Level

F	1	2	3	4	5	6	B6

Force and motion

Strand
Energy and Change

Key concept
The forces acting on objects influence their motion, shape, behaviour and energy.

Purpose

Activities in this module are designed to help students understand that there are different forces that affect the motion, behaviour and energy of objects, and that energy is transferred and transformed. Students have opportunities to:

- investigate how forces affect the motion and energy of particular objects;
- analyse the relationship between the forces applied to objects and their motion and energy;
- communicate their understandings of the relationship between the forces applied to familiar objects and the motion and energy of those objects.

Overview of activities

The following table shows the activities in this module and the way in which these are organised in **introductory**, **developmental** and **culminating** phases.

Introductory ►	Developmental ►	Culminating
Types of forces	Bouncing balls	Guided investigation: Force, energy and motion
Kinetic energy in toys	Making a flic flac	
	Friction	
	Swings and seesaws	
	Paper planes	

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Core learning outcomes

This module focuses on the following core learning outcomes from the Years 1–10 Science Syllabus:

Energy and Change

3.1 Students collect data and make and test inferences to describe the effects of forces (including magnetic and electrostatic forces) on the motion and shape of objects.

4.1 Students design and perform investigations into relationships between forces, motion and energy.

5.1 Students analyse situations where various forces (including balanced and unbalanced forces) act on objects.

Core content

This module incorporates the following core content from the syllabus:

Energy and Change

- motion and forces;
  - pushing/pulling;
  - gravity;
  - friction (opposing motion, everyday applications and implications);
- motion and energy changes;
  - kinetic energy;
  - potential energy (elastic, gravitational).

Assessment strategy

Suggestions for gathering information about student learning are provided in each of the activities in this module. Once sufficient information has been collected, judgments can be made about students' demonstrations of outcomes. Typical demonstrations of this module's intended outcomes are provided here to indicate the pattern of behaviour to look for when making judgments.

Energy and Change

3.1 Students collect data and make and test inferences to describe the effects of forces (including magnetic and electrostatic forces) on the motion and shape of objects.

Students may:

- describe the effect that gravity has on objects;
- generalise that, when something moves or changes shape, it is due to a force or forces acting on it;
- explain that the effect of friction is to slow down the motion of something.

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Energy and Change

4.1 Students design and perform investigations into relationships between forces, motion and energy.

Students may:

- explain that a force must be applied to an object before its motion can be changed;
- relate the motion (direction and speed) of an object to the forces acting on it;
- interpret that, when a force is applied to an object, energy is transferred or transformed;
- conclude that an object has energy if it has the ability to change the motion of another object;
- design and perform investigations that allow them to illustrate the relationships between the forces acting on an object, its energy and its motion.

Energy and Change

5.1 Students analyse situations where various forces (including balanced and unbalanced forces) act on objects.

Students may:

- analyse the effects of applying different amounts of force to an object;
- identify the relationships between variables which affect the motion of an object;
- explain the motion of an object in terms of a number of forces acting, such as air resistance and gravity.

Background information

Current scientific conceptions

Force

A force is an influence that produces, or tends to produce, a change in the motion of an object. When there is a push, a pull, a bend, a twist, a turn, a squeeze, a tear, a lift, a stretch, friction or resistance, at least one force is being exerted.

A force can move something, make it go faster or slower, change its direction, stop it, or change its shape. Often, an object will be affected by a number of forces at once. If these forces are balanced, the object will be held in place and will keep its shape.

When a force is applied, energy can be transferred or transformed. **Transfer of energy** refers to the shifting of energy from one object to another. For example, a bowling ball with kinetic energy (energy of movement) hits the tenpins and gives them kinetic energy. **Transformation of energy** refers to the change from one form of energy to another. For example, electrical energy is transformed to light and heat energy when you switch on a light.

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Energy

The concept of energy is complex, and scientists define the term 'energy' using different emphases, depending on their disciplines. In this module, an object is said to have energy if it has the ability to change the motion of another object. The energy an object has is dependent on its motion and/or position.

