School based activities

Simple machines, tools and gadgets

Background information: Activities 1-6

Machines can make it easier for us to do work. They can do this by allowing us to use a smaller force over a greater distance, changing the size of forces, changing the direction of forces, or by changing the speed at which something moves.

There are six types of simple machines:

- A **lever** consists of a rigid bar pivoted about a fulcrum. One example of a lever is a bottle opener.
- A **wheel and axle** consists of a wheel that rotates at the same rate as the axle that is connected to its centre. Examples include a door knob and a steering wheel of a car.
- A **pulley** consists of a wheel with a rope that can raise loads.
- An **inclined plane** is a sloping surface that can be used to raise a load. One example of an inclined plane is a ramp.
- A **wedge** is an object with two inclined planes. One example of a wedge is a knife blade.
- A **screw** is an inclined plane wrapped around a cylinder or cone. Examples of screws include cork screws, jam jar lids, nuts and bolts.

Work is done when:

- energy is transformed from one form to another, for example when you lift a brick from the floor to a table top you transform your chemical energy into the potential energy of the brick.
- a force moves something through a distance. For example, you do work when you push or drag a box across a floor. If, however, the box won't move when you push it, you do no work, even though you have pushed or pulled with the biggest force you could apply.

Force is a push or a pull.
Forces can alter the motion or shape of an object.

Weight is a type of force. It is the force of gravity that acts on an object. On the Earth it is equal to the mass (in kilograms) of the object multiplied by 10. It is measured in newtons. For example, a child whose mass is 30 kilograms has a weight of 300 newtons.

Friction is another type of force. It is the force that resists the motion of one surface across another surface. There are three basic types:

- static friction occurs when the surfaces aren't moving relative to each other
- sliding friction occurs when one surface slides across the other
- rolling friction is the friction between a wheel and the surface across which it is rolling. Rolling friction is much smaller than static and sliding friction.

Mechanical advantage (or force ratio): The ratio of the output force (load) of a machine to the input force (effort).

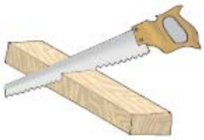
$$MA = \frac{load}{effort}$$

Activity 1: Written reports

Aim

Find out about how tools work or how they can be adapted to do special jobs or help people.

What to do



Carry out one of the following investigations and write a report.

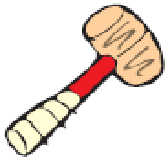
1. Design a tool

- Design a tool that does a specified task.
- Describe the simple machines that the tool makes use of. Your report should include a description of these simple machines, including how the mechanical advantage is calculated and a sample calculation.

2. Adapt a tool

- Write a report on how a common tool or household appliance can be adapted for elderly people or people who have a disability, for example arthritis. Here is a web site that has commercially available products: http://www.elderstore.net/default.aspx

3. Write a handbook



The handbook should include:

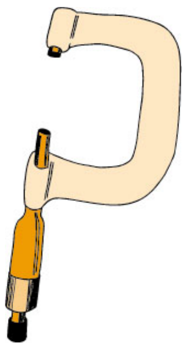
- The name of the tool
- Diagrams and pictures
- The simple machines that the tool makes use of
- A description of these simple machines, including how the mechanical advantage is calculated and a sample calculation
- Where the tool is used
- How the tool is operated.

The handbook could be published in print or as an e-book or website.

4. Interview a person with a disability

The write-up of the interview should include:

- The disability (for example arthritis)
- Problems that the person experiences because of the disability
- The ways in which everyday tools have been adapted to make them easier to use.



Activity 2: Build a force measurer

Aim

Build a device that can help you measure forces.

What you need

- Ruler or similar sized piece of wood
- Strip of paper or masking tape to run down the centre of the ruler
- Weights of uniform mass, for example school laboratory weights or marbles
- Drawing pin
- Paper clip
- Thin rubber band
- Piece of string about 30 cm long

