Level

F	1	**2**	**3**	4	5	6	B6

Forms and sources of energy

Strand
Energy and Change

Key concepts
In interactions and changes, energy is transferred and transformed but is not created or destroyed.

There are different ways of obtaining and utilising energy and these have different consequences.

Purpose

Activities in this module are designed to help students understand that there are different forms of energy and that these have different characteristics and can be obtained in different ways. Students have opportunities to:

- identify and explore different forms and sources of energy in everyday life;
- recognise situations where one form of energy is changed to other forms;
- discuss where their own energy comes from;
- evaluate different sources of electrical energy;
- suggest alternative sources of energy for use in particular situations.

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 ►
Energy connections	From where do we get our energy?	Exploring energy sources
Energy forms and sources	Energy and bouncing balls	Alternatives to electrical energy
Energy around us	Good vibrations	
	Sounds of energy	
	Electricity in — electricity out	
	Electrical appliances	

QUEENSLAND SCHOOL CURRICULUM COUNCIL

Core learning outcomes

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

Energy and Change

2.2 Students identify and describe forms of energy in their community (including heat and energy of movement).

2.3 Students illustrate the ways that energy is used in their community.

3.2 Students identify forms of energy (including electrical and sound energy) and describe the effects and characteristics of those different forms.

3.3 Students identify different ways of obtaining energy.

Core content

This module incorporates the following core content from the syllabus:

Energy and Change

Transfer and transformation of energy types
- sound (vibration, pitch, volume), electrical

Energy converters

Sources of energy
- fossil fuels (coal, oil, gas), sun (wind energy), geothermal, hydroelectric, tidal, nuclear

Consequences of energy use
- social and cultural patterns of energy use

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

2.2 Students identify and describe forms of energy in their community (including heat and energy of movement).

Students may:
- relate changes observed when an appliance is used (for example, when a lamp is turned on) to changes in forms of energy (for example, transformation of electrical energy to light energy);
- generalise that many objects are affected by more than one form of energy;
- list different forms of energy — heat, sound, light, electrical, wind, motion.

Energy and Change

2.3 Students illustrate the ways that energy is used in their community.

Students may:
- identify situations where different forms of energy such as electrical, heat and light energy are used by the community;
- describe different ways in which energy is used by the community — for example, lighting, heating, cooling, transport, computers and industry.

Energy and Change

3.2 Students identify forms of energy (including electrical and sound energy) and describe the effects and characteristics of those different forms.

Students may:

- list the forms of energy associated with a variety of everyday situations;
- identify changes in energy forms occurring in electrical appliances;
- use their understanding of sound energy to explain its effects;
- recognise that current electricity flows through a circuit.

Energy and Change

3.3 Students identify different ways of obtaining energy.

Students may:

- identify a number of ways of obtaining the energy needed to do something;
- discuss where their own energy comes from;
- list different sources and forms of energy that could be used to replace electrical appliances;
- evaluate different ways of obtaining electrical energy.

Background information

Current scientific conceptions

Energy

Energy is the ability to do work. It can be classified as either kinetic or potential energy. Kinetic energy is the energy an object possesses when it is moving. It is often called movement energy. Potential energy is energy that is stored. It can be stored in a variety of forms. For example, the energy stored in food is chemical potential energy.

Energy comes in many forms — for example, heat, light, sound, solar and electrical energy. These forms of energy may come from a variety of sources. It is important to recognise the difference between an energy source and an energy form — that is, the energy source **produces** the particular form(s) of energy. For example, food is a source of chemical potential energy.

Heat energy

Heat is a form of energy that comes from many sources. The sun, friction, some chemical reactions (including burning) and reactions occurring in the Earth's core all provide heat energy.

Light energy

Some wavelengths of radiant energy from the sun can be detected by our eyes. These wavelengths are called light energy.

Sound energy

Sound is a form of energy that travels as vibrations through solids, liquids or gases. The sounds we hear are caused when a moving object makes the air vibrate. These vibrations, travelling through the air, are picked up by our ears and translated by our brains into sounds.

Solar energy

The sun produces radiant energy over a range of wavelengths. Some wavelengths are detected by our eyes and are called light energy (see p. 3). When wavelengths in the infra-red range come into contact with matter, they are changed to heat energy.

Electrical energy

Electricity cannot be seen or heard. It is one of the commonest forms of energy used in industrialised countries.

An electric current consists of a flow of tiny particles called electrons. Batteries are a useful way of storing energy. They change chemical potential energy into electricity. Each cell of a battery contains two electrodes. A chemical reaction occurring at one electrode makes that electrode positively charged. A different chemical reaction at the other electrode makes that electrode negatively charged. When the electrodes are connected via an external circuit, electrons from the negative electrode flow through the circuit to the positive electrode. This is the electric current.

Generating electricity

The following energy sources can all be used to generate electricity:

- fossil fuels;
- geothermal energy;
- nuclear energy;
- energy from the sun, wind and moving water.

When coal, oil or gas is burned, stored chemical energy is changed into heat. The heat is used to produce steam, which turns a turbine to produce electricity.

