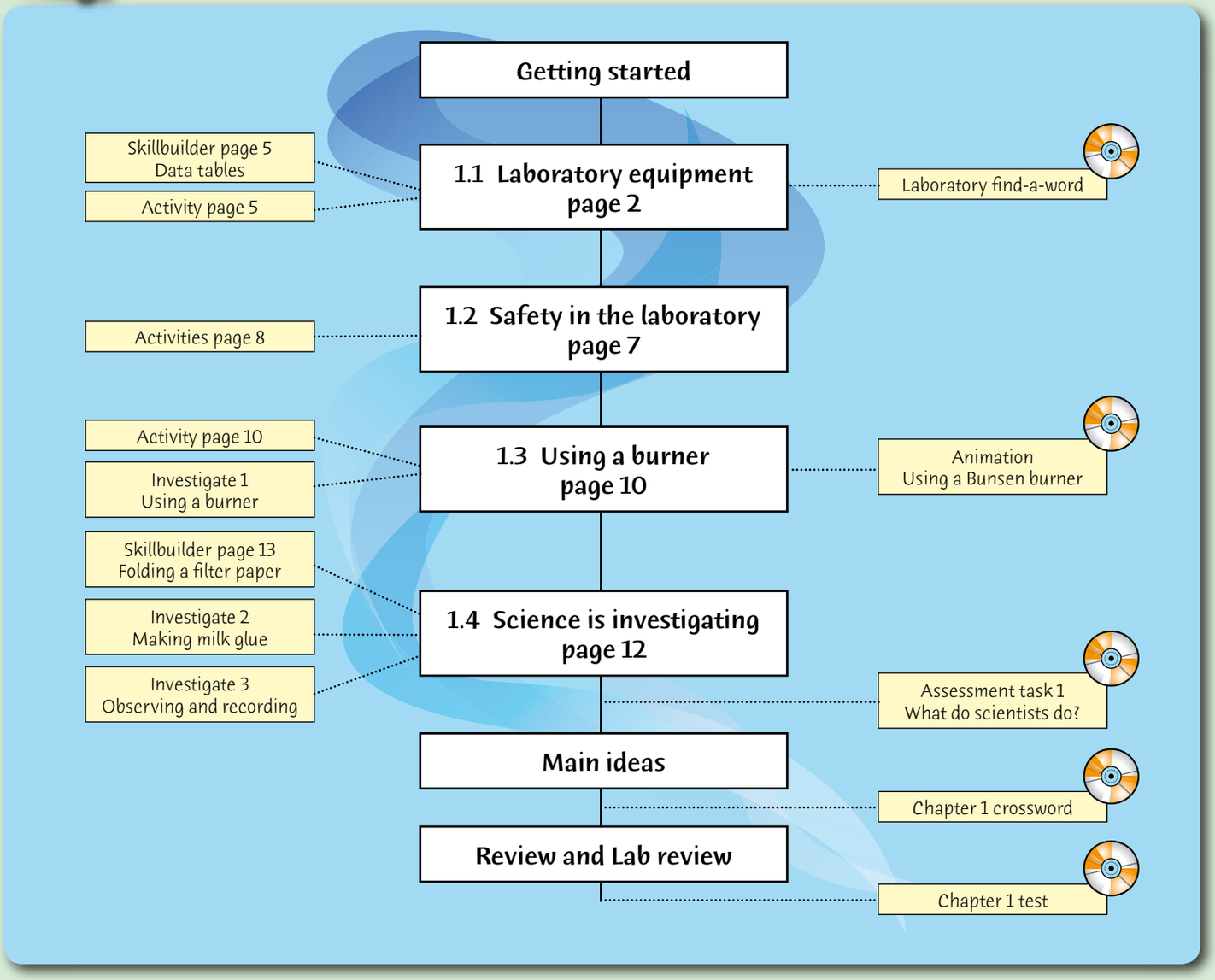
1 Working in a laboratory

Planning page



Essential Learnings for Chapter 1

Essential Learnings	References		
	Student book (page number)	Workbook (page number)	Teacher Edition CD (Assessment task)
Ways of working Conduct and apply safety audits and identify and manage risks	pages 7–10 Investigate 1 page 11 Investigate 2 page 14 Investigate 3 page 16	page 6 page 8	
Select and use scientific equipment and technologies to enhance the reliability and accuracy of data collected in investigations	pages 2–6 Skillbuilder page 13	pages 6–7 page 9	
Communicate scientific ideas, explanations, conclusions, decisions and data, using scientific argument and terminology, in appropriate formats	Skillbuilder page 5 pages 12–15 Investigate 2 page 14	pages 7–14	
Knowledge and understanding *Science as a human endeavour* People from different cultures contribute to and shape the development of science			Assessment task 1 Measuring

QSA *Science Essential Learnings by the end of Year 9*

Vocabulary

apparatus
conclusion
corrosive
data
decant
disposal
equipment
generalisation
hydrochloric
laboratory
observation
poison
safety

Focus for learning

Students become familiar with the science laboratory by drawing a large floor plan showing the position of various items (page 1).

Equipment and chemicals (per group)

Activity page 5	8 pieces of numbered equipment
Investigate 1 page 11	Bunsen burner, heatproof mat, matches, piece of copper wire, metal tongs, 250 mL beaker
Skillbuilder page 13	filter paper
Investigate 2 page 14	100 mL skim milk, 25 mL white vinegar, 5 g baking soda, two 250 mL beakers, spatula, stirring rod, filter funnel and paper, stand and clamp for filter (or filter stand), Bunsen burner, tripod, gauze mat, heatproof mat, matches
Investigate 3 page 16	**Part A:** limewater, drinking straw, flask **Part B:** test tube, small piece of zinc, dilute hydrochloric acid (1 M) **Part C:** test tube, spatula, sodium thiosulfate crystals (hypo), dilute hydrochloric acid (1 M) **Part D:** ink pad, methylated spirits and paper towel (for cleaning up), hand lens

Special preparations

Investigate 3 page 16	To make limewater, add about one teaspoonful of sodium calcium hydroxide, $Ca(OH)_2$, to one litre of water. Shake or stir to mix and allow it to stand overnight if possible, then filter off the solid.

1 Working in a laboratory

Getting Started

A science **laboratory** (la-BOR-a-tory) is a specially designed room where you can carry out experiments safely.

- How is a science laboratory different from other classrooms in the school? Discuss this in a group.
- Draw a large floor plan of your laboratory. Show the position of each of the following items, labelling them clearly:
  - workbenches
  - teacher's bench
  - gas taps and emergency shut-off tap
  - water taps and sink
  - power points and emergency trip switch
  - preparation room
  - doors (including emergency exit)
  - fume cupboard
  - heating equipment cupboard
  - glassware cupboard
  - rubbish bin and broken glass bin
  - fire extinguisher
  - fire blanket
  - sand bucket
  - first aid kit
  - safety shower and eye bath.

Make sure you know why your laboratory contains each of these items.

Starting point

1 Ask students to develop concept maps around key words such as *science, safety, experiments* and *equipment*.

Note: if students are not familiar with concept maps (mind maps), refer to page 35 of *ScienceWorld 1 Workbook*.

2 Ask students to describe what they think *working scientifically* means. They could draw a Y-graph using headings such as *describe, feel* and *sounds like*. To construct a Y-graph, draw a large Y in the centre of a page with a heading in each of the three sections. Students place a series of descriptor words or sentences in each section. For example, in the *describe* section students might write *experiments, lab coats, tests, test tubes, chemicals.*

3 Start the lesson with an exciting demonstration full of colour or noise to create an engaging environment. For example, you could demonstrate burning magnesium (with safety precautions), adding acid to magnesium or using universal solution in acids and bases.

4 Set up the laboratory with biological specimens and posters to assist visual learning.

Hints and tips

In the first class, you may wish to do the following:

- Introduce the lab technician and/or head of science if appropriate. Students like to feel important and introducing these figures of authority not only makes the students accountable to these people, but also makes them more likely to be respectful of school property and more likely to behave appropriately in the science room. Students should know who the lab technician is so they know who to refer to when extra experiment items are needed or a piece of equipment is malfunctioning.
- Explain to the students the emergency procedures, where to locate emergency equipment and how to use these items: fire extinguishers, fire blanket, eye bath, etc. In case of evacuations tell and/or show the class where the evacuation point is located.
- You might like to demonstrate how the room's fume cabinet works and quiz the students on the need for such a cabinet.

