cool. It is also a dirty flame because it leaves a layer of carbon on anything that is heated in it. This flame is called the **safety flame** because it is the coolest flame and is the easiest to see.

If the collar is turned so that the airhole is *open* then a lot of air will enter. The gas will burn efficiently with no smoke and will be extremely hot (about 1500°C). Although difficult to see, this flame is blue in colour and noisy.

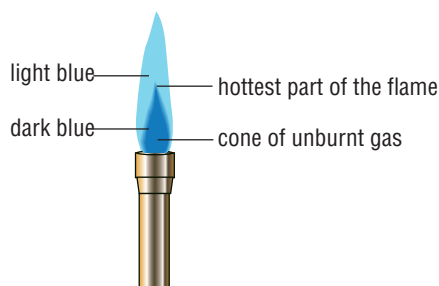


Fig 1.2.5 There is a small cone of unburnt gas at the very base of a Bunsen burner flame. The hottest part of the flame is just above this cone.



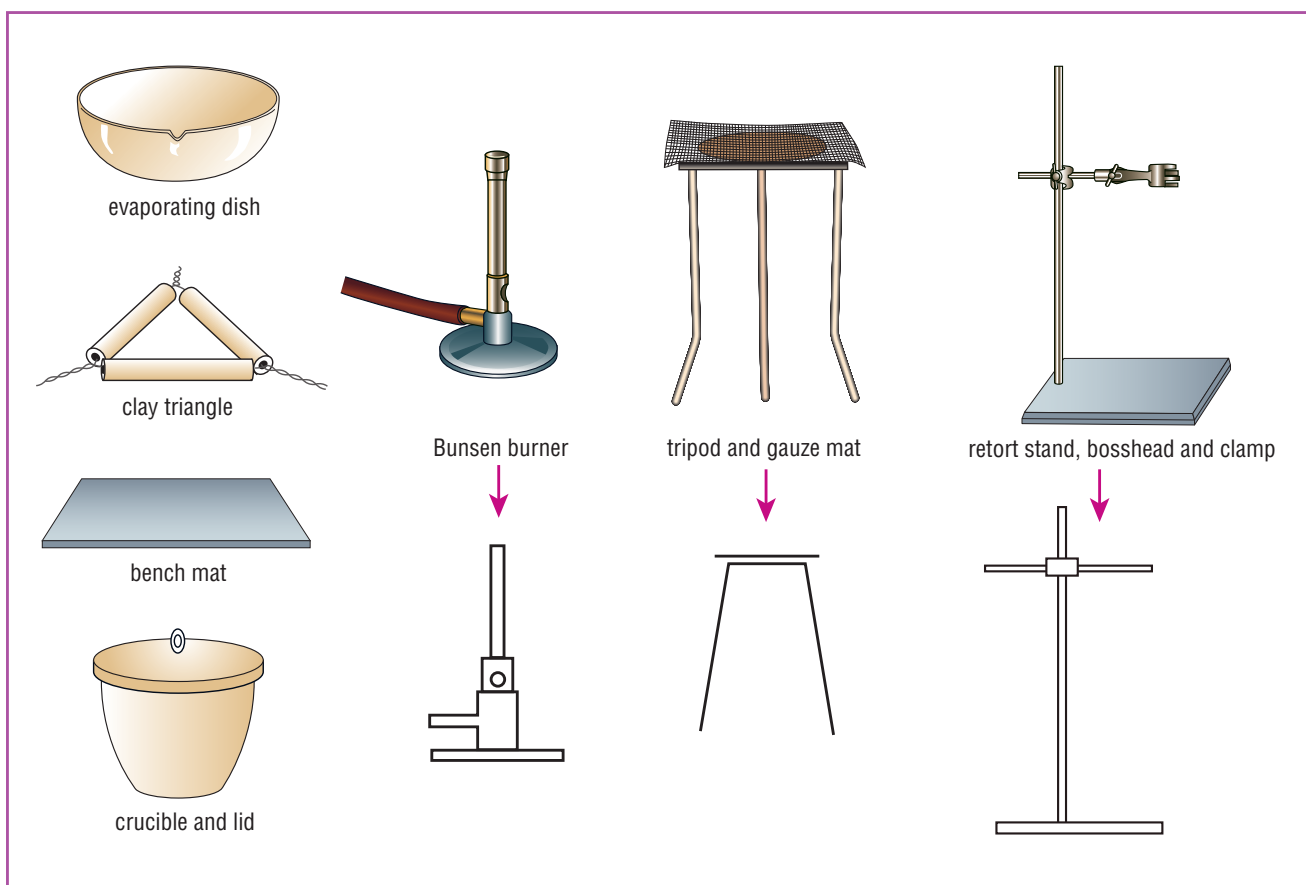
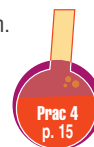


Fig 1.2.6 The Bunsen burner gets so hot that special equipment is needed to safely hold objects when heating them.