Geothermal energy is another name for the Earth's internal heat. Steam from water heated deep in the Earth is used to turn turbines attached to electric generators.

Nuclear energy is produced when the nucleus of an atom splits into smaller particles. The energy is released in the form of heat, which is used to produce steam, which turns turbines to produce electricity.

Photovoltaic cells in solar panels convert sunlight directly into electricity, which is then stored in batteries.

Moving air (wind) is used to turn turbines directly and thus generate electricity.

Moving water in the form of rivers, waves and tides is used to turn turbines and thus generate electricity. The flow of water in rivers is controlled by dams, as is the ebb of tides in some areas where there is a high tidal range. In both these situations, the water can be released in a controlled way and thus turn turbines. In some coastal areas, waves are consistently large, and their energy can be harnessed to generate electricity.

Students' prior understandings

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

Some students may:

- have heard about energy only in relation to foods such as bread, breakfast cereals and sports drinks;
- believe that energy is used up;
- think that electricity is produced in power lines or transformers;
- believe that electricity is made by an energy company in the city.

Students are only beginning to understand the concept of energy and will have little understanding of its different forms. Teachers can enhance students' understandings by emphasising correct usage of the terms 'energy source' and 'energy form' and by providing opportunities for them to consider different forms and sources of energy.

Terminology

Terms associated with different forms and sources of energy are essential to the activities in this module — for example:

chemical energy	fossil fuels	kinetic energy	sound energy
electrical energy	geothermal energy	light energy	wave energy
energy forms	heat energy	nuclear energy	wind energy
energy sources	hydroelectricity	solar energy	

Students may already be familiar with some of these terms and understand their meanings and use in scientific contexts. If so, the activities in this module will provide opportunities for them to evaluate current usage. If not, these activities will provide opportunities for students to develop their understandings.

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:

- the use of matches and candles;
- observing electrical appliances.

Support materials and references

Borushek, A., *Allan Borushek's Pocket Calorie and Fat Counter*, Family Health Publication, Nedlands (Western Australia). (A new edition is published each year. It can be purchased at newsagents and supermarkets or via the Internet. Email: sales@familyhealth.com.au)

ACTIVITY

Energy connections

Introductory

Focus

This activity provides opportunities for students to reflect on their understandings of energy.

Materials

No particular materials are required.

Working scientifically

Time: 30 minutes

Constructing meaning
Making links
Clarifying ideas and concepts
Discussing thinking

▶ Students compare their understandings of the following terms related to energy.

coal	energy source	movement	solar energy
electrical energy	food	natural gas	sound energy
energy	heat	nuclear energy	sun
energy form	light		

▶ Individually or in groups, students write five or six sentences using the above terms. Each sentence should contain two or more terms and show the relationship between them. Terms may be used more than once but must be in different combinations for each sentence. Examples include:

- *Coal* and *natural gas* are both *energy sources*.
- *Solar energy* comes from the *sun*.
- *Heat* is an *energy form*.
- *Food* is an *energy source* for humans.

▶ Each student or group shares one sentence with the class. The teacher records the sentences and guides discussion about each one, focusing on what is meant by 'energy form' and 'energy source'.

Gathering information about student learning

Sources of information could include:

- students' sentences about energy;
- students' contributions to discussions.

ACTIVITY

Energy forms and sources

Introductory

Focus

This activity provides opportunities for students to reflect on and discuss their ideas about energy forms and energy sources.

Materials

No particular materials are required.

Working scientifically

Time: 30 minutes

Constructing meaning
Suggesting
Clarifying ideas and concepts
Discussing thinking

▶ Students compile a class list of different forms of energy and identify familiar sources of each one. Suggestions could be recorded in a table like the one below.

Forms and sources of energy

Energy form	Energy source
Movement	Food, a push, a pull
Sound	Musical instruments, birds singing, radio, people talking, car engines
Light	Torch, candle, television, fire, light bulb
Heat	Fire, sun, candle, radiator, toaster
Electricity	Power point, dry cell, battery

▶ In groups, students develop definitions of the terms 'energy form' and 'energy source'. They share their definitions and with teacher guidance develop class definitions.

Gathering information about student learning

Sources of information could include:

- students' contributions to the table of energy forms and sources;
- students' definitions of terms.

ACTIVITY

Energy around us

Introductory

Focus

This activity provides opportunities for students to identify forms of energy in everyday life.

Materials

For each student:

- Resource Sheet 1, 'Energy around us'

Teaching considerations

Transformation of energy

When energy is transformed (or changed) from one form into another, the process is not 100 per cent efficient. For example, light bulbs transform most of the electrical energy coming into the system into light energy. However, some of the electrical energy is also transformed into heat energy.

It is therefore possible to identify several forms of energy present in each of the situations featured on Resource Sheet 1. For the purposes of this activity, the intended result of the energy transformation in each situation can be referred to as the 'main' form of energy; other forms of energy that occur because of the inefficiency of the system can be referred to as 'secondary' forms. The latter are generally forms of energy that cannot be used in that situation. Note that 'main' and 'secondary' forms of energy are not technical terms — they are just ways of describing these energy forms in this module.