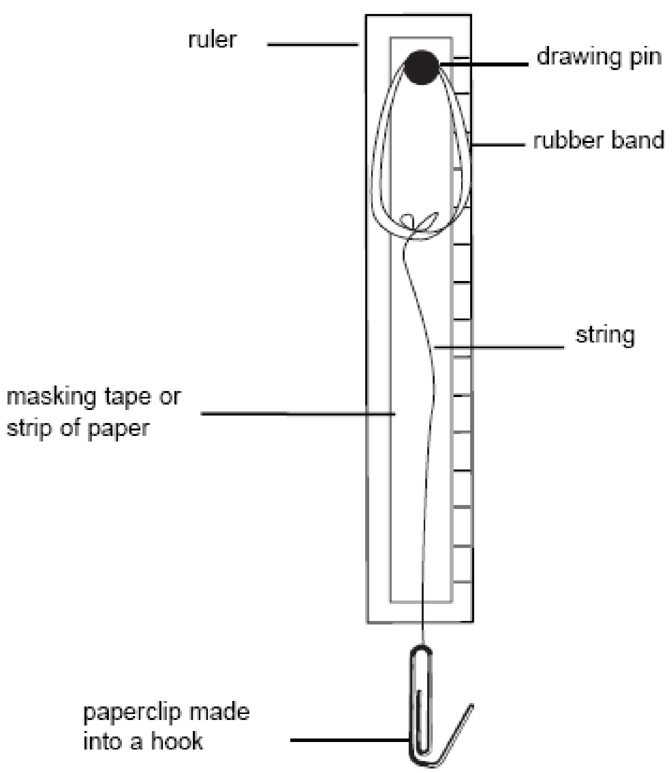
What to do

1. Stick the paper or masking tape along the length of the ruler.
2. Attach the rubber band to the end of the ruler using a drawing pin.
3. Tie one end of the string onto the rubber band and the other end of the string onto the paper clip (refer to the diagram below).
4. Bend the paperclip to make a hook.
5. Add weights onto the hook one at a time and mark on the paper (or the masking tape) the position the knot moves to as each weight is added.
   For example: If using a mass of 10 grams, the weight will pull the knot to a certain position.
   You will need to mark this position on the piece of paper (or masking tape) as 10 force units.
6. Prepare a table on your computer to record your results. Use a data projector to report your results to your class.

Optional

Draw a graph of force against distance for your force measurer. Plot the force on the horizontal axis and the amount the rubber band was stretched on the vertical axis.

Use the graph to find the force acting on different objects as they are lifted (the weight force) or pulled along.



Activity 3: Friction

Aim
Discover the effects that materials or surfaces have on the size of the force of friction acting on a book.

What you need
- Book
- Force measurers
- Digital camera to record your experiment.

What to do
1. Put the book on a horizontal surface and attach the force measurer.
2. Pull the book with the measurer until it starts to move. Note the force required to move the book.
3. Get the book moving at a steady speed and record the force needed to do this.
4. Put the book on straws and repeat steps 2 and 3.
5. Use images of your experiment to describe what you did to the class.

Questions
1. Comment on the size of the force needed to start the book moving and on the size of the force needed to keep the book moving at a constant speed.
2. What effect did the straws have on the force needed to get the book moving?
   Try moving the book across different surfaces.
3. Which surface provided the biggest force of friction?
4. Which surface gave the smallest force of friction?

Activity 4: Inclined planes

Aim
Make an inclined plane and use it to lift a book.

What you need
- Block of wood
- Book
- Drawing pin
- Force measurers
- Wooden plank
- Something to support one end of the plank
- Round straws

What to do
1. Make an inclined plane by resting the plank against the block of wood. Measure and record the angle that the plank makes with the floor.
2. Put the book on the plank and attach the force measurer.
3. Pull the book up the plane with the force measurer at a steady speed. Record the force (effort) required.
4. Put the book on straws and repeat steps 2 and 3. Record the force required.
5. Use the force measurer to measure the force you need to lift the block straight up.
6. Repeat steps 1-5 but this time change the angle of the plank.

Questions
1. How does the angle of the plane affect how easy it is to lift the block?
2. What effect do the straws have on the required effort?
3. (Optional) What is the mechanical advantage of your inclined plane?
4. Webquest: How did the ancient Egptians use inclined planes to build the Pyramids?

Activity 5: Getting into gear

Aim
Experience what it is like to be a tooth on a gear wheel.

Background information
Gears are toothed wheels that transfer energy between parts of a machine.
Gears can change the size of a force or the speed of a rotation.
If gears interlock, they change the direction of a rotation.
Mechanical advantage of gears:

$$MA = \frac{\text{load}}{\text{effort}}$$

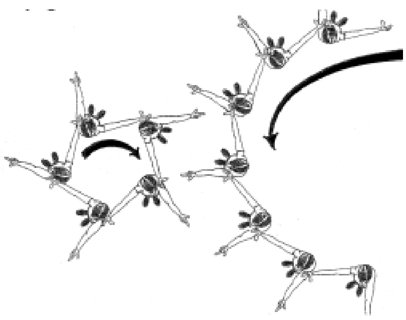
$$MA = \frac{\text{the number of teeth on the output gear}}{\text{the number of teeth on the input gear}}$$

What you need
- Rope or chalk to mark circles on the ground

What to do
Ask the students to:
1. Make a large circle of 15 or 20 students so that each person is facing the back of the person in front.
2. Instruct students to place their inside hand on the inside shoulder of the person in front. They then need to extend their outside arms to make the teeth (cogs) of a gear wheel.
3. Mark the circle on the ground with chalk or the rope. This marks the path the students are to follow.
4. Repeat these steps to make a small gear wheel with 5 students. Make sure the students are facing the correct way and that the two circles are close enough together so that one arm of one wheel will fit between two arms of the other wheel.
5. Ask the large gear wheel to walk slowly once around their circle. Make sure that each tooth fits between two teeth from the other wheel.
6. Try different numbers of teeth on each wheel, for example (16, 4), (10, 5), (10, 10) and so on.

Questions
1. How many times did the small wheel turn when the large wheel turned once?
2. What was it like being in either wheel?
3. In which direction did the wheels turn (clockwise/anticlockwise)?
4. How could you use gears to speed up or slow down a rotation?
5. Investigate the gear box of a car. Find out how many gears a car has.
6. Webquest: How do the gears on a bicycle work?

(From *'Getting into Gear',* Curriculum Corporation.)