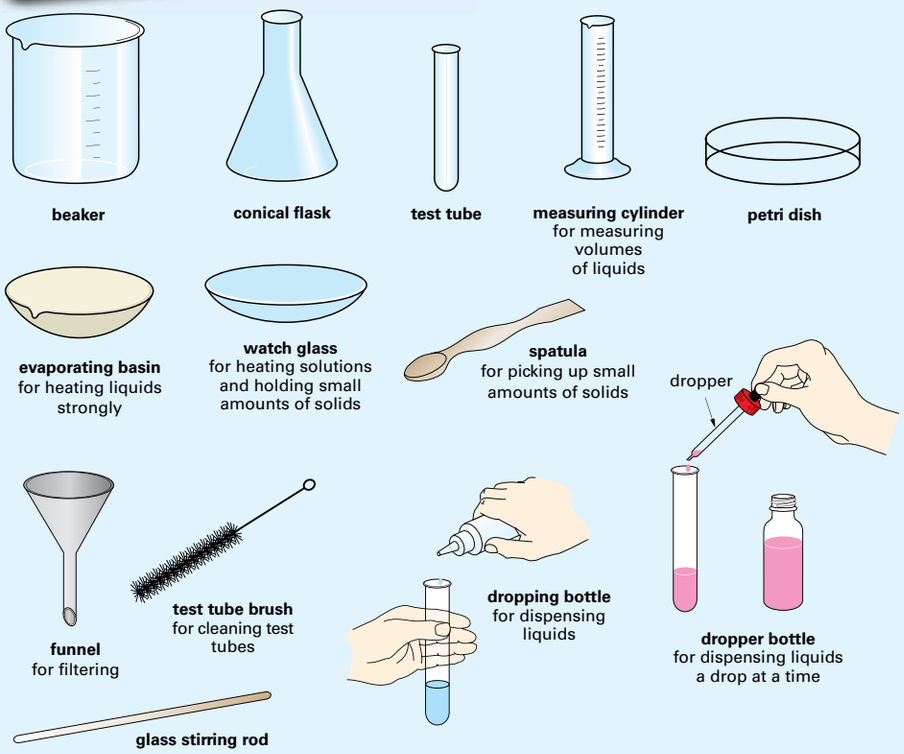
Hints and tips

- Have the equipment set up on the front bench and allow students (in their groups) to come up and examine them. Alternatively, have some containers set up on benches for each group to touch and hold.
- Place coloured water in each holding container. This makes the shape easier to appreciate and enhances the visual learning aspect of the exercise.

1.1 Laboratory equipment

In the science laboratory you will find many different pieces of equipment. Before you can begin experimenting you need to be able to identify these items and know what they are used for. You also need to be able to spell their names correctly, and to draw them when you write reports of experiments.

Containers and other useful items



Note: Containers come in different sizes, depending on how much you want to put in them. Some, like beakers, can be made from glass or plastic.

Learning experience

Allow students to suggest the possible use for each piece of equipment and the reason why each is shaped the way it is. Discuss their answers and enter them in the following table. Complete the table with a diagram of each piece of equipment.

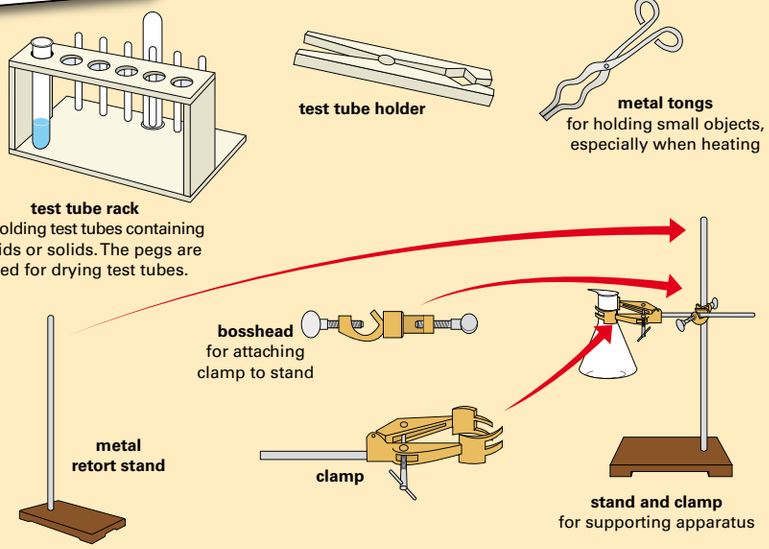
Equipment	Use	Diagram

Learning experience

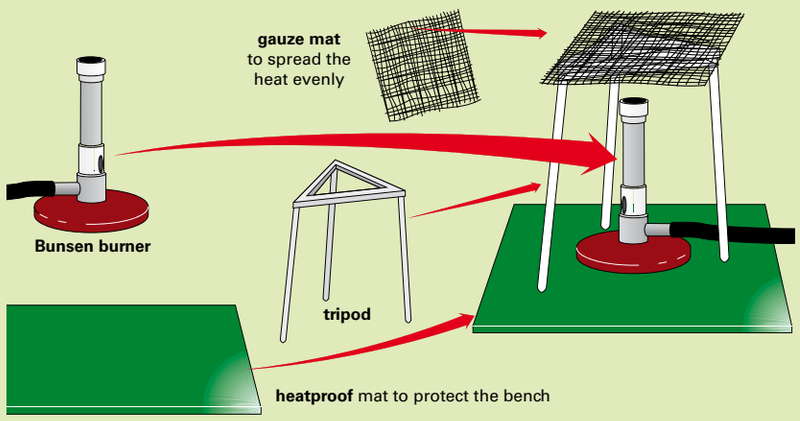
Play the *Equipment Guessing Game*. This is a useful way to help students memorise the names of equipment.

- Place eight items on the bench.
- Ask students to name each item.
- Rearrange the items in a different order.
- Ask students to name each item again.
- Remove one item.
- Have students guess the name of the missing item.

Holding things



Heating apparatus



Hints and tips

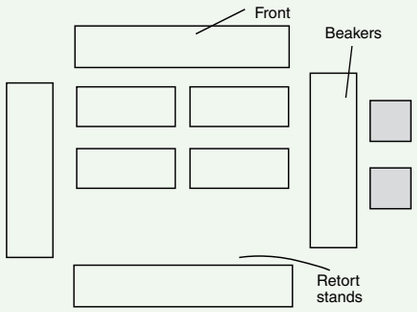
Keep reinforcing the names and appearance of commonly used apparatus. Science is like learning a new language. The more familiar the students are with science words and apparatus the more comfortable they will feel performing experiments.

Hints and tips

Make sure students tighten the bosshead so that the clamp is in a horizontal position.

Hints and tips

If the science equipment is stored in various places in the classroom, ask the students to draw a laboratory map, indicating where each piece of equipment can be found. For example:



This allows the students to move freely around the room, encouraging them to open cupboards without fear. This can be done individually or as a group or class activity.

Learning experience

- Allow the students to set up and handle the equipment.
- Fill test tubes and flasks with coloured water so that students learn that more force or tightening is required when holding full test tubes or flasks.

Learning experience

Allow the students to go on a treasure hunt for equipment. Assign each student a different piece of equipment to locate. Once each student has found their item and brought it back to their seat, get them to describe what the item is, what it is used for and where they located it.

Drawing science equipment

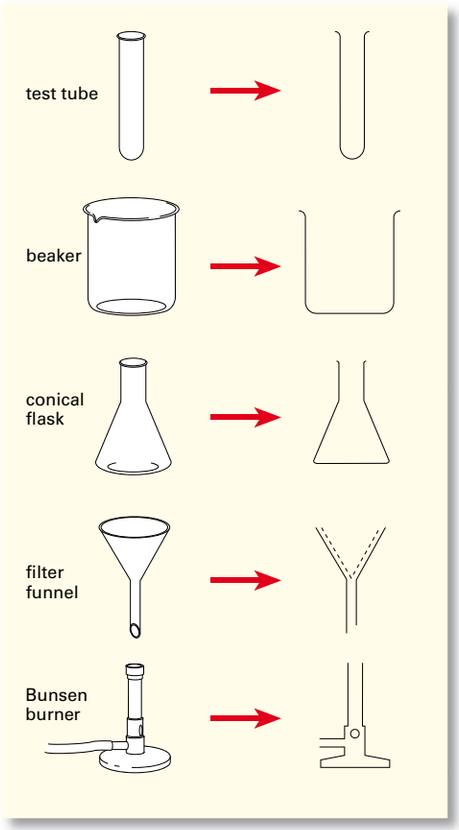
It is best to keep drawings of science equipment simple. Look at the drawings on this page. The ones on the left are three-dimensional and have been drawn by an artist. The ones on the right are simple two-dimensional views, and this is how you should draw equipment for your science investigations. Note how much simpler the right-hand drawings are. For example, there is no line across the mouth of the test tube, beaker or flask.

When science equipment is put together for a purpose, such as heating water in a flask, it is called **apparatus** (see the photo below). Notice how much simpler the diagram on the right is. For example, the tripod has been drawn with only two legs.

When you are drawing apparatus like this you should:

- use a pencil, for ease of correction if you make a mistake
- label the drawing using label lines
- use a ruler for all straight lines, and
- not use shading or colouring.

Note: There are plastic templates available for drawing scientific apparatus.



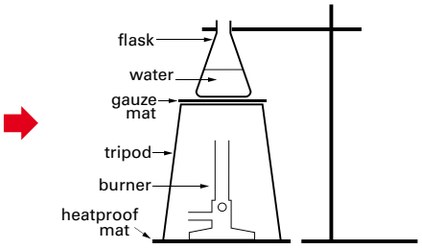


Fig 7 Apparatus for heating a flask of water

Hints and tips

Reinforce the rules for the drawing of diagrams:

- Use a pencil.
- Label the diagram.
- Use a ruler.
- Try to draw equipment in proportion.
- Don't use shading or colour.

Learning experience

Make equipment mobiles to suspend from the ceiling.

This can be done very easily by using fishing line, two pieces of dowel and coloured cards. Make a cross with the pieces of dowel and tie them together with some fishing line. Use the coloured cards to display two-dimensional or three-dimensional images of different pieces of equipment. Tie the cards to the dowels and then suspend the mobiles from the ceiling around the classroom.

Learning experiences

1 Set up different equipment at each work station. Ask each group to draw the item in a two-dimensional form. Draw several matching two-dimensional and three-dimensional diagrams on place cards. Have students match the pairs.