The following table shows the main and secondary forms of energy evident in the situations on Resource Sheet 1.

Energy in different situations

Situation	Main form of energy	Secondary form of energy
Shining light bulb	Light	Heat
Burning fire	Heat	Light, sound
Person running	Movement	Heat, sound
Sailing boat blown by wind	Movement	Sound
Guitar being played	Sound	Heat, movement
Food cooking in microwave oven	Heat	Light, sound, movement

Working scientifically

Time: 30 minutes

Looking for alternatives
Discussing thinking
Explaining ideas and decisions

▶ Students study the pictures on Resource Sheet 1 showing familiar situations where energy is used. They identify the main form of energy used in each situation (for example, light from the shining electrical bulb) and any secondary form of energy present (for example, heat radiating from the light bulb).

Resource Sheet 1

▶ Students discuss their responses and identify other familiar situations where they have been aware of 'secondary forms' of energy.

Additional learning

► Students discuss the sources of energy in each situation on Resource Sheet 1.

Gathering information about student learning

Sources of information could include:

- students' responses to Resource Sheet 1;
- students' explanations of their responses;
- students' application of their understandings to other situations.

ACTIVITY

From where do we get our energy?

Developmental

Focus

This activity provides opportunities for students to clarify ideas and concepts about energy in the human body.

Materials

- butcher's paper or overhead transparencies and suitable pens (optional)
- simple tables showing the energy value of different foods (see 'Support materials and references', p. 5)

Teaching considerations

This could be a whole-class or small-group activity. Work done in small groups would need to be followed by some sharing of ideas with the whole class.

Energy and life

Humans need energy for all body functions and activities, not just obvious movements such as running, walking or jumping. For example, energy is required for:

- breathing;
- digestion;
- blood circulation;
- thinking;
- the development of new cells for growth or the repair of damaged tissue.

Energy is used during sleep.

All living things use energy. Plants use energy as they make new cells and grow and manufacture their food.

Food posters

Supermarket advertisements are good sources of pictures of foods for the posters students create during this activity. Students and teachers could also write to food-growing organisations for materials about food or collect pictures from magazines and newspapers.

Working scientifically

Time: 45 minutes

Making links
Clarifying ideas and concepts
Creating presentations
Discussing thinking

▶ Students suggest answers to the question 'Why does your body need energy?'. Assisted by the teacher, students compile a class list on butcher's paper, an overhead transparency or the board.

▶ Students discuss the energy needs of different groups of people. Questions to guide discussion could include:

- Which groups of people might need more energy than you do?
- Why do they need more energy?
- Which groups of people might not use as much energy as you do?
- Why do they need less energy?
- Think of some animals with which you are familiar. Do you think they would use more or less energy than you do? Why?

- Do plants need energy? Why do you think this? (Refer students to the list of reasons compiled earlier for needing energy.) Plants are living things. Do they do any of the things on the list?

▶ Students suggest answers to the question 'Where do you get most of your energy from?'. They then explore and enhance their understanding of food as a source of energy by comparing the energy value of different foods or food groups. (There are many readily available publications containing simple tables that students can refer to for this task. A suggested source for the tables is provided on p. 5.) Questions to guide exploration could include:

- What foods do you eat?
- What is the energy value of each of these foods?
- Which of these foods are highest in energy value? Which are lowest?

▶ Students collect or draw pictures of different foods and create a poster showing how these contribute to their personal energy supply.

Additional learning

Students suggest reasons for eating other than to gain energy — for example, body building.

Gathering information about student learning

Sources of information could include:

- students' contributions to discussions;
- students' extraction of information from tables;
- students' posters about food and energy.

ACTIVITY

Energy and bouncing balls

Developmental

Focus

This activity provides opportunities for students to investigate the effect of cooling on the ways balls bounce.

Materials

- refrigerator with freezer

For each group:

- a selection of balls (e.g. tennis balls, solid rubber balls, soft foam balls or stress balls)
- metre rulers/tape measures
- butcher's paper
- adhesive tape
- marking pens

For each student:

- planning and reporting worksheets (see the sourcebook guidelines, appendix 3)

Teaching considerations

Stored energy and the effects of cold

A falling ball has kinetic energy and will hit the ground with a force. When a ball comes into contact with the ground, the ground exerts a force on the ball and it slows down. Depending on the magnitude of the force and the composition of the ball, it becomes compressed and distorted. The kinetic energy of the ball is mainly converted to elastic potential energy. This elastic potential energy is then changed back to kinetic energy, and the ball bounces up again.

When a ball is cooled, there are changes in the properties of the materials from which it is made. As a result, less of the kinetic energy of the falling ball can be converted to elastic potential energy. The ball is therefore less able to bounce up again.

Fair tests

Encourage students to explore aspects of fair testing appropriate to the level towards which they are working. (Refer to suggestions in the sourcebook guidelines, p. 35.)

Working scientifically

Time: 60 minutes

Designing and performing investigations
Exploring phenomena
Handling materials
Looking for patterns and meanings
Making and judging observations

▶ Students consider a number of different balls, predict which ones will bounce highest and give reasons for their predictions. They then discuss ways of testing the predictions and, with teacher guidance, think about what makes a fair test.

