ACTIVITY 6·3

DESIGNING SIMPLE EXPERIMENTS

An experiment is a test designed to check out a hypothesis. It is very important that an experiment be a fair test so that what is found out is reliable and true.

In an experiment we make observations and measurements. Personal opinions and emotions are not used.

In designing an experiment you change something and observe what happens. The change you build into the experiment is called the **independent variable**. The 'what happens' that follows after is called the **dependent variable**.

As an example, suppose you wanted to know which rolls down a ramp fastest, a small ball or a large ball? You could release a tennis ball and a basketball at the same time, then observe which one reached the bottom first. The diameter of the ball would be the independent variable. The time they took to reach the bottom would be the dependent variable.

The time it takes for the ball to roll down the ramp depends on its diameter, not the other way around.

Once the dependent and independent variables have been worked out it is then a simple process to work out how you will do the experiment.

PART A

For each hypothesis listed below write down the independent and dependent variables. The first one has been done for you.

Hypothesis 1 Long pendulums swing faster than short pendulums.
Independent variable — the length of the pendulum.
Dependent variable — the time it takes the pendulum to swing.

Hypothesis 2 Small pieces of metal dissolve faster in acid than large pieces of metal.

Hypothesis 3 Light coloured cars stay cooler than dark coloured cars.

Hypothesis 4 Iron rusts faster in sea water than in fresh water.

Hypothesis 5 More sugar dissolves in hot water than in cool water.

PART B

Before actually doing an experiment it is good planning to write down how it will be carried out. This planning might include a series of logical steps and a diagram showing how the equipment you wish to use will be set up. This planning is called the method or **procedure** of the experiment.

Worked example

Hypothesis 1 **Long pendulums swing faster than short pendulums.**

Procedure

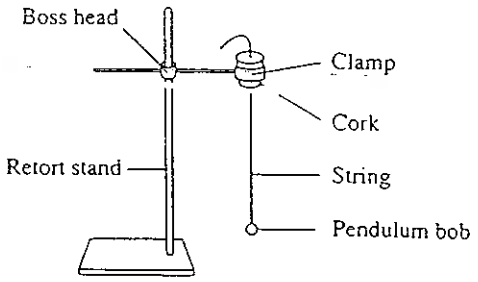

Figure 6.2

1 **Set the length of the pendulum at 100 cm.**
2 **Pull the pendulum bob 10 cm out from its starting position.**
3 **Let the pendulum bob go and at the same time start a stopwatch.**
4 **Count 10 'back and forth' swings of the pendulum, then stop the stopwatch.**
5 **Record the time.**
6 **Change the length of the pendulum to 50 cm and repeat steps 2 to 5.**

(a) Choose one of the other hypotheses from Part A and write a plan that clearly describes how you would go about it.
(b) Give your plan to another student. Ask them to explain to you how they would do the experiment using your plan. If the plan is not clear and not written in the right order try to improve it.
(c) You may like to try out your plan.

PART C

A student was asked to test the hypothesis:
'One Bunsen burner using the blue flame will heat water faster than two Bunsen burners using the yellow flame'.

She designed a simple experiment. The steps she used are written below. However they are not in the correct order.

1 Write down the best sequence of steps in your workbook.

- Stop the stopwatch when the temperature of the water reaches 80°C.
- Pour 100 mL of water into a beaker.
- Put the Bunsen burner with the blue flame under the beaker and straight away start a stopwatch.
- Place the beaker on a gauze mat over a tripod.
- Rinse the beaker with cold water and put another 100 mL of water in it.
- Measure the starting temperature of the water and record it.
- Again set the beaker up over the tripod, measure its starting temperature and record it.
- Light a Bunsen burner and open the hole so as to get a blue flame.
- Record the time for the single blue flame.
- Record the time for the two yellow flames.
- Hold the two burners under the beaker and again time how long it takes the water to reach 80°C.
- Light two Bunsen burners and leave the hole closed so as to get yellow flames.

2 Draw a diagram showing how the equipment was set up.

3 What is the independent variable? What is the dependent variable?

You may be interested in trying this experiment out. Ask your teacher about it.