There are many different forms of energy, including:

- kinetic energy (energy of motion or movement);
- heat energy;
- light energy;
- sound energy;
- electrical energy;
- potential (stored) energy, which includes gravitational energy, chemical energy (food, coal), elastic energy and nuclear energy.

Gravity

According to the Newtonian model, gravity is a force of attraction that any body with mass has towards any other body with mass. The effect of gravity increases with increased mass. For example, the effect of gravity is greater on the Earth than it is on the moon because the Earth has a larger mass than the moon. The effect of gravity is also greater over shorter distances. For example, the sun has a greater gravitational pull on the Earth than other more distant stars do. Gravity contributes towards keeping the planets in orbit around the sun and is the reason that objects fall towards the Earth when they are dropped.

Friction

Friction occurs when two objects slide across each other. It results from contact between the objects' surfaces.

An object will move across a surface if the force applied to move it is greater than the force due to friction. The effect of friction can be reduced by streamlining, and by minimising the amount of contact between surfaces through the use of wheels, ball bearings, lubricants and flat surfaces — for example, snow skis. The presence of friction in many everyday situations is helpful — in fact, movement without friction is difficult if not impossible. The use of cogs in machinery, bitumen on roads and treads on tyres and shoes helps to increase the effect of friction.

Air resistance is the friction that occurs when an object makes contact with particles in the air.

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Students' prior understandings

Students' prior understandings may differ from current scientific conceptions in a range of ways.

Force

Some students may:

- believe that the force of an object resides within the object rather than being an external effect. This may relate to the common belief that if an object is **not moving** there are **no forces** acting on it, and if an object **is moving** there **is a force** acting on it in the direction it is moving. This belief is incorrect. For example, if an object is stationary on the ground, gravity is acting downwards and a reaction force from the ground is acting upwards. If an object such as a toy car is given a push across a flat surface, there is initially a forward force acting on it; however, once it is allowed to move freely, there is no forward force. Friction exerts a force in the opposite direction to the object's motion and is the reason it eventually stops moving.
- believe that forces can be applied only by living things. Thus, they may realise that a human can apply a force but may not consider the effects of gravity or friction.
- be aware of one or several forces being exerted on an object but may not consider all forces. For example, students may realise that gravity is acting on a ball rolling down a hill but may not consider the effect of friction acting in the direction opposite to the motion of the ball.

Resource Sheet 1

Teachers can help students build on their prior understandings by asking them to discuss and reflect on everyday situations that involve forces. (Some examples of situations are provided on Resource Sheet 1.)

Energy

Some students may:

- use the terms 'energy transfer' and 'energy transformation' interchangeably;
- have heard about energy only in relation to food such as bread, breakfast cereals and sports drinks;
- not be aware of potential (stored) energy;
- believe that energy is associated only with living things or moving things.

Teachers can enhance students' understandings by emphasising correct usage of the terms 'energy transfer' and 'energy transformation' and by providing opportunities for students to consider different forms of energy, including potential energy.

Gravity

Some students may:

- believe that the moon has no gravity when, in fact, it does. However, the effects of gravity on the moon are less than those on the Earth because the moon has a smaller mass.

Teachers can help students broaden their understandings by encouraging discussion about the relative effects of gravity on the Earth and on the moon.

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Friction

Some students may:
- be aware of the disadvantages of friction but not its advantages;
- find the concept of air resistance difficult to understand if they are unaware that the air is filled with many invisible gas particles.

Teachers can build on students' understandings by providing opportunities for them to:
- discuss situations where friction is a help and other situations where it is a hindrance;
- investigate the presence of gas particles in the air — for example, by exploring why a balloon expands when it is inflated.

Terminology

Terms associated with forces, motion and energy are essential to the activities in this module — for example:

air resistance	energy transformation	kinetic energy
elastic energy	friction	potential energy
energy transfer	gravity	

Students may already be aware of some of this terminology. If so, the activities will provide opportunities for them to evaluate current usage.

Cooperative learning — working in groups

Many of the activities in this module are best conducted in small groups. When students are working in groups, there should be a focus on cooperative learning. Information about cooperative learning is provided in the sourcebook guidelines, Appendix 2.