▶ In small groups, students design and perform an investigation to test their predictions. They could use the planning and reporting worksheets in the sourcebook guidelines to plan, structure, and report on their investigations.

Predicting
Seeking reasons
Constructing meaning
Interpreting data
Suggesting
Describing
Discussing thinking
Supporting decisions

▶ Students discuss the results of their investigations, focusing on why balls bounce and what determines their degree of bounciness.

▶ Students predict how cooling the balls might affect their bounciness and give reasons for their predictions.

▶ In small groups, students investigate the bounce heights of cooled balls using the same procedure developed for the earlier tests. (Balls should be cooled in a freezer for a minimum of an hour and kept there or in an Esky until the tests begin.) Students record results and compare these with their predictions.

▶ Students compare the results of both investigations. Questions to guide the discussion could include:

- Were all the balls affected by cooling in the same way?
- What do you think cooling did to the ball to change its bounciness?

▶ Students reflect on the different ways groups performed the investigations and discuss whether or not testing was fair.

Gathering information about student learning

Sources of information could include:

- students' predictions and supporting explanations;
- students' planning and performing of investigations;
- students' reports on their investigations;
- students' contributions to discussions.

ACTIVITY

Good vibrations

Developmental

Focus

This activity provides opportunities for students to explore sound as a form of energy.

Materials

- Resource Sheet 2, 'Investigating sound energy'
- materials listed on Resource Sheet 2

Teaching considerations

The apparatus required for this activity needs to be assembled beforehand. Instructions and a diagram are provided on Resource Sheet 2. Students may be able to assist with preparations.

Investigating sound energy

Hitting the rubber at one end of the cardboard tube causes the rubber to vibrate. This produces soundwaves. The soundwaves travel through the tube to the other end causing the rubber at the other end to vibrate. This causes air particles in front of the tube to move forward and make the candle flames move. The candle flames may even be extinguished if the draught is strong enough. The vibrations will be seen only if there are no other air currents affecting the candle flames.

Safety

Inform students about safe practices for using matches and candles.

Working scientifically

Time: 30 minutes

Exploring phenomena
Making and judging observations
Predicting
Describing

▶ Students examine the apparatus and predict what might happen to the flames of the candle when the rubber on the end of the tube is tapped with a pen or small spoon. They record their predictions and give reasons for these.

▶ In small groups, students tap the rubber on the cardboard tube to observe how this affects the flames of the candles.

▶ Students discuss their observations. Stimulus questions could include:

- How did your observations compare with your predictions?
- What do think caused the candle flames to move (waver)?
- What could have caused the air to move (vibrate)?
- How could hitting the rubber on the end of the tube cause the air between the tube and the candle to vibrate?

▶ Students record their observations and explain what happened in written or diagrammatic form.

Gathering information about student learning

Sources of information could include:

- students' records and explanations of their observations.

ACTIVITY

Sounds of energy

Developmental

Focus

This activity provides opportunities for students to investigate the characteristics of sound energy.

Materials

- tuning fork
- glass of water
- Resource Sheet 3, 'Home-made musical instruments'
- materials for musical instruments on Resource Sheet 3

Teaching considerations

This activity involves students playing with simple musical instruments. Instructions for making these are provided on Resource Sheet 3. Students could collect materials for the instruments and help to make them.

One way of organising this activity is to place instruments in learning centres around the room. Have students form small groups and explore the various sounds that can be produced on each instrument.

Students with hearing impairment

Some students with hearing impairment may need assistance for this activity. Seek advice from their support teacher.

Working scientifically

Time: 60 minutes

Exploring phenomena
Handling materials
Making and judging observations
Seeking reasons
Suggesting
Describing
Discussing thinking


Resource Sheet 3

▶ The teacher introduces the concept of sound and demonstrates the vibrations of a tuning fork by hitting it against a firm surface and then holding the vibrating end in a glass full of water. The following discussion should focus on how sound is caused — that is, by the vibration of the medium through which the sound is passing. This vibration is then detected by our ears.

▶ Students explore ways of varying the characteristics of sound by playing with the musical instruments listed on Resource Sheet 3. At each learning centre, students observe what happens when an instrument is played in various ways and suggest reasons for different sounds being produced.

Clap sticks

▶ One student holds the hardwood clap sticks at one end and hits them together. Another student in the group does the same thing with the softwood clap sticks. They describe the different sounds produced.

▶ Students hold the clap sticks at points progressively further from the end, in effect making the sticks shorter and shorter. They describe how the sound changes.

▶ Students hit the clap sticks together with different amounts of force and compare the sounds they make.

Glass jar xylophone

▶ Students gently hit the sides of the jars and describe how the sound changes as the amounts of water in the jars increase.

▶ Students look carefully at the surface of the water as they hit the jars and compare the vibration of the water in different jars.

▶ Students hit one jar with a metal spoon, wooden rod and then a plastic rod. They compare the sounds made by the different implements.

Ice-cream drums

▶ Students hit the top of each drum with a piece of wooden dowel or a drumstick. They describe the different sounds produced.