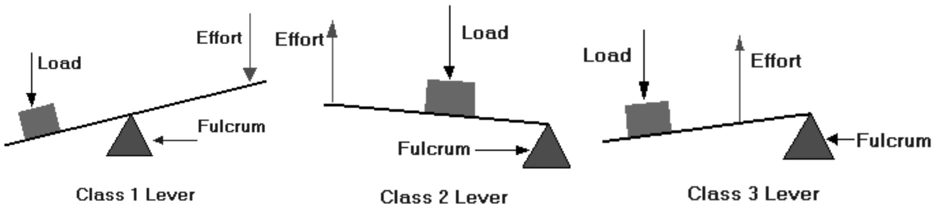
Activity 6: Levers around the house

Aim

Find out which appliances around your house use levers. Classify them into their classes.

Background information

Levers can be classified into three groups; first class, second class or third class.
First class levers have the fulcrum between the load and the effort.
Second class levers have the load between the fulcrum and the effort.
Third class levers have the effort between the fulcrum and the load.



What you need

- A wide range of household tools and implements that use levers.
  Use the Internet (Search: simple machines) to expand your list of implements.
  See, for example http://www.edheads.org/activities/lesson_plans/pdf/sm_04.pdf

What to do

1. Make up lists of the implements that have first, second and third class levers.

Questions

1. Describe how one implement from each list makes it easier to do work.
2. Draw a diagram of each of these implements and mark in the location of the fulcrum, load and effort.
3. Which implements increase the force you can apply?
4. Which implements increase the speed you can achieve?

Energy

Background information: Activities 7-11

- Energy is the ability of something to do work.
- Energy cannot be created nor destroyed, but it can be transformed from one form to another.
- Kinetic energy is due to an object's movement (from the Greek word *Kinema*, from which we also get the word cinema).
- Gravitational potential energy is due to the height of an object above some surface.
- Elastic potential energy is stored in springs or rubber bands.
- Sound is a form of energy that is caused by vibrating surfaces.
- Heat (thermal energy) is due to the movement or vibration of particles (atoms or molecules). The higher the temperature of an object, the faster the particles move or vibrate.
- Light is a form of radiant energy.
- Electrical energy is due to the movement of electricity.
- Chemical energy is due to the chemical reactions that can occur in the object. You contain chemical energy because of the food you ate, you can transform it to kinetic, potential, sound and heat when you walk up stairs. Batteries contain chemical energy and transform it to electrical energy.

Activity 7: Hair raising balloons (static electricity)

Aim
Create static electricity with this hair raising experiment.

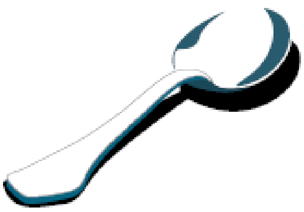
What you need
- A rubber balloon
- Small pieces of tissue paper

What to do
1. Blow up the balloon.
2. Rub it on your hair or jumper. Use it on a friend.
3. Try to pick up the small pieces of paper with your charged balloon.

Questions
1. Will the balloon stick to your hair?
2. Can you pick up pieces of paper with the balloon?
3. What else can you pick up with the balloon?
   (Visit the How Stuff Works website: http://science.howstuffworks.com/vdg1.htm).
4. What sorts of things use electricity in your homes or classrooms?

Activity 8: Reflections from a soup spoon (light)

Aim
Explore images produced by curved surfaces.



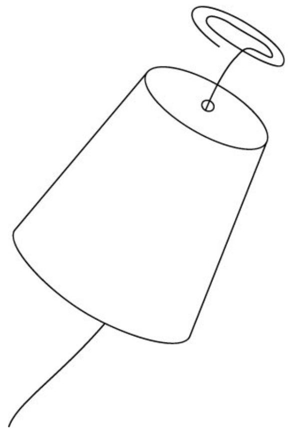
What you need
- A well polished soup spoon

What to do
1. Look at one side of the spoon and answer questions 1 to 3.
2. Turn the spoon around and answer questions 1 to 3.
3. Show what you have discovered to a friend.

Questions
1. Is your reflection upside down or right way up?
2. Is your reflection smaller or larger than your face?
3. What happens to the images as you move the spoon closer to your face from arms-length away?

Activity 9: Clucking hen (sound)

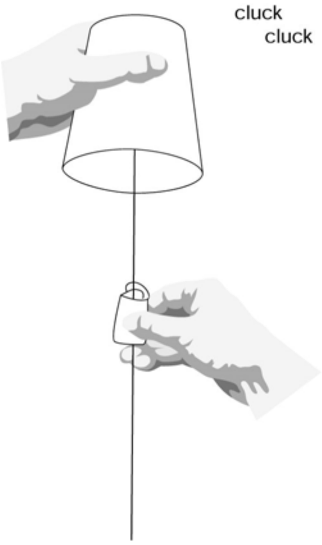
Aim
Make a noisy toy. Investigate how it produces sound.



What you need
- Plastic drinking cup
- Bamboo skewer
- Piece of string about one metre long
- Paperclip
- Wet piece of sponge or paper towel
- Decorations

What to do
Here is a noisy present for someone younger.
1. Poke a hole in the centre of the bottom of the cup.
2. Thread the string through the hole.
3. Tie a paperclip onto the end of the string. It will be inside the cup and stop the string coming out.
4. Decorate your cup to make it look like a hen.
5. To make your hen squawk, hold the cup by the bottom with one hand. Wrap the wet sponge around the string and pull down along the string. It should make a clucking noise.
6. Put some sugar in the cup and watch what happens when you pull down the string with the sponge.