School authority policies

Teachers need to be aware of and observe school authority policies that may be relevant to this module.

Safety policies are of particular relevance to the activities that follow. It is essential that demonstrations and student activities are conducted according to procedures developed through appropriate risk assessments at the school.

In this module, teachers need to consider safety issues relating to:
- using elastic bands;
- using swings and seesaws;
- making and flying paper planes.

Support materials and references

Australian Academy of Science 1994, *Primary Investigations: Teacher Resource Book 6 — Energy and Investigation*, Canberra.

Skamp, K. (ed.) 1998, *Teaching Primary Science Constructively*, Harcourt Brace and Co. Australia Pty Ltd, Marrickville, NSW.

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ACTIVITY

Types of forces

Introductory

Focus

This activity provides opportunities for students to reflect on and share their ideas about forces.

Materials

Provide two or three of each object:

- locks and keys
- jars with screw lids
- pens with lids
- toys with wheels
- balls
- playdough or Plasticine
- tweezers or tongs
- bricks (or other objects to be lifted)
- paper (to tear)
- elastic bands

For each student:

- Resource Sheet 1, 'Force and motion'

Teaching considerations

Classroom organisation

Set up workstations so that students can move around and interact easily with a variety of objects. (The listed objects are suggestions only. Anything that requires application of a force is suitable.)

Safety

Warn students to take care if they are lifting heavy objects or manipulating elastic bands.

Working scientifically

Time: 30 minutes

Discussing thinking

▶ Individually, students make notes on everything they know about forces, including ways that forces can be exerted. They then share these with a partner, their group or the class.

▶ Students interact with the objects listed above and identify ways they exerted a force to move the objects — for example, pushed, pulled, twisted. They should make notes in each case and then share their ideas.

▶ As a follow-up, students could:

- brainstorm ways that forces are exerted in everyday situations;
- discuss the ways that the term 'force' and synonyms for 'force' are used in everyday language — for example, police force, armed force, compel, coerce, break open. They can then compare this use to the scientific use of the term 'force' (see 'Background information', p. 3).

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Resource Sheet 1

▶ Students consider the scenarios on Resource Sheet 1, write answers to the questions and share their responses.

▶ Students then return to the notes they wrote about forces at the beginning of the activity and identify instances where their understanding has changed. They should modify their notes accordingly.

Gathering information about student learning

Sources of information could include:

- anecdotal notes about students' contributions to discussion;
- students' notes about forces;
- students' responses to scenarios on Resource Sheet 1.

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ACTIVITY

Kinetic energy in toys

Introductory

Focus

This activity provides opportunities for students to reflect on their understanding of energy and to investigate kinetic energy.

Materials

- toy cars
- jack-in-the-box
- wind-up toys
- battery-operated toys
- toy gliders
- spinning tops

Teaching considerations

Kinetic energy

Kinetic energy is the energy of motion. If an object is moving, it has kinetic energy.

When students play with the toys during this activity, they exert an initial force which leads to those toys having kinetic energy. Some intermediate forms of energy in the toys listed above are:

- elastic potential energy (wind-up toys, jack-in-the-box, some types of gliders);
- electrical energy (battery-operated toys).

Friction will affect the motion of all moving toys, particularly toy cars and spinning tops.

Classroom organisation

Set up workstations so that students can move around and interact easily with a variety of toys.

Safety

Gliders should be played with in an open space such as a playground.
Ensure that students stand well behind the throwers when gliders are launched.

Working scientifically

Time: 30 minutes

Playing
Creating diagrams
Discussing thinking

▶ Students write sentences using the word 'energy' and share these with a partner, their group or the class. They can then compile a joint list of different types of energy.

▶ Guided by the teacher, students discuss the concept of kinetic energy. Students then explore the concept by playing with moving toys and identifying the source of kinetic energy and any other forms of energy involved. Following this exploration, students could:

- draw diagrams to show how they think the toys work;
- dismantle designated toys to see how they work.