2 Place equipment on the front bench and allow students about 60 seconds to observe the equipment. Remove the equipment and write a list of all the equipment that was observed on the board. Ask the students to describe the equipment, including its use, and then ask them to draw a two-dimensional diagram of each piece.

Skillbuilder

In the next activity you are going to look at a number of pieces of laboratory equipment. You will record the name of each piece and what it is used for. A way to record information so that it is easy to read and understand is by drawing a table.

In other investigations you will have to record results that include numbers or measurements. These numerical results are called **data**. You record data in a *data table*.

For example, suppose you counted the number of people in your class with blue eyes, brown eyes and green eyes. The results are easy to read if they are in a data table like the one shown.

Eye colour	Number of people
blue	8
brown	11
green	9

try this

Sam and Amanda were investigating how long it takes bean seeds to germinate at different temperatures. They recorded their results in a data table.

At 10 °C, the bean seeds took on average 8 days to germinate. At 20 °C they took 6 days. At 5 °C they took 12 days, and at 30 °C they took 4 days. None germinated when the pottting mix was at 50 °C.

Draw up a data table for the results.

Activity

Your teacher will place about eight pieces of numbered equipment on your table.

Your group's task is to identify the equipment by using the information on the previous pages.

For each piece of equipment, record its number, name, size (if it is a container), and what it is used for. Record this information in a data table like the one below.

Equipment number	Equipment name	Size (if container)	What is it used for?	Diagram of equipment
1 2 3 …		Draw a data table similar to this		

Activity note

An alternative to placing the numbered equipment on the students' bench is to place the pieces of equipment around the room and have the groups circulate.

Learning experience

Reinforce the importance of tables for the collection of data with the following activity.

- Hand out a small box of Smarties (fun-pack size) to each group or student. Ask them to make up a table showing the number of different coloured Smarties in each pack. Alternatively, you could use coloured paperclips.
- Extension: combine all the results and draw up a class table.

Learning experience

On plain coloured card (lighter shades of paper work best) ask the students to make their own two-dimensional apparatus template which they can use for writing up experiments. The shapes will need to be drawn with solid black lines so that they can easily be traced (seen through a sheet of lined paper). Remind students of the rules for drawing equipment and suggest they draw each item so it is about 3 cm high.

Science in action

Dr Josh Mylne is a plant biologist working on how plants know that winter has passed. Winter makes plants flower faster and many crops wait until after winter before they flower and make seeds.

Most of Josh's work is done in his laboratory using some of the equipment you have seen and identified. His plants are grown on plastic petri dishes in growth rooms or in soil in glasshouses.

Look at the equipment in the photo of Josh's laboratory. Make a list of as many pieces of equipment as you can recognise.

Working with technology — Try doing the **Laboratory find-a-word** on the CD.

Check!

1 Match each item of equipment listed below with its use. Write the correct pairs in your notebook in a table as shown.

Apparatus	Use

tripod — a general purpose glass container for small amounts of material
gauze mat — for holding hot objects
spatula — placed on top of a tripod to spread the heat
test tube — you stand equipment on this when heating things
beaker — for picking up small amounts of solids
Bunsen burner — a general purpose glass container with a pouring lip
stand and clamp — used for heating things
metal tongs — for holding equipment in place

2 Draw simple two-dimensional drawings of the following pieces of equipment.
- round-bottom flask
- measuring cylinder
- tripod
- stand and clamp
- filter funnel
- evaporating basin

Check with your teacher that you have drawn them correctly.

3 Which equipment would you need to:
- **a** measure out exactly 20 mL of water
- **b** heat a small volume of liquid
- **c** heat a small amount of solid strongly
- **d** take a small amount of powder from a bottle and dissolve it in water
- **e** test whether a small piece of fabric will burn
- **f** boil about 200 mL of water
- **g** add 2 drops of liquid A to about 5 mL of liquid B?

4 Look at the equipment in Fig 7 on page 4. What other container could you use to heat water? What is the advantage of the flask?

Hints and tips

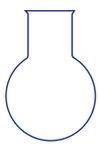
The **Laboratory find-a-word** on the student CD can be set as a homework activity.

Check! solutions

1

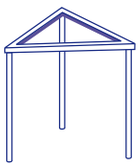
Apparatus	Use
tripod	for standing equipment on in order to heat it
gauze mat	placed on top of a tripod to spread the heat
spatula	for picking up small amounts of solids
test tube	a general purpose glass container for small amounts of material
beaker	a general purpose glass container with a pouring lip
Bunsen burner	used for heating things
stand and clamp	for holding equipment in place
metal tongs	for holding hot objects

2 round-bottomed flask

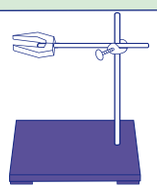


measuring cylinder

tripod



stand and clamp



filter funnel

evaporating basin

3 The following equipment is recommended:
- **a** measuring cylinder
- **b** test tube and Bunsen burner
- **c** metal tongs, crucible and Bunsen burner
- **d** spatula and beaker or test tube
- **e** metal tongs, Bunsen burner and heatproof mat
- **f** large beaker, Bunsen burner, tripod and gauze mat
- **g** test tube, measuring cylinder and dropping bottle.

4 Another container that could be used to heat water is a beaker. An advantage of the flask is that a stopper can be inserted into the neck to prevent the water from evaporating and to keep it clean. Another advantage is that it will reduce splashing.

1.2 Safety in the laboratory

A laboratory is a place for doing things. You will enjoy working there. However, to make the laboratory a safe place for everyone, there are two main rules to follow.

1 Know what you are doing in the laboratory—read the instructions carefully before you start.
2 Always think of others and behave sensibly.

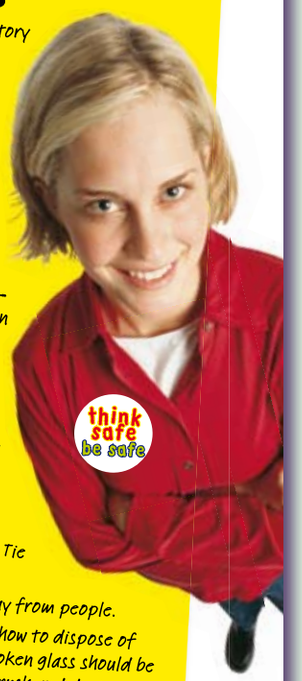
Follow the safety rules on the right and accidents should not happen. Many accidents can be avoided by keeping alert and using common sense. Read about the types of accidents that can occur and how to avoid them. And if an accident does occur, report it to your teacher.

Eye injuries can be caused by liquids splashing into your eyes during investigations.

- Always wear safety glasses whenever there is a chance of liquid splashing into your eyes, especially when heating things.
- Always wear safety glasses when you see the safety glasses symbol on investigation pages.
- Never point a test tube towards yourself or anyone else. If you get a chemical in your eye, wash it immediately with lots of water, and tell your teacher. Your laboratory may have a special eye bath to make this easier.

SAFETY RULES

1 Do not enter the laboratory unless you are with a teacher.
2 Never touch equipment in the laboratory unless you are told to use it.
3 Don't eat or drink in the laboratory.
4 Always walk—never run.
5 Wear protective clothing—a laboratory coat or apron and, when appropriate, safety glasses.
6 Never taste anything.
7 Don't use paper to light Bunsen burners, and don't put burning or hot things in the rubbish bin.
8 Keep books, paper and clothing away from flames. Tie up long hair.
9 Always point test tubes away from people.
10 Check with your teacher on how to dispose of waste liquids and solids. Broken glass should be cleaned up using gloves, a brush and dustpan, and placed in a special bin.
11 If you spill something on your skin or clothes, wash it immediately with lots of water. Tell your teacher.
12 Report all accidents and breakages to your teacher.
13 After heating equipment, let it cool on a heatproof mat before picking it up. This will avoid burns.
14 Clean all equipment after use and put it back where you got it from. Clean and dry your work bench.



Hints and tips

A list of ten rules is easier for students to remember. Get the class to condense the list of fourteen rules in the text to ten.

Homework

Ask students to list some safety rules that are in place at home, such as in the kitchen or garage. Students could also ask their parents which rules they need to be aware of in their workplaces.

Learning experience

- Divide the class into small groups to design concept maps around the word *safety*.
- As a class, discuss the importance of safety in the laboratory.
- Ask each group to come up with a set of rules for the laboratory. Each group can then read out their rules and explain why each rule is so important.
- Students could design safety posters to place around the room.

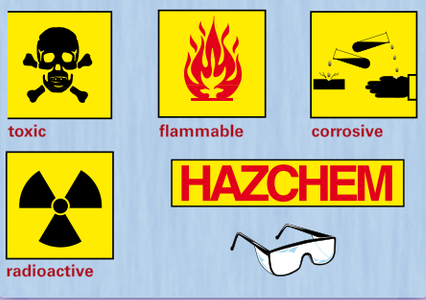
Poisoning can be caused by breathing in fumes during an investigation, by tasting chemicals or by spilling them on your skin.

- Never taste anything, and never bring food or drink in the laboratory.
- Check the labels on chemicals before you use them.

Activity

In a small group discuss what each of these labels or symbols means.

Give examples of where you would find each of these.



Cuts are caused mainly by broken glass.

- Use gloves, a brush and shovel or dustpan to clean up any broken glass and put it into the special bin.

Burns can be caused by touching hot equipment, or by spilling hot liquid.

- Treat these types of burns with cold running water for about 10 minutes.
- More serious burns can occur when using a Bunsen burner. If this happens, tell your teacher immediately.