Bottles

▶ Students suspend the bottles and hit them with a wooden stick. They start with the smallest bottle and compare the sounds made as the sizes of the bottles increase.

▶ In the class group, students share and discuss their observations and explanations. Questions to guide discussion could include:

- What was vibrating to cause the sound made by the musical instrument?
- How was the vibration changed by playing the instrument in a different way?
- What sort of vibrations makes a high-pitched sound? A low-pitched sound?
- What difference was there between the vibrations of the soft sounds and the loud sounds?

Gathering information about student learning

Sources of information could include:

- students' observations during tasks at each learning centre;
- students' contributions to discussions;
- students' explanations of their observations.

ACTIVITY

Electricity in — electricity out

Developmental

Focus

This activity provides opportunities for students to explore characteristics of electricity.

Materials

For each group:

- D-cell battery in a holder
- electrical wires
- light bulb (1.5 V) in a holder

For the teacher:

- two-pin electrical plug with cord attached (not connected to an appliance)

Teaching considerations

Electrical cables

Many students will have seen electrical cables carrying electricity from power lines into their homes. If some students live in areas with underground cables, point out the electrical cable coming into the school or show them pictures of power lines.

Electrical plugs

A two-pin plug is used for demonstration purposes during this activity. If students point out that many household plugs have three pins, explain that the top two pins create the circuit, while the third pin connects the appliance to the earth in case there is a short circuit. This is a safety feature to protect people from electric shocks.

Working scientifically

Time: 40 minutes

Clarifying and challenging
Engaging with problems
Handling materials
Playing
Applying ideas and concepts

▶ Students reflect on the way that outside sounds get into their homes. They relate this to the characteristics of sound and the way it travels through air.

▶ Students reflect on the way that heat from the sun enters their homes and relate this to the way heat is transferred.

▶ Students reflect on the way that electrical energy comes into their homes.

▶ Students form groups and are given a battery, some wires and a light bulb. The teacher explains that the battery represents the electricity supply, the wire is the cable coming into the house and the light bulb represents any of the electrical appliances in the home. The students' task is to use this equipment to make the 'appliance' work — that is, make the light come on.

▶ Students discuss what they have done and whether they have succeeded in the task. Guided by the teacher, students identify what is required to make the light work. (Two wires must be used — one going from the electricity source to the appliance and another from the appliance back to the source. This creates an electric circuit.) The teacher shows students a two-pin electrical plug, points out the two wires in the attached cord and explains that, together, these complete the circuit.

► Students discuss the differences between electrical, sound and heat energy. (Electrical energy moves in one direction away from the source. Heat or sound energy moves away from the source in all directions.)

Gathering information about student learning

Sources of information could include:

- students' reflections on the characteristics of heat and sound energy;
- students' manipulation of equipment and suggestions about how it could be used to make the light work;
- students' contributions to discussions;
- students' comparisons of electrical, sound and heat energy.

ACTIVITY

Electrical appliances

Developmental

Focus

This activity provides opportunities for students to identify the uses of particular electrical appliances and to suggest other sources of energy that may be used to perform the same activity.

Materials

- electrical appliances and/or pictures of appliances (e.g. electric light, airconditioner, electric blanket, microwave oven, electric jug/kettle, refrigerator, washing machine, hair drier, sewing machine, television, electric drill, computer)

Teaching considerations

If possible, display small electrical appliances around the room. (Students may be able to provide some of these.) Display pictures of other larger appliances.

Safety

Students should not plug in or operate the appliances.

Working scientifically

Time: 40 minutes

Looking for alternatives
Suggesting
Creating tables

▶ Students view the electrical appliances and complete a table like the one below. The table requires them to record:

- what each appliance is used for;
- the main and secondary forms of energy resulting from the conversion of electrical energy in each appliance.

Electrical appliances

Electrical appliances	Used for . . .	Electrical energy is converted to . . .	
		Main form of energy	Other energy forms involved
Electric light	Lighting	Light	Heat
Airconditioner	Cooling	Electricity	Heat, sound
Electric blanket	Warming bed	Heat	Light
Washing machine	Washing clothes	Movement	Heat, sound, light
Television	Entertainment Obtaining information	Light, sound	Heat
Drill	Making holes in wood and masonry	Movement	Heat, sound
Electric jug	Heating water	Heat	Sound, movement

► In the class group, students discuss their responses and group the uses of electrical energy evident in the table — for example, many of the appliances are used for heating. Using this information, students create a table showing the uses of electrical energy and possible alternatives. Some examples are shown below:

Uses and sources of energy

Uses of electrical energy	Alternative sources of energy
Lighting	Candle wax, lamp oil, wood (fuel for fire), the sun
Heating	Food (fuel for exercise), gas, wood, kerosene

Gathering information about student learning

Sources of information could include:

- students' completed worksheets identifying forms of energy in appliances;
- students' synthesis of information in their tables;
- students' tables showing alternative energy sources;
- students' contributions to discussions.

ACTIVITY

Exploring energy sources

Culminating

Focus

This activity provides opportunities for students to explore alternative ways of generating electricity.