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▶ The follow-up class discussion should focus on the relationship between the initial force applied to the toy and the generation of kinetic energy. Questions to guide students' thinking could include:

- What was the first thing that had to happen/be done to the toy to make it move?
- How did this lead to the toy having kinetic energy?
- How do you know the toy had kinetic energy?
- What types of energy are involved before and after the toy moves?
- What are the forces involved?
- When are forces exerted?

Gathering information about student learning

Sources of information could include:

- students' sentences about energy;
- anecdotal notes about students' contributions to discussion.

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ACTIVITY

Bouncing balls

Developmental

Focus

This activity provides opportunities for students to compare how the motion of two different balls is affected by their elastic energy.

Materials

- different types of round balls (e.g. golf balls, basketballs, netballs, superballs)
- metre rulers/tape measures
- butcher's paper
- adhesive tape
- marking pens

Teaching considerations

Gravity, energy and motion

When a ball is released, the force of gravity leads to a transformation from potential energy (due to the ball's initial position) to kinetic energy (motion) to elastic energy and back to kinetic energy and so on. A ball eventually stops bouncing because some kinetic energy is transformed into heat and sound energy each time it makes contact with the ground. Some energy is also lost due to friction from the air as the ball falls. Variation in the motion of different balls is mainly due to the different amounts of potential elastic energy they have. These amounts vary depending on the material from which the balls are made and their internal content.

Fair tests

Students may need assistance to ensure their investigations incorporate the elements of a fair test:

- Only the variable being tested should change (the type of ball).
- All other variables should be kept constant. (Balls must be released from the same height onto the same surface; the only initial force should be gravity — balls must not be pushed.)
- Measurements should be taken in the same way each time (height of the first bounce).
- Measurements should be as accurate as possible. (Attach butcher's paper to the wall so that bounce heights can be marked and measured.)
- Several trials should be conducted. (Average measurements should be calculated from the results of at least three trials.)

Working scientifically

Time: 30 minutes

Making and judging observations
Predicting
Analysing
Discussing thinking

▶ In groups, students choose two different balls and predict what might happen when these are released from the same height. Predictions should be recorded. Students then plan how to test their predictions and establish what they need to do to ensure they perform a fair test.

▶ Students release the balls and record measurements of bounce heights, along with any other relevant observations. They then write a brief explanation of why the balls bounced as they did and share this with the class.

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▶ Questions to consider during the follow-up class discussion include:

- Why do the balls fall when released?
- Why don't the balls go up into the air after they are released?
- Why don't the balls stay in mid-air?
- What makes the balls bounce?
- Why do the balls eventually stop bouncing?
- Why do some balls bounce higher than others?
- Would the balls behave differently on the moon?

Additional learning

▶ Students could:

- investigate what difference is made when the balls are released from higher and lower points;
- investigate how a ball's bounce is affected by the surface on which it bounces;
- record the order of balls from highest bounce to lowest bounce;
- consider why a ball bounces higher if it is released from a greater height.

Gathering information about student learning

Sources of information could include:

- students' explanations for why the balls bounced as they did;
- anecdotal notes about students' contributions to discussion.

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ACTIVITY

Making a flic flac

Developmental

Focus

This activity provides opportunities for students to analyse the motion of a jumping toy called a 'flic flac' when its stored elastic energy is released.

Materials

- Resource Sheet 2, 'How to make a flic flac'

Teaching considerations

Stored energy

A force is applied to the flic flac to 'set' it initially. The application of the force leads to a transformation of kinetic energy into stored elastic energy. When the flic flac opens, the elastic energy is transformed into kinetic energy, as well as some sound energy.

Safety

Warn students that they must not have their faces close to the flic flac when it is 'set'. It could hit them in the eyes, or some other part of their faces, when it jumps open.

Working scientifically

Time: 30 minutes

Resource Sheet 2

Constructing and using models

Discussing thinking

▶ Students construct, release and observe a flic flac, following the directions on Resource Sheet 2.

▶ In groups, students discuss their observations, make notes about why they think the flic flac acted as it did and report to the class.