Questions
1. What happened to the sugar?
2. How does the clucker make a sound?
3. How can you make the sound louder?
4. What does the cup do to the sound?
5. What energy transformations occur when you make the hen cluck?



Activity 10: Cooling effects of evaporation (heating and cooling)

Aim

Investigate the cooling effects of evaporating water.

What you need

- Empty drink can
- Cotton cloth
- Rubber bands
- Plate
- Thermometer
- Electric fan
- Water
- Digital camera to record each step in your experiment

What to do

1. Wrap the cotton cloth around the can, hold it in place with the rubber bands.
2. Stand the can on the plate.
3. Wet the material by adding water to the plate (observe the capillary action that forces the water up the material.)
4. Place the thermometer in the can.
5. Blow air across the can using the fan.
6. Record the temperature inside the can every minute for ten minutes.
7. Use your computer to plot a graph of how the temperature inside the can changed with time.
8. Use PowerPoint to describe your experiment and findings to your class.

Questions

1. What happened to the temperature inside the can?
2. Suggest a reason why the temperature did this.
3. Describe how you feel on a hot windy day when you get out of a swimming pool.
4. Where does the energy needed to change water from a liquid into a gas come from?

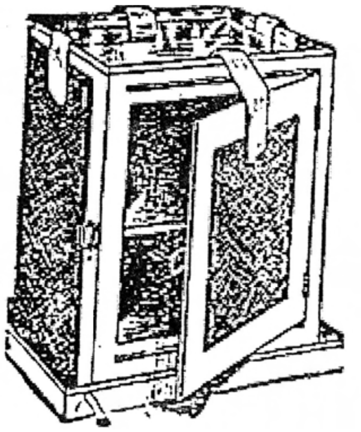
Activity 11: Make a coolgardie safe (heating and cooling)

Aim

Make a model Coolgardie safe that keeps things cool in hot weather.

What you need

- Washed milk carton
- Rubber bands
- Scissors
- Hessian material
- Strips of cloth
- Stapler
- Sticky tape
- Thermometer
- Electric fan (optional)
- Water

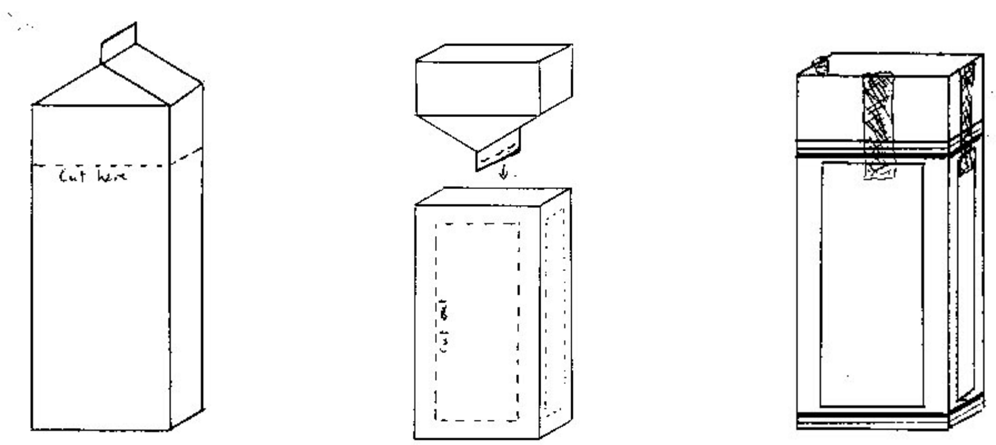


What to do

1. Research 'Coolgardie Safe' on the Intenet. The Aussie Things website has a description and image: http://www.aussiethings.biz/coolgardie_safe.html
2. Cut the top from the carton at about 2 cm below the base of the sloping bit.
3. Staple the top, seal with sticky tape.
4. Cut 5cm x 10cm rectangles from each side of the carton.
5. Wrap a 30cm x 12cm rectangle of hessian around the sides, hold in place with rubber bands or staples.
6. Invert the top and sit it in the top of the safe.
7. Fill the top tray with water, use strips of cloth to draw water onto the hessian.
8. Test the safe, using the fan and thermometer (see previous activity).

Questions

1. Describe what happens to the temperature inside the safe when air flows around it.
2. Describe the process that causes the temperature to do this.
3. Where does the energy needed to change water from a liquid into a gas come from?



Kitchen chemistry

Background information: Activities 12-20

What are chemicals?
Everything around us is a chemical. In the popular press, the word 'chemical' is mostly used to describe chemicals which are made in laboratories and which have some harmful properties. In fact, everything including the air we breathe, the food we eat, the plants and animals in our garden and even ourselves are made up of chemicals. Scientists now know the atoms and molecules that make up the chemical structure of just about all matter. So all matter is a chemical, or a mixture of chemicals.
For example, here are some of the chemicals in milk:
water, fat, casein, lactose, vitamin A, riboflavin, thiamine, ascorbic acid, vitamin B12, vitamin D, nicotinic acid, pantothenic acid, pyridoxine, biotin, folic acid, inositol, chlorine, calcium, phosphorus and iron.