Fires are always possible when using burners.

- Don't use paper to light a burner, and never place burning things in rubbish bins.
- If you have long hair, it is essential you tie it back whenever you are using a burner.
- If there is a fire, stay calm and call for help. If a person's hair or clothing catches fire, remember the three rules: stop, drop and roll. The person must stop moving around, drop to the floor and roll. While the person is rolling, a fire blanket should be quickly wrapped around the person to smother the flames.

Damage to clothing and skin can occur when chemicals, especially corrosive liquids such as acids and alkalis, are spilt.

- Wear a lab coat or other protective clothing when doing investigations.
- If there is a spill, wash the area immediately with lots of water and send someone to tell the teacher.
- In serious cases it may be necessary to use the safety shower.

Activities

1 At the start of the year your teacher may have given you a copy of the laboratory safety rules for your school.

Work in a small group and compare the rules in the list on page 7 with your school's rules.

- Which rules are the same?
- Which are different? Suggest why these rules are different. Your teacher may want to discuss this with the whole class.

2 Without looking at the information on this page, make a dot-point list of the things you would do in the following situations:

- you have spilt a chemical on your skin
- your friend has picked up a very hot piece of glassware
- you have splashed a liquid in your eye.

Hints and tips

Explain that HAZCHEM stands for 'hazardous chemicals'.

Activities note

You may already have a set of standardised safety rules for the laboratory. Get the students to compare these rules with the list in the text. Are there any rules which should be added to the school list? Why?

Homework

Have students draw some (say, five) symbols they see around the home or on roads. Ask the students to write what they think the symbols mean and to describe why they are so important.

Learning experiences

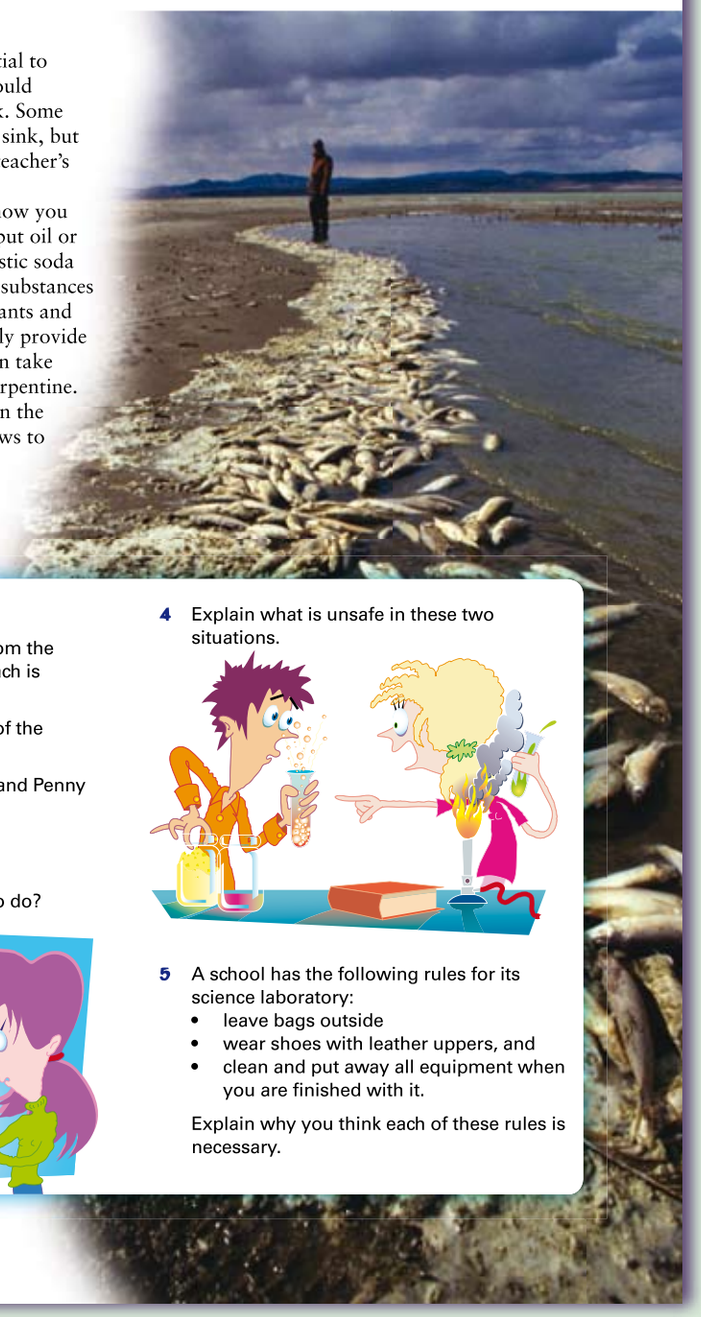
1 As an extension activity, ask the students to design a safety pamphlet about how to avoid accidents and what to do in an emergency if one occurs. The students could each choose a specific type of injury for their pamphlet.

2 Ask students to design other safety symbols which could be used around the laboratory.

Disposal of chemicals

To protect our environment it is essential to dispose of chemicals properly. You should never put leftover solids down the sink. Some liquids can safely be poured down the sink, but others cannot, so always follow your teacher's instructions.

At home you must also be careful how you dispose of chemicals. You should not put oil or petrol or corrosive substances like caustic soda down the sink. Drains can carry these substances into creeks and rivers and harm the plants and animals that live there. Councils usually provide places at the local dump where you can take liquids such as used oil and mineral turpentine. Industries must also take special care in the disposal of chemicals, and there are laws to enforce this.



Check!

1 Select three of the safety rules from the list on page 7 and explain why each is important.

2 Design a poster to illustrate one of the safety rules.

3 Look at the cartoon showing Ian and Penny in the laboratory.
- **a** What has happened to Ian?
- **b** What was he trying to do?
- **c** What did he do wrong?
- **d** What should Penny tell him to do?

4 Explain what is unsafe in these two situations.

5 A school has the following rules for its science laboratory:
- leave bags outside
- wear shoes with leather uppers, and
- clean and put away all equipment when you are finished with it.

Explain why you think each of these rules is necessary.

Hints and tips

Prepare fact sheets on some well-known toxic or chemical spills that have caused significant environmental damage. Ask the students to briefly summarise a relevant article and report to the class.

Learning experience

Discuss the environmental issues that could occur as a result of the incorrect disposal of chemicals.

Research/extension

1 How do local industries or businesses such as vehicle workshops dispose of their wastes?

2 What is the government (eg the Department of Primary Industries, local councils, etc) doing to regulate the disposal of waste?

Check! solutions

1 Students could select any of the rules as they are all to do with personal safety, the safety of others or the safety of the equipment. For example, rule number 4 states that you should walk and not run. The reason is that there may be something on the floor that is slippery or you may collide with the corner of a bench if someone is in your way and this could cause an injury.

2 Explain to students what they need to do with this poster and help them with this task.

3 These are some possibilities:
- **a** Ian has been careless and has spilled some chemicals in his eye.
- **b** He was trying to show off.
- **c** He was not wearing safety glasses, should not hold the test tube near his eye and should not grab things from other students.
- **d** He should immediately wash his eye with the eye-wash hose or bottle while Penny should tell the teacher.

4 These situations are unsafe because:
- The student on the left should use a spatula instead of handling chemicals with his fingers and he should also be wearing safety glasses.
- The second student is not concentrating on her own business and should have her hair tied back so that it does not go near the flame and possibly catch alight. She should also be wearing safety glasses.

5 Possible reasons for the rules are:
- Bags inside a laboratory are a safety hazard because people can trip over them or spill things on them.
- Shoes which are open at the top do not protect your feet from hot, sharp or corrosive materials.
- Equipment should be cleaned and put away so that it is not in the way for the next students who are going to use the bench.

Animation

View the **Using a Bunsen Burner** animation in class, or ask students to watch it as homework.

Hints and tips

- Don't assume that students can use matches.
- Demonstrate to the class before students use the burner themselves. Talk through the process and continue to name and rename parts of the Bunsen burner. Review the 'Rules for safe use' (page 11).
- Keep instructions simple: attach hose, close air hole, light match, turn on gas.
- When allowing students to work in groups and light the Bunsen burners, always get their full attention. Work in small steps, ensuring each group is up to the same point as the rest of the class.
- Assign a student to be in charge at the gas main. Rotate this responsibility through the members of the group.

Activity note

The main risk is burns. It is very important to teach students not to touch the Bunsen burner barrel when it is on and to leave sufficient time for it to cool down when it has been turned off. Most burns occur when students touch the hot barrel as they are putting the burners away.

1.3 Using a burner

In the laboratory a Bunsen burner is used to heat things. The burner is named after a German chemist called Robert Wilhelm Bunsen. He found that he could get a cleaner and hotter flame if he allowed air to mix with the gas before it was burnt. This piece of technology quickly became essential in science laboratories, and led to improvements in gas burners used in everyday life.

As the gas flows through the gas jet, air is drawn in through the air hole. This mixture of gas and air then burns at the top of the barrel to produce a flame.