▶ The follow-up class discussion should focus on the relationship between the forces applied, the stored energy and the motion of the flic flac. Questions to guide thinking could include:

- What forces are applied to the flic flac?
- Where does the energy come from to 'set' the flic flac?
- Does the 'set' flic flac have energy? How do you know?
- What form of stored energy is in the 'set' flic flac?
- What causes the flic flac to move after it is 'set'?
- Where does the energy go when the flic flac opens?

Gathering information about student learning

Sources of information could include:

- students' reports to the class;
- anecdotal notes about students' contributions to discussion.

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ACTIVITY

Friction

Developmental

Focus

This activity provides opportunities for students to investigate how friction affects the motion of a toy car.

Materials

- toy cars
- planks of wood and blocks to create ramps
- various flat surfaces (e.g. polished and unpolished tiles, carpet, desktops, paper, cement, cement with water on it, grass, dirt, gravel, surfaces sprinkled with talcum powder)
- marking pens
- tape measures or rulers
- planning and reporting worksheets, model 2 (see the sourcebook guidelines, Appendix 3)

Teaching considerations

Friction

A toy car will roll across a surface if the force applied to move it is greater than the force due to friction. The more friction there is between the car and the surface it is travelling on, the sooner the car will slow down and eventually stop — thus, the shorter the distance it will travel.

Fair tests

Students may need assistance to ensure their investigations incorporate the elements of a fair test (see 'Teaching considerations', p. 11). The only variable that should change in this investigation is the type of surface. The force used to initially move the toy car should be gravity only, thus the use of a ramp. The height of the ramp should be the same each time, as should the place from where the toy car is released. Measurements should be taken from the bottom of the ramp to the front of the car at the point where it stops. Several trials need to be done for each surface and an average calculated. The car should generally travel straight ahead each time.

Working scientifically

Time: 60 minutes

Designing and performing investigations
Identifying and controlling variables
Inferring from data
Making comparisons
Creating tables and graphs

▶ In groups, students write notes in response to the following stimulus questions and share them with their group or the class:

- What do you think of when you hear the word 'friction'?
- What do you think the word 'friction' means?
- In what situations is friction a help/hindrance?
- How can friction be reduced/increased?

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▶ In groups, students design and perform investigations to compare the distance a toy car travels on different surfaces. They should use the planning and reporting worksheets listed on the previous page to plan and structure their investigations. Students could design their own table to record results or draw up one similar to the following:

Surface tested	**Distance travelled by toy car from the bottom of the ramp (in cm)**			
	Trials 1	2	3	Average

▶ Students report their results and conclusions to the class.

Gathering information about student learning

Sources of information could include:

- anecdotal notes about each student's participation in the design and performance of the investigation;
- students' completed planning and reporting worksheets.

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ACTIVITY

Swings and seesaws

Developmental

Focus

This activity provides opportunities for students to explore the effect that different forces have on the motion and energy of swings and seesaws.

Materials

- swings and/or seesaws

Both swings and seesaws can be easily simulated if necessary:

- Use a ruler balanced on a suitable object with weights on the ends instead of a seesaw.
- Use a pendulum instead of a swing.

Teaching considerations

Forces, energy and motion

A swing or seesaw will move with the application of a force or forces. This leads to transformation of energy, which in turn leads to movement of the swing or seesaw. The forces involved are gravity and the force exerted by the muscles in the body. The energy transformations involved are:

- chemical energy (stored in muscles) → kinetic energy (movement);
- potential energy (due to gravity) → kinetic energy.

To a lesser extent, heat and sound energy are also involved.

Safety

This activity should be supervised according to school playground safety procedures.

Working scientifically

Time: 60 minutes

Exploring phenomena
Playing
Creating diagrams
Explaining ideas

▶ Students play on swings to explore what happens when they keep their legs straight out in front of them or tucked in under the seat.

▶ Students investigate what happens in different situations on a seesaw — for example, when only one person sits on the seesaw; when there is one person on each end; when there is one person on one end and two people on the other end; when one person sits on one end and another person sits half a metre from the other end.

▶ Students then draw diagrams to show what happens in various situations on the swings and seesaws and, in each case, add notes explaining why it happens.