Safety
Kitchen chemistry provides an excellent opportunity to discuss and develop safe work practices with children. Depending on the age of the children, you can gradually develop their awareness of potential hazards and co-operatively work out strategies for both making the potential hazard safer and dealing with accidents that may occur.
Things to remember:
1. Try identifying potential hazards at the beginning of each session and remember safe practices which will minimise the hazard.
2. Remember that some hazards are invisible, such as hot metal, clear liquids.
3. Reactions that produce gases should not be done in tightly sealed containers.
4. Never use our sense of taste (except when cooking).
5. Measure out only the required quantities for each activity. Children have a natural curiosity about making it bigger and 'better'.
6. Dilute liquids as much as possible (for example 50/50 vinegar and water works as well as pure vinegar for most activities).
7. All of the chemicals used in these activities are not dangerous if used properly. However, to a certain extent all the chemicals used in these activities could be potentially hazardous if used incorrectly. For example, vinegar is an acid and can sting your eyes, and soap is a base and can also sting your eyes.

Solids, liquids and gases
Most people know if something is a solid, liquid or a gas - but have difficulty describing what they mean. For example you could say that a liquid can be poured - but what about sand?
A solid is usually defined as something that holds its own shape.
A liquid is usually defined as something that has a fixed volume and assumes the shape of the container without necessarily filling it.
A gas is usually defined as something that expands to completely fill its container.
Heating can cause a solid to melt and become a liquid.
Heating can cause a liquid to evaporate and become a gas.
Cooling can cause a gas to condense and become a liquid.
Cooling can cause a liquid to freeze and become a solid.
When a solid turns into a liquid it expands slightly. When a liquid turns into a gas it expands enormously (about 700 times). This principle is used to propel rockets. Conversely, when a gas turns into a liquid it shrinks enormously and when a liquid turns into a solid it shrinks a little.

Activity 12: Ice block and toothpick

Aim
Pick up an ice cube using a toothpick.

Background information
The ice block and the toothpick freeze together. First the salt decreases the freezing temperature of water and the ice melts. Heat is required to melt the ice. This heat is taken from the moisture under the toothpick that has not come into contact with the salt, and so it refreezes.

What you need
- An ice cube
- Salt
- A toothpick

What to do
1. Put the toothpick on the ice cube. Scatter salt over the top without moving it.
2. Wait a few seconds, then slowly and gently pick up the toothpick.

Questions
1. Describe what happens to the toothpick and the ice.
2. Why do you think this happens?
3. Why do you think salt is sometimes scattered on icy roads?

Activity 13: Ice and water

Aim
Discover if frozen water expands or contracts when it melts.

Background information
The water does not overflow when the ice melts. Water increases its volume (1/11th) when it freezes. When the ice melts, the volume of the resulting water is less. The water produced takes up less space than the ice cube.

What you need
- A glass of water
- Ice cubes

What to do
1. Put three ice cubes in a glass and fill with water until it is just about to overflow.
2. Leave the glass for 20 minutes and observe what happens to the ice and the water level in the glass.

Questions
1. What happens as the ice melts?
2. Does the water overflow?
3. Does frozen water take up more or less space than liquid water?
4. Why do full glass bottles sometimes explode when they are put in the freezer?

Activity 14: Chocolate crackles (states of matter)

Aim
Study changes in the states of matter and eat the results!

Background information
One of the main ingredients in chocolate crackles is copha. When copha is heated it melts and when cooled it goes back to being the same as it was. This is called a physical change.

What you need
- Chocolate crackle recipe
- A large bowl
- Paper patty pans
- A large spoon
- Access to a refrigerator

What to do
Follow the recipe to make the chocolate crackles. Put them in a refrigerator to set. Eat the chocolate crackles!

Chocolate Crackle recipe

Ingredients
4 cups Rice Bubbles
1 block Copha
1 cup icing sugar
3 tablespoons cocoa
1 cup desiccated coconut

Method
1 Melt the Copha in a saucepan or in the microwave oven.
2 Mix all the other ingredients with the melted Copha in a large bowl.
3 Spoon into patty pans. (Makes about 24)
4 Put the chocolate crackles into a refrigerator to set.

Questions
Circle the correct answer for questions 1-3.

1. At room temperature, copha is a **Solid** **Liquid** **Gas**
2. When copha is heated, it becomes a **Solid** **Liquid** **Gas**
3. When warm copha is cooled it becomes a **Solid** **Liquid** **Gas**
4. What do you think would happen to chocolate crackles on a very hot day?

   ____

5. Chocolate crackles taste really good. **yes** **no**

Activity 15: Make a lava lamp (density of liquids)

Aim
Make a model of a lava lamp that does not need electricity.

Background information
The oil does not mix with the water so we have two separate layers. The oil is lighter (less dense) so it floats on top of the water. Salt is heavier than water and oil, so it sinks, taking some of the oil with it. When it gets to the water layer the salt dissolves and the oil is released and it floats back to the oil layer.

What you need
- A glass jar or clean glass
- Vegetable oil
- Salt
- Water
- Food colouring (optional)

What to do
1. Use the Internet to research 'lava lamps'.
2. Put a few centimetres of water into the jar.
3. Add about 1/3 of a cup of oil. Observe what happens to the oil and water.
4. Add a drop of food colouring if you want. Observe what happens to the food colouring.
5. Shake some salt onto the top of the oil, count to five and watch your lava move.
6. Demonstrate your lava lamp to your class, describing how it works.

Questions
1. Which is less dense, water or oil?
2. Describe what happened when you sprinkled salt into the jar.
3. What happens to the salt when it enters the water layer?
4. Could you keep adding salt to the jar indefinitely and expect the effect to continue?