Materials

- resources on alternative energy sources
  (Information can be obtained from relevant government departments and by searching under **alternatives and energy** on the Internet.)
- Resource Sheet 4, 'Futures wheel'

Teaching consideration

Some students may have preconceived ideas about the use of some energy sources. These may not have a factual basis. Encourage students to consider all information gathered during the activity with an open mind.

Working scientifically

Time: 5 minutes for brainstorming; research time depends on resources available; 20 minutes for creation of chart

Collecting information
Generalising
Recognising and analysing options
Creating presentations

▶ Students brainstorm different ways of generating electrical energy — for example, using coal, oil, gas, wind, moving water, energy from the sun, nuclear energy, geothermal energy.

▶ In pairs, students research one advantage and one disadvantage of each method. They share and discuss their findings, focusing on:

- how to make decisions about the significance of advantages and disadvantages;
- factors that could influence decisions about preferred ways of generating electrical energy in the future.

▶ Students create a class chart showing advantages and disadvantages of different sources of electrical energy. They can display their chart in the classroom or library.

▶ Students create futures wheels about alternative energy sources. These could be based on:

- the depletion of coal and oil supplies;
- a ban on nuclear power stations;
- the discovery of a new energy source from sea water.

Resource Sheet 4

A sample futures wheel is provided for reference on Resource Sheet 4.

Gathering information about student learning

Sources of information could include:

- students' collection and synthesis of information about alternative energy sources;
- students' contributions to discussions;
- students' contributions to the class chart;
- students' futures wheels.

ACTIVITY

Alternatives to electrical energy

Culminating

Focus

This activity provides opportunities for students to recognise and analyse options regarding the use of electrical energy in everyday life.

Materials

- resources providing information about past and future sources of energy (Information about possible future alternatives can be obtained from relevant government departments and by searching under **alternatives and energy** on the Internet.)

Teaching consideration

Electricity plays a significant role in everyday life. Historically, electricity has contributed to major social, scientific and technological changes. Some of the sources of electrical energy currently used are non-renewable (fossil fuels) and some cause air pollution (fossil fuels) or landscapes to be altered (hydroelectricity). Research is being conducted worldwide into finding alternative ways of generating electricity.

Working scientifically

Time: 30 minutes

Collecting information
Forecasting and backcasting
Looking for alternatives
Recognising and analysing options
Suggesting
Describing
Envisioning alternative futures

▶ Students compile individual lists of everyday activities that rely on electrical energy. Lists could be based on events during one day or a longer period of time such as a week.

▶ Students review commonly used forms of energy resulting from the conversion of electrical energy — for example, heat, light, sound. They then write these forms of energy beside the relevant activities on their lists as shown below:

Uses of energy

Activity	Form of energy used
Making toast	Heat
Watching television	Light, sound

▶ Students imagine living in earlier times when there was no electricity. For each activity in the above list, they suggest alternative sources of energy that could be used. Where there does not appear to be a suitable alternative energy source, students can suggest alternative activities. Some examples are shown below:

Energy alternatives

Activity	Form of energy used	Alternative sources of energy	Alternative activities
Making toast	Heat	Fire, gas stove	
Watching television	Light, sound		Go to the theatre. Read a book or newspaper.

► Students describe how using these different sources of energy and/or doing different activities may have affected life in earlier times.

► Students imagine living in a future situation when fossil fuels are no longer available. They suggest alternative sources of electrical energy and describe the consequences of using these. Possible alternatives are solar, wave, wind and geothermal energy. They could present their envisioned alternative futures in the form of drawings, skits, television advertisements or newspaper articles set in the future.

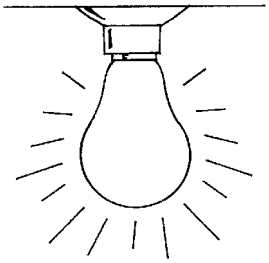
Gathering information about student learning

Sources of information could include:

- students' lists of activities requiring electricity;
- students' identification of energy forms used for activities;
- students' lists of alternative energy sources and activities;
- students' descriptions of life in the past without electricity;
- students' suggestions about alternative sources of electricity and the consequences of using these;
- students' presentations.

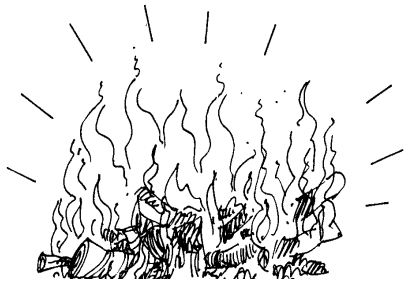
Energy around us

Write the main and secondary forms of energy shown in each of these pictures.