▶ The follow-up discussion should focus on the forces applied, the energy sources and the motion that takes place. Questions to guide thinking could include:

- Why don't you keep going around in a complete circle when you are on a swing?
- What is the force that pulls you towards the Earth when you are on a swing?
- Where does the energy that is required to start the swing come from?

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- What do you do when you want to swing higher on a swing?
- What is the position of the swing when its potential energy is greatest?
- What happens when you try to use a seesaw on your own?
- What forces help you to go down on a seesaw?
- How do you exert a force when you go up on a seesaw?
- Where does the energy come from to enable you to go up on a seesaw?
- Why is it easier for you to go up on the seesaw when there are two people on the other end?

Additional learning

▶ Students could investigate the relationship between forces, motion and energy in:
- balanced and unbalanced forces;
- pendulums;
- levers.

Gathering information about student learning

Sources of information could include:
- anecdotal notes made during discussion and play;
- students' diagrams and explanations for what happens on the swings and seesaws.

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ACTIVITY

Paper planes

Developmental

Focus

This activity provides opportunities for students to explore the flight of paper planes in order to develop an understanding of how different forces affect the motion of the planes.

Materials

- pictures or diagrams of planes
- sheets of A4 paper
- materials to use as weights (e.g. Plasticine)
- string (for taking measurements)
- tape measures/metre rulers and protractors

Teaching considerations

Forces and motion

Gravity, **thrust** (the force exerted by the engines), **air resistance** and **uplift** (due to the difference in the air pressure above and below the wings) affect the motion of an aeroplane.

The motion of a paper plane is affected by gravity, thrust (the force exerted by muscles when the plane is thrown) and air resistance. If the wings of a paper plane are flat, uplift will not be a factor which affects its motion.

The distance and direction the paper plane travels are determined by the overall effect of the forces. For example, if the effect of the forces acting upwards is less than the effect of the forces acting downwards, then the plane will tend to move towards the ground. If the forces acting on the plane in one direction are less than the forces acting in the other direction, then the plane will tend to turn.

Safety

Paper planes should be tested in an open space such as a playground.
Ensure that students stand well behind the throwers when planes are launched.

Working scientifically

Time: 60 minutes

Assessing and reassessing
Inferring from data
Constructing and using models
Creating presentations
Explaining ideas and decisions

▶ Students view pictures or diagrams of planes and then, individually or in groups, design and construct their own paper planes. Their planes should be able to travel a reasonable distance in a straight line, or turn to the left or right.

▶ Students draw diagrams showing the design of their planes and make notes about the reasons they designed them in this way.

▶ Students test their planes and modify designs to achieve the best possible result. (If possible, they should take specific measurements of the distance the plane travelled or angle of the turn.) Students record details of the plane's performance, any adjustments made, the reasons for these adjustments and the results of adjustments.

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▶ After completing their testing, students infer why the paper plane behaved as it did and record this in their notes, along with supporting diagrams. Their inferences should focus on how the forces affected the motion of the plane.

▶ Students give presentations to the class based on their investigations.

Gathering information about student learning

Sources of information could include:

- students' notes and diagrams about the design and performance of their planes;
- students' presentations.

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ACTIVITY

Guided investigation: Force, energy and motion

Culminating

Focus

This activity provides opportunities for students to investigate how applying different amounts of force to a toy car affect its motion and energy.

Materials

- toy cars
- planks of wood and blocks to make ramps
- flat surfaces
- material to use as weights (e.g. Plasticine)
- kitchen scales
- marking pens
- tape measures or rulers
- planning and reporting worksheets, model 2 (see the sourcebook guidelines, Appendix 3)

Teaching considerations

Fair tests

Students may need assistance to ensure their investigations incorporate the elements of a fair test (see 'Teaching considerations', p. 11). This activity is similar to the activity titled 'Friction' (see p. 14), except that in this case students decide for themselves which variable to change. Variables that could be changed are angle of the ramp; mass of the car (by adding weights); shape of the car (by attaching paper or Plasticine).

Teacher–student consultation

Teacher–student consultation should take place throughout the investigations so that students receive guidance where necessary.