Activity 16: Cabbage indicator (acids and bases)

Aim

Make an indicator and use it tp test liquids to see if they are acid, base or neutral.

Background information

Liquids and solids we find in our house can be tested to find out if they are acids or bases. We can do this using a liquid indicator that turns red in acids and blue or green in bases. Red cabbage can be used to make one of these indicators.
Safety Hints:
Be careful with sharp knives and boiling water.
You can add alcohol or methylated spirits to preserve the indicator using a 1:5 ratio of alcohol to water. It can also be frozen.

What you need

- Red cabbage
- Knife and chopping board
- Boiling water
- Two jugs
- Strainer
- Cups for testing (glasses are OK for edible things, otherwise try clear plastic disposable ones)
- Things from the kitchen (or bathroom) to test: lemon juice, vinegar, soft drink, milk, baking soda, soap, detergent

What to do

1. Cut up about one cup of cabbage and place it in a jug.
2. Add 1-2 cups of boiling water and allow to stand for about 5 minutes.
3. Strain the liquid from the cabbage into the other jug.
4. List the products to be tested in the table below.
5. Guess whether the product is an acid or base before testing it.
6. Put a little of the products to be tested into each of the cups.
7. Add some of the cabbage water to each and look for the colour change.
8. Record whether they are an acid or base as determined by the indicator.
9. Copy the table below to your computer and fill it in.
   Use the table to report the results of your experiment to your class.

Questions

1. What is an acid - base indicator?
2. Why do you think these indicators might be useful?

	Product to be tested	My guess (acid or base)	acid/base
1			
2			
3			
4			
5			
6			

Activity 17: Fizzy sherbet (acids and bases)

Aim

Make your own yummy fizzy sherbet to eat!

Background information

The food acid gives the icing sugar a tangy sensation. When the bicarbonate of soda is added, this reacts with the acid to give little bubbles of carbon dioxide, which makes the sherbet fizzy.
The BBC provides more information: http://www.bbc.co.uk/dna/h2g2/A4175228

Safety hints:
Don't eat too much! It will make you burp!

What you need

- Twenty parts icing sugar
- One part food acid, tartaric or citric
- One part bicarbonate of soda (baking soda)
- Flavouring and colouring (optional)

What to do

1. In a bowl, place five tablespoons of icing sugar.
2. Add one teaspoon of food acid and one teaspoon of bicarbonate of soda.
3. Mix them together and add some flavouring if you like.

Questions

1. Why doesn't the sherbert fizz when you first mix it?
2. Why does the fizzy sherbert fizz inside your mouth?
3. What gas is formed when the chemicals react?

Activity 18: Bath salts

Background information

Washing soda is sodium carbonate. Its chemical formula is Na_2CO_3. When crystals of sodium carbonate form, they incorporate 10 water molecules in their structure, So washing soda is actually sodium carbonate decahydrate ($Na_2CO_310H_20$). One of the common household uses of washing soda is to 'soften' water. In Melbourne our water is not 'hard', so it is not necessary to use washing soda to 'soften' the water. Hard water does not allow soap to froth well. For areas where the water is hard, washing soda can be added to allow soap to form a good froth. Synthetic detergents will usually froth up even in hard water.

Washing soda is also used by some people to soothe tired muscles or aching limbs. The scientific explanation of how this works is unclear.

In industry, sodium carbonate is used in the manufacture of glass, soaps and detergents, in the processing of wood pulp and in the refining of aluminium.

Safety note

Treat the crystals like soap. Keep them away from the eyes. They will cause stinging to the eyes or open cuts. Wash hands after use. Only use about half a cup to a bath full of water.

Hints and tips

Pure essential oils are quite expensive. Cheaper oils for classroom use can be purchased from '$2 shops' or similar. Do not use too much colour. Err on the side of too little, then adjust the colour later. Discuss with students whether certain colours go with certain scents. What would happen if they used 'inappropriate' colours (eg yellow with lavender).

Package this up as a present in a glass jar that can be decorated by painting, sticking on dried flowers or shells and/or making a fabric cover for the lid. Try layering two different colours.

If the bath salts are to be used as a present, ask students to write a procedural text to accompany them. Include instructions for quantities to use, safety instructions and a use by date. The use by date is important, because bath salts tend to lose moisture and become damp. After about six months, the jar of crystals may appear half full of water. A use by date about two months after packaging is suggested.

Activity 18: Bath salts (continued)

Aim
Make your own bath salts.

What you need
- Washing soda
- Food colouring
- Essential oil (eg. lavender, rose geranium, eucalyptus)
- Mixing bowl
- Jars for packing
- Decoration (optional)
- Digital camera to record each step in your experiment

What to do
1. Measure out a cup of washing soda.
2. Place in a bowl or plastic bag for mixing.
3. Add essential oils and colours. Mix well.
4. Transfer to the jar and seal tightly.
5. Use an indicator (for example red cabbage indicator) to see whether bath salts are acidic or basic.
6. Package the salts up for a present. Include instructions on how to use bath salts as part of the present.
7. Use PowerPoint and the images you have taken to tell your class how to make bath salts.

Question
Think about what colours go with what oil scents. Are there appropriate and inappropriate colours?

Activity 19: Bubble mix

Aim
Make your own bubble mix.