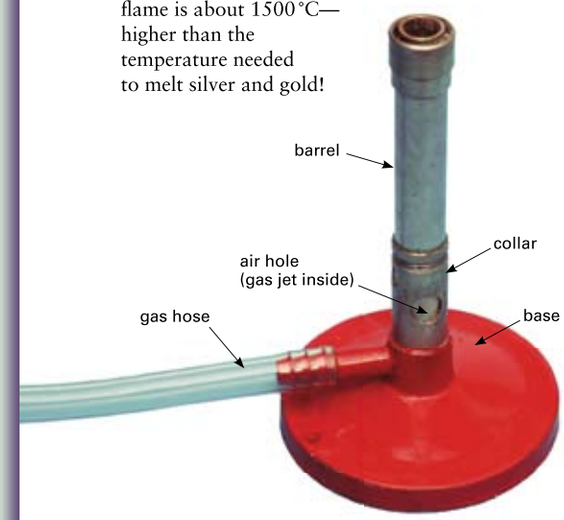
You can control the temperature of the flame by turning the metal ring or collar. As you rotate this collar you either open or close the air hole, which then changes the amount of air mixed with the gas. The more open the air hole is, the more air is drawn in, and the hotter the flame.

Air hole closed—yellow safety flame

This yellow safety flame is easy to see. Use it if you want to leave the burner on for a short time without using it for heating.

Air hole open—blue heating flame

This blue flame is very hot and hard to see, and can cause serious burns. The hottest part of the flame is about 1500 °C—higher than the temperature needed to melt silver and gold!



WEB watch

Robert Bunsen spent most of his life working in a laboratory. He nearly killed himself with arsenic poisoning and he lost one eye in an explosion when a small piece of glass went into his eye.

To find out more about this interesting scientist, click on the icon on this page on your CD or go to www.scienceworld.net.au and follow the links to **Robert Bunsen**.

You could also type *Robert Bunsen* in the search frame of your internet search engine. You will find a number of sites.

What did you find most interesting about Robert Bunsen?

Activity

Before you start an investigation you need to understand what you are doing. You should read through the steps, look at the diagrams and prepare data tables where necessary.

To help you make the most of the investigations, there is a **Planning and safety check**. Read the one on the next page.

You can avoid most laboratory accidents if you are aware of any risks to your safety before you start. You can do this by doing a *risk assessment*.

Read through the investigation on using a burner.

1 In a group list the risks involved in this investigation, using what you have learnt on pages 7 and 8.
2 For each risk, discuss which safety precautions you will need to take.

To see how the Bunsen burner works, open the **Using a Bunsen burner** animation on the CD.

Working with technology

Learning experience

Laminate small cards and create a 'Bunsen burner licence' for the students. Issue a card to each student when they can light the Bunsen burner correctly. This will encourage the students, as the rewards are based on a skill rather than knowledge.

Investigate

1 USING A BURNER

Aim

To use a Bunsen burner correctly.

Materials

- Bunsen burner
- heatproof mat
- tripod
- gauze mat
- matches
- piece of copper wire
- metal tongs
- 250 mL beaker

Wear safety glasses.

RULES FOR SAFE USE

1. Keep the burner away from books, and away from the edge of the bench.
2. Use a heatproof mat under the burner.
3. Always light the burner with the air hole closed.
4. Switch to a yellow safety flame when not heating.
5. The barrel of the burner gets very hot. If you have to move the burner, turn it off first. Move it by holding the base or the gas hose.
6. Check that the gas is off properly when you have finished.

Planning and Safety Check

Read through the experiment carefully before you do it, then answer these questions.

- Why should you light the match before you turn on the gas?
- What does the sign ✎ mean?
- What is the purpose of Part C?

PART A
Lighting the burner

1. Place the Bunsen burner on a heatproof mat. Connect the gas hose to a gas tap.
2. Rotate the collar so that the air hole is closed.
3. Light a match, turn on the gas, and bring the match close to but not over the top of the barrel, as shown. The gas should ignite.

   If a hissing noise comes from the burner or a flame burns at the jet, immediately turn off the gas. The burner is said to be 'burning back' and needs cleaning. Report this to your teacher.

4. Observe the flame with the air hole closed. This flickering yellow safety flame is not very hot, and is very sooty.
5. Gradually open the air hole, noting carefully what happens to the flame. This roaring bluish flame is the one you use for heating. You can change the size of the flame by adjusting the gas tap.

   ✎ In your science notebook, draw diagrams of the yellow safety flame and the blue heating flame. Use coloured pencils.

Note: Whenever you see the sign ✎ it means that there is something to record in your science notebook.

PART B
How hot is the flame?

1. Turn the gas on fully and open the air hole.
2. Use metal tongs to hold a piece of copper wire in the flame. Note how long it takes for the wire to become red hot.
3. Let the wire cool down and then repeat Step 2 in other parts of the flame.

   ✎ On your diagram of the blue flame, mark in the hottest part.

Lab notes

Parts A and B

- Advise students to handle the Bunsen burner by its base rather than the hose or barrel.
- Copper wire needs to be heavy gauge (1.25 mm or more) or it will melt too quickly.
- It is important to cool the tripod and gauze mat completely, possibly under cold running water, before returning them to storage.

Hints and tips

Revise the laboratory safety rules on page 7 before students do Investigate 1.

Learning experience

The following demonstration can be used in conjunction with Investigate 1:

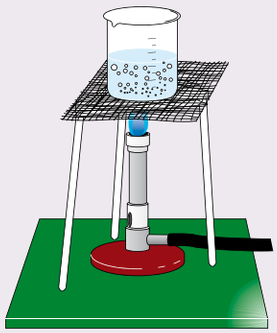
- Using tongs, hold an evaporating dish over the top of the Bunsen burner (point out the orange and the blue flame). Show the students the 'soot' which is produced by the orange flame.
- Ask the students why they think this 'soot' is formed (incomplete combustion).

PART C
Comparing flames

For Part C you will need to work with another group. One group will use the yellow flame and the other a blue flame.

1 Add 50 mL of water to a beaker. (Use the graduations on the side of the beaker.)

2 Set up the heating apparatus as shown below.



3 Light both burners. Leave one with the air hole closed (yellow flame) and the other with the air hole open (blue flame).

4 Start heating the beakers at the same time, and time how long the water takes to boil for each.
Which flame boiled the water first?

Discussion

1 Which flame was hotter?

2 When the beakers are cool, lift each one and check underneath. What do you observe?

3 Which flame was easier to see?

4 When you are not using a burner you should always leave the air hole closed. Why?

5 Suggest why it is important to light the burner with the air hole closed.

6 What is the purpose of the gauze mat?

7 What is the purpose of the heatproof mat?

1.4 Science is investigating

Scientists like Dr Josh Mylne carry out their investigations in the laboratory and in the field to answer questions, such as why plants need cold weather to flower and fruit.

Josh plans his investigations carefully and makes many observations. An **observation** is something you can find out with your senses. We mainly use our sense of sight, but you can also feel the texture of an object or whether it is hot or cold.

Scientists also take measurements during investigations and record them in data tables. Here Josh is counting and marking the leaves of plants that have been in the coldroom. Notice the data table in his recording book.

Lab note

Part C

Make sure students do not heat an empty beaker or place cold water in or on a very hot beaker as it may cause the beaker to break.

Hints and tips

Discuss how the five senses—sight, sound, touch, taste and smell—are used to make observations. In science, why can taste, touch and smell be potentially hazardous?

Homework

Get the students to draw a scientific diagram of the apparatus they used in Part C of Investigate 1. Remind students of the rules for drawing scientific diagrams (page 4).

Writing reports

As well as planning his investigations carefully, Josh also plans how he is going to record his observations and write how he conducted his investigations. He does this in a report. A report is important because other people can find out what he did and what he discovered.

A report is organised using seven headings.

TITLE the name of the investigation, your name and the date.

AIM you say why you did the investigation. Sometimes this is a question.

MATERIALS a list of equipment and chemicals you used in the investigation

METHOD you say what you did in the investigation in numbered steps. Whenever possible include a large, neat diagram of the apparatus.

RESULTS you record the **data**. Data includes qualitative observations (words) and measurements (numbers). Usually these are recorded in a data table. This makes the data easier to read.

DISCUSSION you try to explain your results, and list any problems that you experienced. You might also explain how you could improve the investigation.

CONCLUSION you answer the question posed in the aim.

Sometimes in your conclusion, you can write a general statement or **generalisation**—one that seems true in most cases. For example, a student investigating the stopping distances of toy trucks concluded: The heavier the truck is, the longer it takes to stop.

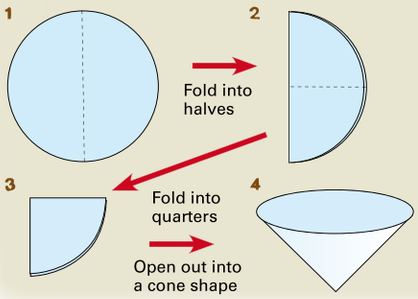
You will not always be able to make a generalisation like this, and in some cases it may not be possible to make a conclusion at all.

In the investigation on the next page you can practise writing your own report.

Skillbuilder

In the next investigation you are going to filter a solid from the liquid in a beaker. To do this you will need to know how to fold a filter paper and set up the apparatus for filtering.

The diagram below shows how to fold a filter paper. Your teacher will give you a filter paper to fold.



The apparatus for filtering

try this

Your teacher will give you some cold tea with lots of tea leaves in it. Your job is to filter the tea.

A quick way to do this is to *decant* (pour off most of the tea leaving the tea leaves behind) the tea, then filter the remainder.

Hints and tips

Ask the students to give examples of different types of reports in everyday life.

At this point, it would be advisable to recall:

- the rules for drawing diagrams (page 4)
- the information on drawing data tables (page 5).