Main _____

Secondary _____

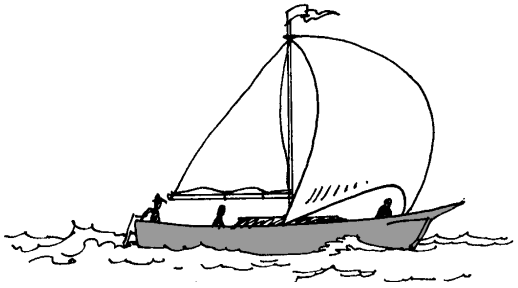


Main _____

Secondary _____

Main _____

Secondary _____

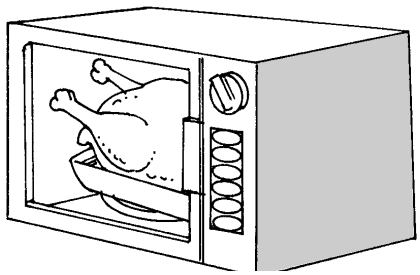


Main _____

Secondary _____

Main _____

Secondary _____



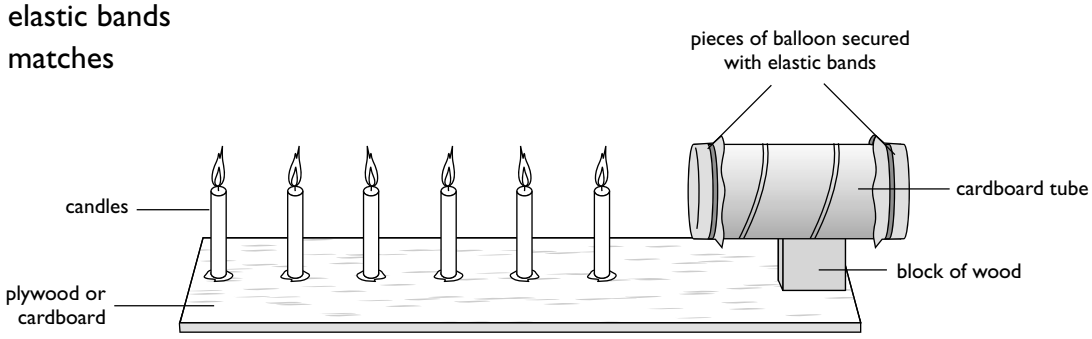
Main _____

Secondary _____

Investigating sound energy

You will need:

- flat piece of plywood or thick cardboard for mounting candles (approximately 30 cm x 10 cm)
- small candles (e.g. birthday cake candles)
- small block(s) of wood or cardboard boxes
- craft glue
- cardboard tube from a finished roll of foil or plastic wrap (cut to a length of approximately 10 cm) or a finished toilet roll
- balloons
- elastic bands
- matches



1. Mount the candles 2–3 cm apart in a single line at one end of the plywood as shown in the diagram. This can be done by dripping a small amount of melted wax onto the plywood and pressing the bases of the candles onto the wax before it cools.
2. Glue the block(s) of wood onto the other end of the plywood. The height of the blocks must be low enough to allow the cardboard tube that sits on the top to be level with the candles (see step 4).
3. Stretch pieces of rubber from the balloons over each end of the tube and secure firmly with an elastic band.
4. Attach the tube to the top of the block so that its centre lines up with the top of the candles.
5. Light the candles when the investigation is about to begin. (Birthday cake candles will burn only long enough for one or two groups to make observations.)

Home-made musical instruments

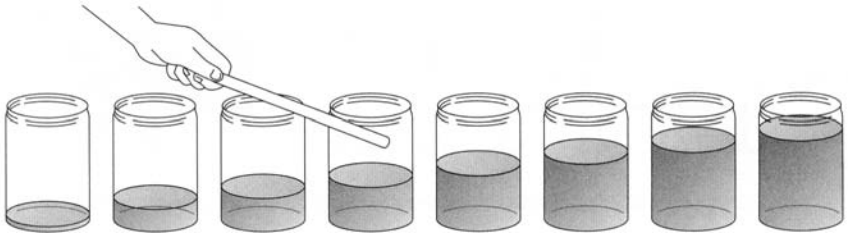
Clap sticks

For clap sticks, use pieces of dowel about 30 cm long and 2–3 cm in diameter. If dowel is not available, flat pieces of wood can be used.

Dimensions should be 30 cm x 1 cm x 2–3 cm. Four clap sticks are required altogether — two made of hardwood and two of softwood.

Glass jar xylophone

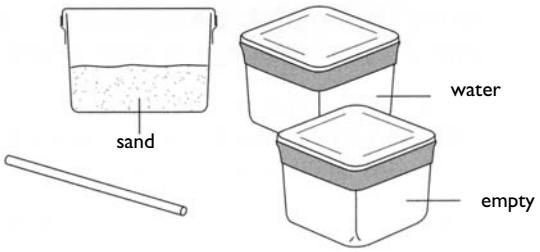
Have eight glass jars all the same size. Measure the height of the jar. Fill the first jar one-tenth full, the second two-tenths, the third three-tenths and so on until the last jar is eighth-tenths full. A teaspoon, a flat piece of wood and a plastic ruler can be used to play the instrument.