Background information
Bubbles are held together through surface tension. Water molecules at the surface of water are more attracted to each other than the air. When water molecules are 'stuck' together like this, it is difficult for bubbles to form. The detergent reduces the forces between water molecules and 'breaks' the surface tension. The soapy film of a bubble is very elastic and can therefore expand without breaking.

Additional information is available from Exploratorium:
http://www.exploratorium.edu/ronh/bubbles/bubbles.html

Safety Hints
Bubble mix may sting eyes.

What you need
- One part dish-washing detergent
- Five parts water
- ½ part glycerine (or glycerol available from pharmacies)
- String or wool
- Two straws
- Large container
- Things to make bubbles with (wands, things with holes, etc.)

What to do
1. Mix all ingredients together in a bowl.
2. Try to make different shaped bubbles using a variety of kitchen utensils. Remember don't throw away your bubble mix – it actually gets better with age, so put it somewhere safe (with a label) and come back to it another time.
3. When making bubble-mix you can experiment with your ingredients – because mixtures can perform differently for different people in different places.
4. Organise a competition with your classmates to see who can do the best bubble demonstration.

Questions
1. How big was the biggest bubble?
2. What was the longest time that a bubble lasted before it burst?
3. What colours could you see in the bubble?

Activity 20: Dancing currants

Background information

The surface of the currants is naturally hydrophobic, or water hating. The currants 'want' to get away from the water. Gas bubbles surround them so that their surface is less exposed to the water. When enough gas bubbles are attached they float to the surface. At the surface, the bubbles burst and the currants fall down. The cycle is repeated. If you add detergent to the mixture, it alters the surface of the currants. They become water loving and the bubbles no longer stick to their surface.

What you need

- Soda water
- Currants
- Glass jar
- Spoon
- Water
- Dish washing detergent

What to do

1. Almost fill the jar with soda water.
2. Add a handful of currants. (At first the currants will sink to the bottom of the jar, however after a short moment, each will rise to the surface – but they will not stay there! The currants will continue to sink to the bottom and rise again for hours.)

Questions

1. Observe what happens to the currants for a couple of minutes and record your observations.
2. Why did the currants rise to the surface?
3. Why did they fall to the bottom again?

Optional

- There are quite a few other objects that will work. Try using mothballs, cooked rice or even spaghetti and add food dye for colour effects.
- After a while, you can try adding a small amount of detergent and watch what happens. (The objects will sink to the bottom).
- Use your computer to make a table showing objects that dance and objects that don’t dance. Describe your results to your class.

Living Things

Activities 21-23

Activity 21: From minibeasts to arthropods

Background information

Minibeasts is a useful term often used to describe the small creatures found in the environment. In this exercise students are introduced to the way we scientifically classify the large group of minibeasts known as arthropods.

What you need

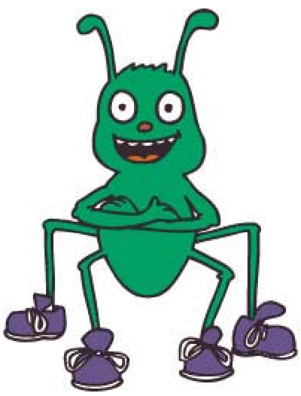
- Images of 'minibeasts' (invertebrates).
  These can be obtained from magazines, or from the Internet – search for 'Invertebrates', then Images.
- Scissors

What to do

1. Ask the students to brainstorm as many things as they can about minibeasts and list their responses.
2. Ask the students to collect lots of pictures of different minibeasts. You could then ask them to decide on ways to group the pictures. Each group should report back to the class on the criteria they used for grouping the pictures.
3. Explain that grouping or classifying things is an essential part of the work that scientists do, and that over many years scientists have developed specific criteria for the way they group animals and other things in the world. One thing scientists look at is the number of legs that an animal has. Ask the students to count the number of legs on the animals in their pictures.
4. Students could then re-group their animal pictures according to the leg numbers.

For example:

animals with no legs (slugs, worms, etc.)
animals with six legs (beetles, dragonflies, cockroaches, wasps, bees, etc.)
animals with eight legs (ticks, spiders, scorpions, etc.)
animals with more than eight legs (millipedes, centipedes, slaters, etc.)



Activity 22: Arthropods

Background information

Explain that scientists look at the type of skeleton animals have to help classify them. Hard external skeletons, called exoskeletons, are found in many animals including cockroaches, cicadas, ants, flies, grasshoppers, spiders, scorpions and lobsters.
A hard exoskeleton is one characteristic of an arthropod.

What you need

Pictures of minibeasts from Activity 21
Table that summarises how to classify arthropods (located at the bottom of this page)

What to do

1. Ask the students to re-examine their pictures and find the animals with an exoskeleton. Discard any pictures that do not fit this criterion. Explain that animals which have both an exoskeleton and jointed legs are called arthropods.
2. Arthropods can be further divided into four smaller classes based on the numbers of legs, antennae and body parts they have. Ask the students to count the numbers of legs which the different arthropods in their pictures have. They could then group the pictures as follows:
   Animals with six legs such as beetles, dragonflies, cockroaches, wasps, bees, are insects;
   Animals with eight legs, known as arachnids, include spiders, scorpions and ticks;
   Animals with more than eight legs such as millipedes, centipedes and slaters belong to the remaining two arthropod classes – crustaceans and myriapods.
3. The scientific criteria used for classifying arthropods is based on the number of legs, antennae and body parts that they have. Ask the students to classify their minibeasts even further by using the table below.