Skillbuilder note

Students will need to be walked through the filtering process several times. As an extension activity, students could have a go at 'fluting' the paper. This involves folding it into sixteenths (folding it four times). Students will find that the liquid drains more quickly, although the paper is more easily broken.

Learning experience

Giving the students an outlined sheet of a scientific report with the *headings* and *quick descriptions* beside them provide a scaffold for the process. For example:

Title: _____

Aim: (why you did the investigation)

_____

_____

Materials: (the equipment you used)

_____

_____

Method: (what you did, in numbered steps)

_____

_____

_____

_____

and so on.

Homework

Ask students to brainstorm some simple separation investigations that can be done at home. Students should be encouraged to describe what is being separated and the piece of equipment that is used to perform this process, eg kitchen sieve to separate large flour particles from small particles. You could also ask students to draw simple diagrams of their techniques.

Investigate

2 MAKING MILK GLUE

Aim

Can glue be made from milk?

Materials

Wear safety glasses.

- about 100 mL of skim milk
- about 25 mL of white vinegar
- baking soda (about 5 g)
- two 250 mL beakers
- spatula
- stirring rod
- filter funnel and paper
- stand and clamp (or filter stand)
- Bunsen burner
- tripod, gauze mat and heatproof mat
- matches

Planning and Safety Check

- Carefully read through the method and list safety precautions you will have to take. Discuss this with your teacher before you start.
- Why should you wear safey glasses during this investigation?

Method

1. About one-third fill a 250 mL beaker with skim milk.
2. Add 25 mL of vinegar to the milk.
3. Set up a tripod, gauze mat, Bunsen burner and heatproof mat.
4. Heat the mixture slowly, stirring all the time with the stirring rod. When you see small white clumps (called curds) forming, turn off the burner. The curds will fall to the bottom of the beaker. You have made cottage cheese!
5. While the mixture settles and cools, set up the filtering apparatus.
6. Decant the clear liquid (called the whey) into another beaker, and try not to lose any of the curds. Pour the liquid down the sink.
7. Fold the piece of filter paper, and put it in the funnel.
8. Pour the curds into the filter paper. When all the liquid has filtered through, gently scrape the curds into a beaker.
9. Add 20 mL water and one spatula of baking soda to the curds.
10. Stir to make a paste. This is the milk glue.
11. Test your glue by sticking paper or ice-cream sticks together.
    Record your observations when the glue dries.

Writing your report

Write a full report of the experiment, using the headings from the previous page.

In this case the TITLE and AIM have been written for you.

Under METHOD you should write, in your words, what was done. Include diagrams to help your description.

Under RESULTS record your observations of what happened during the investigation.

In the DISCUSSION try to explain your results and list any improvements you would make to the method.

In the CONCLUSION write down an answer to the question in the aim.

Compare your report with the one on the next page, but don't look at it until you have written your own.

Lab notes

- Make sure the stirring rods are long enough so that students will not burn their fingers.
- Warn students that if the rods are put on the bench they may roll off and break.
- Wet filter paper is easily torn so it needs to be handled carefully.

Hints and tips

- Be organised. Students will be very excited. Make sure you discuss the safety precautions with them.
- Ensure that all students in the groups are engaged in the investigation.
- You may want to work in sections, eg students do steps 1 to 4, then stop to show their results before continuing.
- Ask students to draw a flow diagram of the investigation. This will minimise all excess wording and is quick and to the point. Students can also see exactly what they need to do this way.
- Give students a copy of what a perfect report would look like. This can serve as a model for them to work towards.

  Reports are traditionally written in the third person, past tense. Students will need assistance with writing a Method this way (no *I*, *we*, *they*), eg *The beaker was placed on the tripod and the liquid boiled.*

  However, you may prefer students to write their reports in the active voice, eg *I placed the beaker on the tripod and boiled the liquid.*

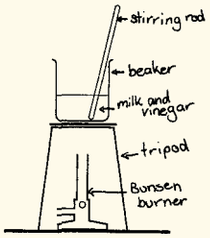
Investigation 2 — 8 March

Making Milk Glue

Aim:
To find out if glue can be made from milk.

Materials:
100 mL skim milk, 25mL white vinegar, 5g baking soda, spatula, stirring rod, filter funnel and paper, stand and clamp, Bunsen burner, tripod, gauze mat, heatproof mat and matches.

Method:
1. About 100 mL of milk was added to a 250 mL beaker, then about 25mL of vinegar was added.
2. The mixture was heated slowly with a burner while stirring.
3. When white curds were noticed, the burner was turned off.
4. The mixture was set aside to cool, while the filtering apparatus was set up.
5. The liquid was decanted from the mixture, and the curds were filtered.
6. The curds were scraped into a beaker.
7. About 20mL of water and a spatula of baking soda were added to the curds.
8. The mixture was stirred to make a paste.



Results:
The glue paste was tested with paper and with wooden ice-cream sticks. We found that the glue stuck paper together really well. But the wooden ice-cream sticks came apart with a little force.

Discussion:
We think milk glue works really well with paper. However, we found out on the internet that the curds are actually made from casein which is a protein in milk. This casein glue was used by the Egyptians as a wood glue.
We don't know why our glue didn't work well on wood. But we think we should have dried the curds better before we added the baking soda.

Conclusion:
A glue can be made from milk.

Skills for investigating

In this chapter you have learnt how scientists make careful observations of their investigations and then record them in a report. Making accurate observations and recording them are important skills in science.

These skills are also used in other fields. If you have read mystery stories or watched them on TV, you will know that many crimes are solved because somebody has made careful observations and written accurate reports.

Assessment task

This would be a good time to set Assessment task 1: What do scientists do? Attach a copy of the rubric for this assessment task to the handout sheet given to students. Alternatively, design a self-evaluation sheet for the students to complete as a self-assessment of their work. For the teacher this is invaluable as it gives insights into how the students feel they performed.

Learning experiences

1 A simple task involving most of the senses is to ask students to collect a leaf from outside and record as many observations about it as they can.

2 Another worthwhile activity is to burn a candle and have a competition to see who can record the greatest number of observations. You will be surprised at how many there are. A time limit may be necessary.

Learning experience: observation game

Watch a small segment of a video or DVD (something appealing to your students, and not necessarily related to science) for about three minutes and observe it very carefully. On completion, ask the students questions about aspects of the scenes they watched, eg *What colour was the character's shirt? Was the logo on the shirt on the left-hand side or the right?*

Ask students to record their answers without discussing them. Replay the segment of the film and have them check their observations.

Learning experience: creative story

In groups of three or four, ask students to write a creative short story in which the characters have observed a situation, some making incorrect observations and others more accurate observations. The story should explore the dilemmas this causes in re-creating the situation.

Alternatively, ask students to describe situations in which correct or incorrect observations have got them into or out of trouble.

Investigate

3 OBSERVING AND RECORDING

Aim

To practise the skills of observing and recording.

Planning and Safety Check

Carefully read the instructions for each of the six parts.
Look at Parts A, B and C.
For each part say why you need to wear safety glasses.
In your notebook draw up a table like the one below.
Use as many senses as possible—sight, touch, smell and hearing—but do not taste any of the chemicals.

Part	Observations
A	
B	

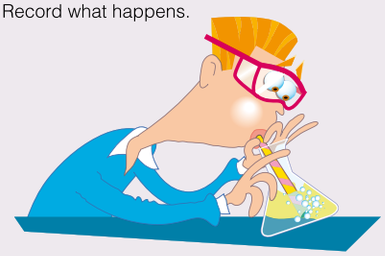
PART A

Materials

- limewater
- drinking straw
- flask (eg 250 mL)

Method

Pour about 50 mL of limewater into the beaker.
Blow through a drinking straw into the limewater.
Record what happens.



PART B

Materials

- test tube
- small piece of zinc
- dilute **hydrochloric acid** (1 M) in dropping bottle

Corrosive

Method

Place a small piece of zinc in a clean test tube.
Cover the zinc with dilute hydrochloric acid.
Record as many observations as you can.

PART C

Materials

- test tube
- spatula
- sodium thiosulfate crystals (hypo)
- dilute **hydrochloric acid** (1 M)

Corrosive

Method

Use a spatula to add about a teaspoonful of sodium thiosulfate to a test tube. One-third fill the test tube with water and shake to dissolve the crystals.
What do you notice when you feel the test tube?

Add about 10 drops of dilute hydrochloric acid to the test tube.
What happens now?

Lab notes

You can maintain control here by restricting the number of activities going on. Perhaps spread the activities over two lessons (i.e. Parts A and B in one lesson, then parts C and D in another).

Part A

- Do not allow students to share straws.
- Remind them to blow and not suck through the straw, which is the natural thing to do!

Hints and tips

Before starting Investigate 3, recall:

- safety rules and laboratory rules (page 7)
- drawing data tables (page 5).

Explain what corrosive chemicals are. Demonstrate this by adding HCl to some magnesium, or place a few drops of concentrated HCl on some cloth.

For some students, Investigate 3 may be their first experience in working independently with laboratory chemicals, solutions and equipment. Students may need help and pre-lab practice pouring liquids out of dropping bottles and using a spatula.

- Allow students to work with a partner or in small groups. Minimise the amount of instruction and allow them to become independent learners/ investigators.
- Walk around the room and ensure all students are engaged and participating.
- Give students time between activities to write up observations before starting the next one.