Working scientifically

Time: 2 hours

Designing and performing investigations
Identifying and controlling variables
Looking for patterns and meanings
Drawing conclusions
Inferring from data
Creating tables and graphs

▶ In groups, students design and perform an investigation to explore the relationship between the total force applied to a toy car and the distance it travels. They should use the planning and reporting worksheets listed above to plan and structure their investigations. Students' notes should include a description of how variations in the force applied to the car affect its motion and energy.

▶ Groups report their findings to the class.

Gathering information about student learning

Sources of information could include:

- anecdotal notes about each student's participation in the design and performance of the investigation;
- anecdotal notes made during teacher–student consultation;
- students' completed planning and reporting worksheets;
- students' reports.

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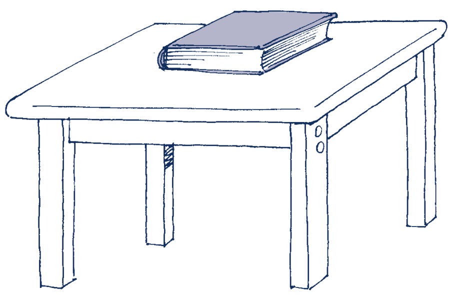
Force and motion

When someone kicks a ball, it rolls across the ground. If the person stops kicking the ball, it will eventually stop rolling. Why?

It is harder to ride a bicycle up a hill than it is to ride it on flat ground. Why?



If you place a book on a table, it stays still. What forces are acting on the book?

Why wouldn't it be advisable to ride a skateboard on dry sand?

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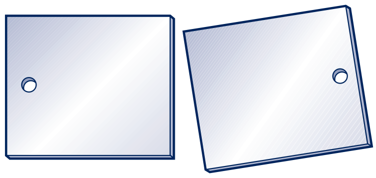
How to make a flic flac

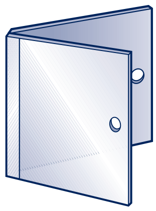
You will need:

- 2 pieces of stiff cardboard (about 6 cm x 6 cm)
- scissors or hole puncher
- adhesive tape
- elastic band (about 8 cm long)
- matchstick with head removed

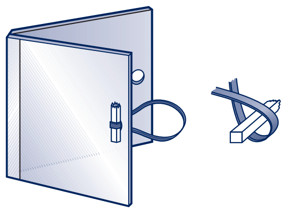
1. Make holes mid-way along the side of both cardboard squares with scissors or a hole puncher. Make the holes about 1 cm from the edge.



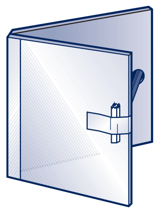
2. Tape the two pieces of card together to form a hinge opposite the holes.



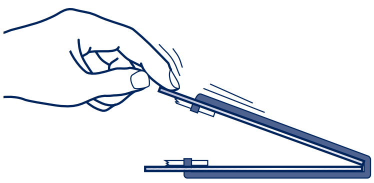
3. Thread one end of the elastic band through one of the holes in the card. Break a matchstick in half and put one piece through the loop.



4. Do the same for the other end of the elastic band and tape down the two matchsticks.



5. Set the flic flac by bending it inside out. Place it on a desk and hold it down with your finger. Making sure that you do not have your face close to the flic flac, move your finger away.



Source: Australian Academy of Science 1994, *Primary Investigations: Teacher Resource Book 6 — Energy and Investigation*, Canberra, pp. 23–26.

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Acknowledgments

This module includes material developed by Madeline Fisher, Fraser Coast Anglican College, Hervey Bay (trial school).

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Australian Academy of Science, Canberra, for material from *Primary Investigations: Teacher Resource Book 6 — Energy and Investigation*.

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ISBN 0 7345 2066 2

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Any inquiries should be addressed to:
Queensland School Curriculum Council
PO Box 317
Brisbane Albert Street, Q 4002
Australia

Telephone: (07) 3237 0794
Facsimile: (07) 3237 1285
Website: http://www.qscc.qld.edu.au
Email: inquiries@qscc.qld.edu.au

Illustrations by Stephen Francis (p. 21) and Brent Hagen (p. 22)

PIP 98158