   As an alternative, students could classify their images using their computers. Prepare a page for each of the four arthropod classes (below), with a title and description at the top of each page. Download, classify and paste images of arthropods onto each page from the Internet (search 'arthropods', then images).

Arthropod classes	Number of legs	Number of antennae	Number of body parts	Some examples
Insects	6 (3 pairs)	Two (1 pair)	Three (head, thorax, abdomen)	Ants, bees, wasps, flies, beetles, praying mantids, cockroaches, dragonflies, cicadas, fleas, moths
Arachnids	8 (4 pairs)	None	Two (cephalothorax, abdomen)	Spiders, scorpions, ticks, mites
Crustaceans	Variable: 8 or more	Four (2 pairs)	Variable	Prawns, crabs, shrimp, crayfish, lobsters, slaters
Myriapods	Variable: 18 or more	Two (1 pair)	Two (head, segmented trunk)	Centipedes, millipedes

For more details refer to the following web sites:
http://museumvictoria.com.au/spidersparlour/ed1.htm
http://museumvictoria.com.au/bugs/aboutbugs/index.aspx

Activity 23: Do you have 'Spiderphobia'?

Background information

Phobias are unreasonable fears which cause distress and adversely affect people's lives. Research suggests that phobias and fears can be reduced by becoming more familiar with what you are frightened of and learning more about it.

Find out how many of your class members are 'spiderphobic' by asking them to answer true or false to the questions on the following questionnaire.

What you need

- A copy of the questionnaire for each student
- A pen or pencil for each student
- A Spiderphobia Scoresheet

What to do

1. Ask your students to fill in the Spiderphobia questionnaire by rating each question with a true or false.
2. Ask them to use the score sheet to get an overall score.
3. Give them their Spider Fear Rating (below).
4. Collate the scores of the class.
5. Calculate the average score for the class.
6. Compare this score to the Spider Fear Rating averages.

Your Spider Fear Rating

Score	Rating
0-8 **(average score = 3.1)**	Not spider fearful
8-18 **(average score = 14)**	Spider fearful
18-31 **(average score = 21.9)**	Spider phobic

'Spiderphobia' questionnaire

Instructions

1. Read each statement below.
2. Decide whether true or false best represents your feelings.
3. Put a cross under true or false on the **scoresheet.**
4. Work quickly and answer every question. It is important that you give your first impressions on this questionnaire.

Questions

1. I am cautious in gardens because there may be spiders about.
2. I would feel some anxiety holding a toy spider in my hand.
3. If a picture of a spider crawling on a person appears on the screen during a movie, I turn my head away.
4. I dislike looking at pictures of spiders in a magazine.
5. If there is a spider on the ceiling over my bed, I cannot go to sleep unless someone kills it for me.
6. I enjoy watching spiders build webs.
7. I am terrified by the thought of touching a harmless spider.
8. If someone says that there are spiders anywhere about, I become alert and on edge.
9. I would not go to the shed to get something if I thought there might be spiders down there.
10. I would feel uncomfortable if a spider crawled out of my shoe as I was about to put it on.
11. When I see a spider, I feel tense and restless.
12. I enjoy reading articles about spiders.
13. I feel sick when I see a spider.
14. Spiders are sometimes useful.
15. I shudder when I think of spiders.
16. Some spiders are very attractive to look at.
17. I don't believe anyone could hold a spider without some fear.
18. The way spiders move is repulsive.
19. It wouldn't bother me to touch a dead spider with a long stick.
20. If I came upon a spider while cleaning I would probably run.
21. I am more afraid of spiders than of any other animal.
22. I would not want to travel to Central America because of the greater prevalence of tarantulas.
23. I avoid going on camping trips because there may be spiders about.
24. I have no fear of non-poisonous spiders.
25. I wouldn't take a course in biology if I thought I might have to handle live spiders.
26. Spider webs are very artistic.
27. I think that I am no more afraid of spiders than the average person.
28. I would prefer not to finish a story if something about spiders was introduced into the plot.
29. Even if I was late for a very important appointment, the thought of spiders would stop me from taking a shortcut through an underpass.
30. Not only am I afraid of spiders, but millipedes and caterpillars make me feel anxious.

When you have finished answering all the questions, unfold your scoresheet, add up your score and check your spider fear rating.

'Spiderphobia' Scoresheet

1. **Fold this scoresheet in half so you can't see the key.**
2. Put a cross under **true or false** in response to the thirty statements, then unfold this scoresheet to work out your score.

No.	True	False	Key	Your Score
1			true = 1	
2			true = 1	
3			true = 1	
4			true = 1	
5			true = 1	
6			**false** = 1	
7			true = 1	
8			true = 1	
9			true = 1	
10			true = 1	
11			true = 1	
12			**false** = 1	
13			true = 1	
14			**false** = 1	
15			true = 1	
16			**false** = 1	
17			true = 1	
18			true = 1	
19			**false** = 1	
20			true = 1	
21			true = 1	
22			true = 1	
23			true = 1	
24			**false** = 1	
25			true = 1	
26			**false** = 1	
27			**false** = 1	
28			true = 1	
29			true = 1	
30			true = 1	
Total				