PART D

Materials

- ink pad
- methylated spirits and paper towel (for cleaning up)
- hand lens

Method

1 Examine your fingers using a hand lens. Can you see the fingerprint patterns?

2 Prepare a fingerprint chart on white card or paper, as shown. Each box needs to be at least 3 cm x 3 cm.

	Thumb	Index	Middle	Ring	Little
Right hand					
Left hand					

3 Place the ink pad and your fingerprint chart on the edge of the bench. Roll your right thumb on the ink pad, then carefully roll it over the right thumb spot on the chart as shown below.

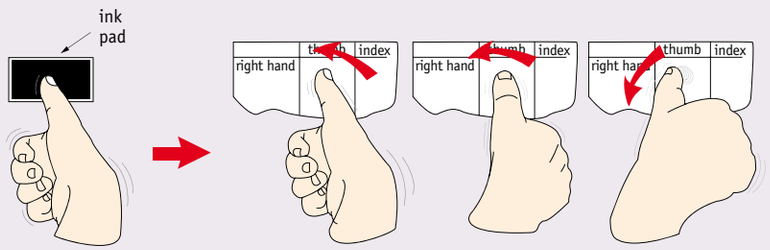
4 Repeat this procedure for all fingers, on both hands.

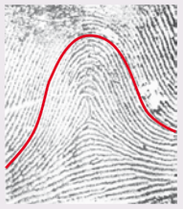
5 Use the methylated spirits and paper towel to clean your fingers.

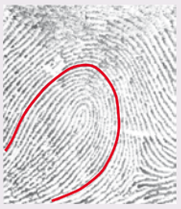
6 Use a hand lens to examine your fingerprints. Are any of them the same?

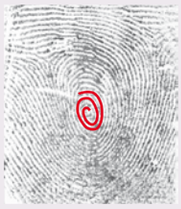
Use the photographs below to try to classify your prints as arches, loops or whorls. (A composite print has several of these patterns joined together.)

Collect data from the whole class on the numbers of arches, loops, whorls and composite fingerprints. Which type is most common?




Arch


Loop


Whorl

Lab notes

Part D

- Allow students to do a trial run to get the right amount of ink.
- If the ink pads have too much ink in them or are new, students should roll their finger or thumb over a scrap piece of paper first to remove excess ink and then make their fingerprint in their chart.
- It is a good idea to take shots of the fingerprints using a digital camera or a video camera. Use a computer and interactive whiteboard to display different patterns to the class, as it makes them a lot easier to see.
- Solvol soap in warm water is good for cleaning hands. Also have plenty of paper towel for cleaning up.

Hints and tips

Fingerprints can be displayed on an overhead projector (OHP). Supply students with a piece of acetate. Use the ink pad and have them make their fingerprints on the plastic sheet. Then project the fingerprints on a screen.

Science in action

Look closely at your fingers and you will see a pattern of ridges on your skin. In the last investigation when you put ink on your fingers, these ridges formed fingerprints when you placed your fingers on paper.

Your fingers are normally covered by small amounts of sweat and fats that have been given off by the tiny glands that are found in your skin. When you touch something you leave behind traces of sweat and fats that were on the ridges of your fingers. These prints are usually invisible, but when they are dusted with powder that sticks to the sweat and fats, they can be seen clearly.

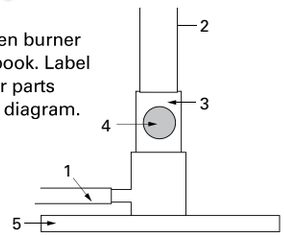
You may have found out in the last investigation that everyone's fingerprints are different. Scientific investigators use this knowledge to test for fingerprints at crime scenes to help identify suspects.

WEB watch

Go to www.scienceworld.net.au and follow the links to **Fingerprints**. There are many interesting sections in this site. You could also type *fingerprints* in the search frame of your search engine for more sites. For help with internet searches, open the ICT skillsheet Getting started with Google on the CD.

Check!

1 Draw a Bunsen burner in your notebook. Label the five major parts shown in the diagram.



2 Give two reasons why the blue flame is a hazard. Why is the yellow flame called a safety flame?

3 Alistair's teacher asked him to write in point form the steps in lighting a Bunsen burner so that other students could follow it.

Alistair wrote the first step:
1 Connect the burner hose to the gas tap.

Complete Alistair's task.

4 Why is it important to turn off the gas if a burner flame goes out?

5 Copy and complete this table.

	Air hole	
	open	closed
What colour is the flame?		
Is the flame easy to see?		
Does the flame make a noise?		

6 You are heating a beaker of water when you have to go and get some extra equipment. What should you do with the Bunsen burner? Explain.

7 List the seven headings you use when writing a report. Briefly describe what each heading means.

Hints and tips

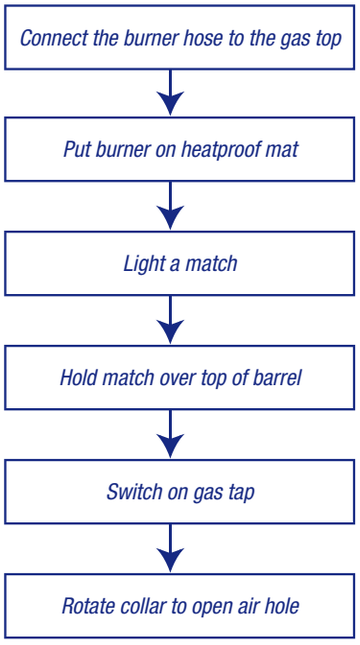
Have a set of magnifying glasses available for the students to use so they can investigate their fingerprints.

Check! solutions

1 The labelled parts are:
Part 1 gas hose
Part 2 barrel
Part 3 collar
Part 4 air hole
Part 5 base

2 The **blue** flame is a hazard because it is difficult to see and is also very hot.
The **yellow** flame is a safety flame because it is cooler and easier to see.

3 These are the points Alistair should have written:



4 It is important to turn off the gas because it is poisonous and flammable.

5

	Air hole	
	open	closed
What colour is the flame?	blue	yellow
Is the flame easy to see?	no	yes
Does the flame make a noise?	yes	no

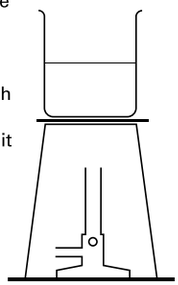
6 You should close the air hole so that the flame turns yellow, which is more visible and cooler and therefore safer. You should also remove the beaker from the heat so that it does not get sooty.

7 The seven headings should be:
Title—the name of the investigation and date
Aim—outlines what you are trying to do in the investigation
Materials—all of the equipment and possibly living things you will need to do the investigation
Method—the steps you intend to follow to do the investigation, making sure you take safety into account
Results—a record of your observations. They may be in words or numbers in a table
Discussion—attempts to explain your results and comments on the method you followed
Conclusion— a brief statement saying whether you have achieved the aim of your investigation.

8 Josh Mylne, like other scientists, writes full reports of his investigations. He details what he does in the investigations and lists all the results. He posts his investigations on the internet and often publishes them in science journals. Suggest why scientists do all of these things.

9 Look at the diagram below. Write down how you would set up this apparatus, by putting the sentences below in the correct order.

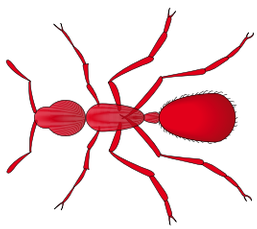
A Put a gauze mat on the tripod.
B Put the burner under the gauze mat.
C Half fill the beaker with water.
D Adjust the air hole so it is open.
E Put the beaker on the tripod and gauze.
F Put the tripod on the heatproof mat.
G Light the burner.



10 You want to add a few crystals of copper sulfate to about 3 teaspoons of water, and heat the water to dissolve the crystals. Make a list of the equipment you think is most suitable for this task. Beside each item of equipment explain why you chose it.

11 Compare the skills used by a scientist doing an investigation to those of a detective trying to solve a crime.

12 Look at the drawing below of an insect for 10 seconds, then cover it up. Now try to draw the shape as you remember it. Finally, compare your drawing with the one here.



13 When making observations you often compare and contrast what you are observing with something else. You do this by looking for similarities and differences. Here is an example:

Mars is similar to Earth in size and gravity. It is different from Earth in that it is much cooler.

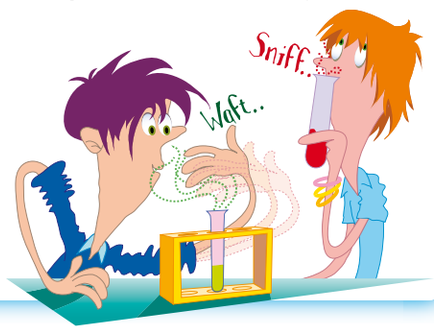
For each pair of objects below write a sentence using similar to and a sentence using different from. In each case explain how the objects are similar or different.

a

b

c

14 The cartoons show two ways of smelling a gas. Which one is safer? Why?



8 It is very important for scientists like Josh Mylne to communicate with other scientists so they can share their knowledge and help each other to solve difficult scientific problems.

9 The correct and safest order would be: F, A, B, D, C, E, G.

10 **Test tube:** to hold the water and crystals while they are being heated.

Bunsen burner: to heat the contents of the test tube.

Wooden test tube holder: to hold the test tube so that your fingers are not burnt.

Heatproof mat: to protect the bench top.

11 A scientist must have similar skills to a detective because they each have to make careful observations with their senses, sometimes using special instruments, and record this information or data accurately. They then usually make some inferences which can explain these observations. These steps are particularly important when forensic scientists help to solve crimes.

12 In particular, notice the number and location of the body segments and the way that the legs and feelers are attached.