Science Fact File

People in science:

Robert Bunsen (1811–1899)

The German chemist Robert Bunsen invented many different pieces of laboratory equipment but the Bunsen burner was not one of them. It is likely that Bunsen's laboratory assistant, Peter Desdega, developed it in 1855, possibly from earlier designs by the English scientist Michael Faraday (1791–1867). This presents a few questions: Who should get the credit? Who does the work in science?

Bunsen worked on explosive arsenic compounds, which almost killed him, and he lost one eye when a glass container exploded. Working with the German physicist Gustav Kirchhoff (1824–1887), Bunsen discovered two new elements—caesium and rubidium.

Science Clip

Smelly Bunsen!

Bunsen was a bachelor for all his life. He developed a number of strange personality quirks, including not bathing! International Bunsen day is celebrated each year on Bunsen's birthday of March 31.

1.2 QUESTIONS

Remembering

- State** what each piece of equipment is used for:
 - clay triangle
 - beaker
 - safety glasses
 - test tube
 - thermometer
 - measuring cylinder
 - tongs.
- Recall** the following pieces of equipment by drawing their correct 2D scientific diagrams:
 - beaker
 - a conical flask
 - a test tube
 - a tripod and gauze mat.
- List** the characteristics of:
 - the safety flame
 - the blue flame.

Understanding

- Clarify** the purpose of the collar in a Bunsen burner.
- Explain** why a yellow flame is called a safety flame when it is still hot enough to seriously burn you.
- Explain** why the gas must be turned on *after* the match is lit.
- Explain** why a Bunsen burner should be left for awhile before it is packed away.
- Propose** why you should not use a piece of burning paper to light a Bunsen burner.

Applying

- Identify** a piece of equipment that you would use to:
 - Measure the temperature of boiling water.
 - Measure out exactly 55 mL of salt water.
 - Transfer a small amount of solid onto a balance.
 - Pour liquid into a conical flask.
- Identify** a piece of equipment that would assist these scientists in making the following observations:
 - A microbiologist wants to study extremely small bacteria that have been causing infections.
 - A chemist is measuring the heat generated by a chemical reaction.

- A physicist wants to accurately measure the time it takes for a stone to drop 2 metres.
- An astronomer wants to study the surface of the Moon.

- The Bunsen burner can be extremely dangerous if not treated carefully. **Identify** what each of the students in Figure 1.2.7 might be doing wrong.



Fig 1.2.7

Analysing

- Compare** the following pieces of equipment by listing their similarities:
 - a beaker and a conical flask
 - a beaker and a measuring cylinder
 - tongs, a peg and a clamp
 - a clay triangle and a gauze mat
 - a test tube and an evaporating dish.

Creating

- Construct** a labelled 2D scientific diagram that shows the set-up used for boiling water. You will need to show the bench mat, tripod and gauze mat, Bunsen burner and beaker.
- Construct** a plan of your school laboratory that shows where the following special safety equipment is located:
 - fire blanket
 - fire extinguishers (Is there more than one type?)
 - eyewash
 - broken glass container
 - bucket (maybe containing sand or another chemical to soak up spills)
 - first aid cabinet
 - safety signs.

1.2 INVESTIGATING

Investigate your available resources (e.g. textbooks, encyclopaedias, Internet etc.) to find what these pieces of equipment look like and state what they are used for:

- a pipette
- b burette
- c micrometer
- d barometer
- e mortar and pestle
- f ammeter.

e-xploring

To find out more about Bunsen burners, a list of web destinations can be found on *Science Focus 1 Second Edition Student Lounge*.



1.2 PRACTICAL ACTIVITIES

1 What is it?

Aim

To draw, classify and name common laboratory equipment.

Equipment

A range of everyday scientific equipment.

Method

- 1 In your science workbook **construct** a table with eight sections, as shown opposite.
- 2 *Each* piece of equipment you have been provided with must be drawn under *one* of the headings. Draw each piece:
 - a as realistically as you can
 - b as a scientific diagram.
- 3 Write the name of each piece of equipment under the diagram.

Measuring equipment	Pouring equipment	Storage equipment	Equipment to run chemical reactions in
Safety equipment	Holding equipment	Cleaning equipment	Mixing equipment