Ice-cream drums

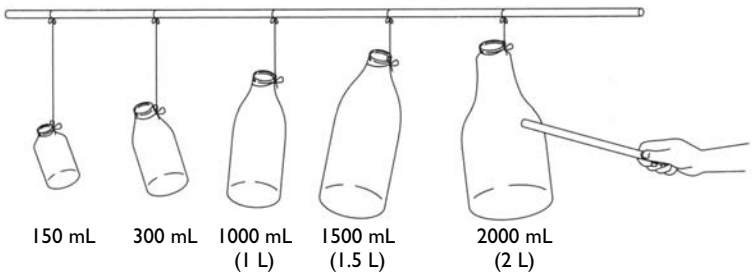
Have three (or more) ice-cream containers, all the same size and with lids. Keep the first container empty, half fill the second with water and the third with sand. Tape the lids firmly in position. Alternative materials for filling the containers are cotton wool, fabric, polystyrene beads and oil.

Use a piece of wood for the drumstick.



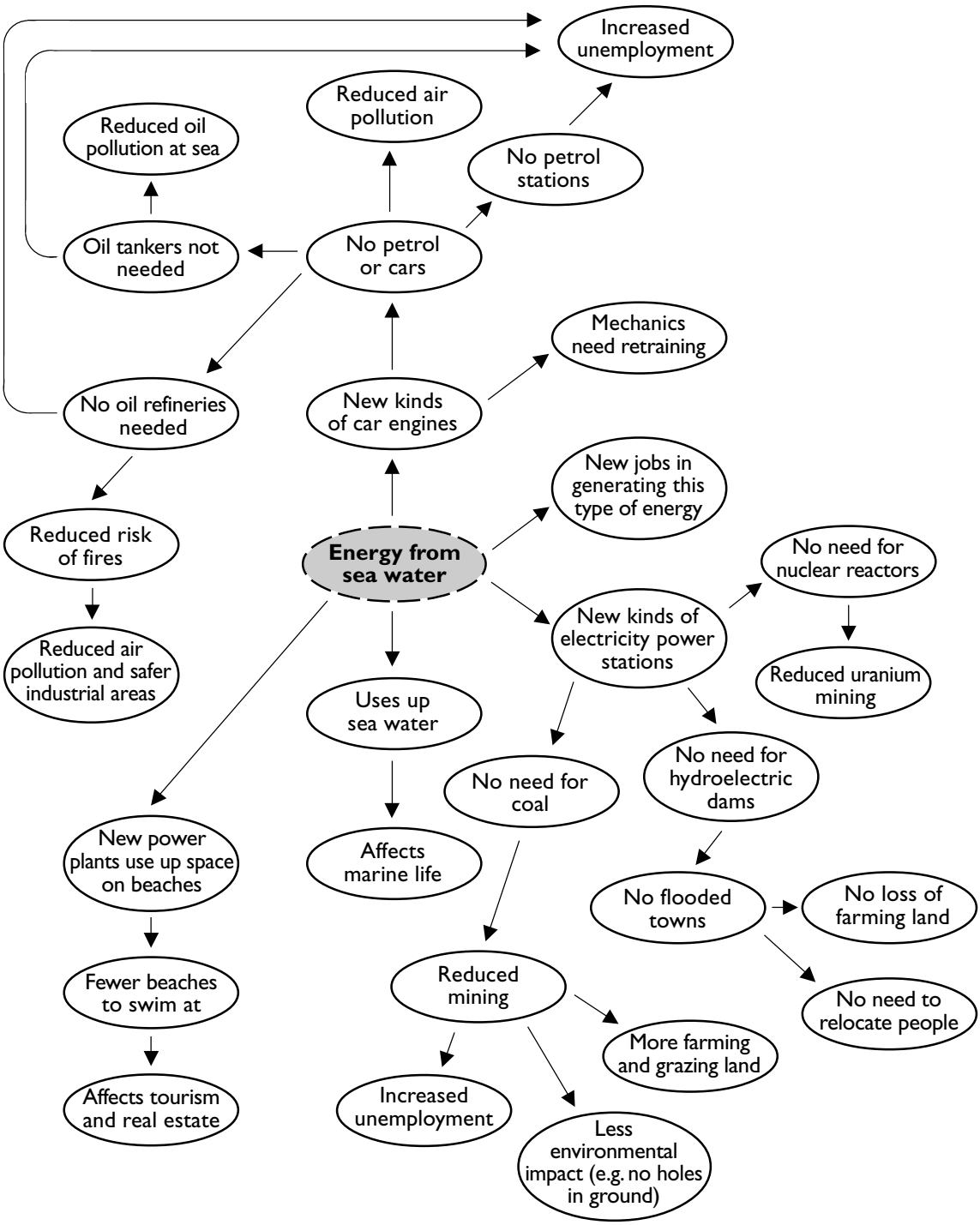
Bottles

Collect plastic soft-drink bottles of different sizes — 150 mL, 300 mL, 1000 mL, 1500 mL, 2000 mL. Tie a piece of string around the necks of the bottles so they can be suspended. A piece of wood is needed for a drumstick.



Futures wheel

A futures wheel is a diagrammatic representation of the consequences or results of an action or situation. The following example is based on the use of sea water as a source of energy.



Acknowledgments

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This sourcebook module should be read in conjunction with the following Queensland School Curriculum Council materials:

Years 1 to 10 Science Syllabus
Years 1 to 10 Science Sourcebook: Guidelines
Science Initial In-service Materials

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