13 The following are suggestions only:

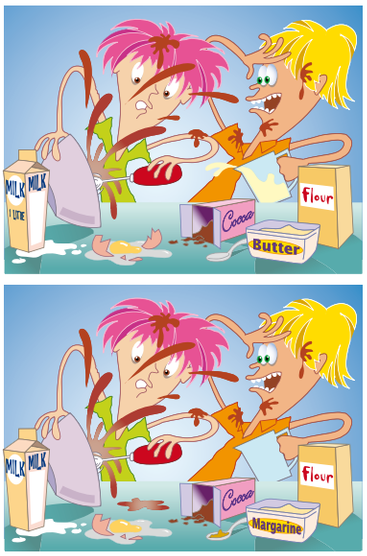
a The two dogs are **similar to** each other because they each have dark eyes and a dark nose. They are **different from** each other because one has long hair and the other has short hair.

b These two animals are **similar to** each other because they each have six legs. They are **different from** each other because one has thin, visible wings and the other does not.

c These two objects are **similar to** each other because they are both fingerprints. They are **different from** each other because they show different patterns.

14 It is safer to waft some of the gas towards your nose as shown in the lower diagram. This is because the gas may have an unpleasant smell and if you sniff it directly it could be harmful to you.

15 How good are you at observing? Can you spot the six differences between the two cartoons below?

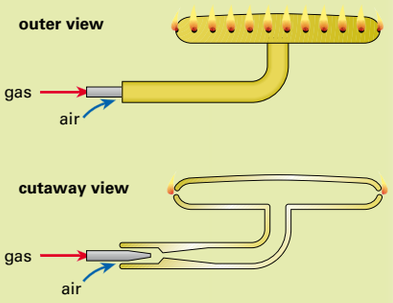


16 People who witness a crime often have to record their observations of a suspect they saw at the crime scene. Study the photo below for 15 seconds. Then shut the book and try to record as much information as possible to help police identify the suspect.

challenge

1 A gas stove burner needs to give a clean flame so that it doesn't make saucepans sooty. The flame must also be easily controlled. The diagram here shows the design of a typical burner.

In what ways is this gas stove burner similar to a Bunsen burner? In what ways is it different?



2 Somebody gives you a clear, colourless liquid in a bottle. What could it be? What observations could you make to try to find out what it is?

3 Collect five similar items; for example, five leaves, five insects, five shells or five pieces of laboratory glassware. Label them 1 to 5. Choose one of the items and write a detailed description of it, without naming it.

Pass your description to another student and ask them to pick which one of the five items you described. If they cannot tell which it is, you need to make your description clearer or more complete.

15 The six differences are:
- labels on the milk carton
- egg shells
- the contents of the teaspoon
- margarine versus butter
- the contents of the jug
- the splash from the jug.

16 Students might be surprised by this but in fact in real life you may not be paying careful attention or have as long as 15 seconds to make observations.

Challenge solutions

1 The gas stove burner is similar to a blue flame on a Bunsen burner because air is mixed with the gas before it ignites. This means it will burn hot and clean. It is different because there is no way to adjust it and therefore you don't get a yellow flame unless it gets blocked. Another difference is that instead of one big flame there are about 24 all the way around the ring.

2 The clear colourless liquid could be water, methylated spirits, bicycle oil, alcohol or any one of many liquids. Some tests which a scientist could do to try to find out what it is could include:
- smelling it (water has no smell)
- trying to burn it (water will not burn)
- seeing whether other substances will dissolve in it (water is a good solvent)
- seeing whether it reacts with other substances.

Safety: it is dangerous to taste an unknown substance and you should always wear protective clothing like an apron and safety glasses when handling chemicals.

When students have made their observations they should ask you or look in a book to make some inferences about what the liquid could be.

3 In this exercise it is very important for students to make sure that an observation is something they *observe* and not something they *think* might be true. Their description should be good enough for another student to recognise the one object they have described out of the five.

MAIN IDEAS

Copy and complete these statements to make a summary of this chapter. The missing words are on the right.

aim
apparatus
Bunsen
conclusion
disposal
glasses
laboratory
observations
safety

1 You must be able to correctly identify the equipment in a science _____.
2 There is a standard way to draw scientific _____.
3 You must obey the _____ rules for the science laboratory.
4 You need to know how to use a _____ burner correctly.
5 It is important to wear safety _____ whenever there is a chance of anything getting into your eyes.
6 You must take special care in the handling and _____ of chemicals.
7 Accurate _____ and recording are essential skills in science.
8 A good report of an investigation usually has the following headings: title, _____, method, results, discussion and _____.

Try doing the Chapter 1 crossword on the CD. Working with technology

REVIEW

1 Look at the cartoon below. Make a list of the laboratory rules that are being broken.

Main ideas solutions

1 laboratory
2 apparatus
3 safety
4 Bunsen
5 glasses
6 disposal
7 observations
8 aim, conclusion

Review solutions

1 See the cartoon.

REVIEW

2 Write the correct terms for the following. Make sure your spelling is correct.
- **a** a room with special equipment for conducting science experiments
- **b** equipment put together for a science experiment
- **c** a device used for heating in the laboratory
- **d** a tool used for holding small objects, especially when heating
- **e** an item used for stirring
- **f** a piece of equipment which spreads the heat evenly from a burner
- **g** the purpose of an experiment

3 What should you do if:
- **a** you burn your finger on a hot tripod
- **b** you drop a test tube of hot acid on the floor
- **c** you splash some liquid in your eye
- **d** your sleeve catches fire when you are using a burner?

4 Why are safety glasses such an important safety item in the science laboratory? Give examples of when it is important to use them.

5 Which of the following are true and which are false? Rewrite the false ones.
- **a** Test tubes hold less than flasks.
- **b** A spatula is used for stirring.
- **c** Immediately treat burns with cold running water.
- **d** If you spill acid on yourself, wipe it off with a cloth.
- **e** When lighting a burner, turn on the gas before striking the match.
- **f** You should always put a gauze mat under a Bunsen burner.
- **g** The hottest part of a Bunsen flame is near the top of the barrel.
- **h** To heat a test tube gently you should use a small blue flame.

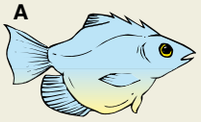
6 Draw a labelled diagram of the apparatus you would need to boil water in a beaker.

7 Many homes have gas stoves for cooking. The flame is produced by the Bunsen burner method. Do you think the air hole will be open or closed? Explain your answer.

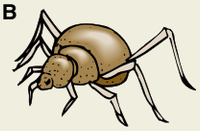
8 Suggest a safe way of disposing of each of the following chemicals.
- **a** dilute hydrochloric acid
- **b** mineral turpentine (used with oil-based paints)
- **c** copper sulfate crystals

Questions 9 and 10 refer to the animals shown below.

A



B



C

D

9 Match each of the following observations with the animal it best describes.
- **a** This animal has three sharp spines on its back.
- **b** This animal has a coiled shell.
- **c** This animal has a round body and eight legs.

10 List at least three features of animal D.

Do this test in pairs. Your partner will watch what you do and note any errors you make. He or she will discuss these with you when you have finished. Then swap jobs and check your partner's skills. Here is the task.

Light a Bunsen burner. Then one-third fill a test tube with water and boil it using the burner. Heat the tube carefully so that the water does not splash out of the tube.

LAB REVIEW

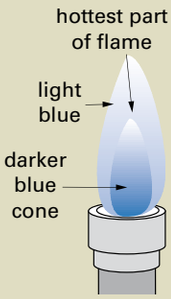
Check your answers on pages 298–299.

2 **a** laboratory
- **b** apparatus
- **c** Bunsen burner
- **d** metal tongs
- **e** stirring rod
- **f** gauze mat
- **g** aim

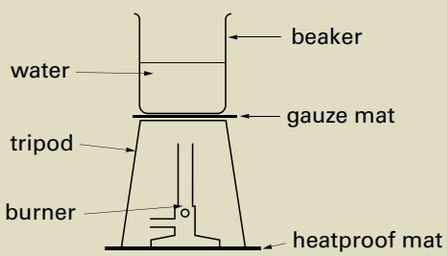
3 **a** Hold it under cold running water and tell your teacher.
- **b** Flood the area immediately with lots of water and tell your teacher. Check whether any acid has splashed onto you or your clothing.
- **c** Wash your eye immediately with lots of water and tell your teacher.
- **d** Immediately extinguish it under a running tap and tell your teacher.

4 Safety glasses are to protect your eyes in the laboratory, especially from splashing liquids. You should wear them whenever you use a Bunsen burner to heat a liquid in a test tube or a beaker.

5 **a** True
- **b** False. A spatula is used for picking up small amounts of solids.
- **c** True
- **d** False. If you spill acid on yourself, wash it off immediately with lots of water.
- **e** False. You should turn on the gas after striking the match—see Investigate 1, Step 3, page 11.
- **f** False. You should always put a heatproof mat under a Bunsen burner.
- **g** False. The hottest part of a Bunsen flame is just above the dark blue cone.
- **h** True



6



7 The air hole will be open to give a hotter flame. If the air hole is closed the saucepans will become black from the soot from the yellow flame.

8 **a** Wash down the sink with lots of water.
- **b** Put in a special container for proper disposal.
- **c** Put in a special container for waste solids.

9 **a** A **b** C **c** B

10 four legs
back legs longer than front legs
three toes on each leg
large eyes on top of head
lighter green patch behind eye

Lab review
See page 11 Part A