Fonterra Science Roadshow

2009

Programme
We have produced this comprehensive resource of activities to better enable teachers to plan and incorporate ‘The Fonterra Science Roadshow visit’ into student learning programmes. The over-riding objective is to enhance the learning outcomes of students.

We would also like to draw your attention to The Building Science Concepts series produced by the Ministry of Education that will further extend your students on many of the topics covered by the Roadshow.

**Included within this resource are:**

a) Language and science activity based resources that explore six exhibit Themes within the 2009 Fonterra Science Roadshow.

**Suggested usage:**

1. Pre-visit activities (language based)
2. Visit to Roadshow (exhibit use and demonstrations)
3. Post-visit activities (practical science, activity based)

b) A three stage Unit Plan on Sustainability:

- **Stage 1**
  - Pre-evaluation

- **Stage 2**
  - Visit to Roadshow

- **Stage 3**
  - Post-visit unit work (including unit evaluation)

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Making the most of learning opportunities during your visit to the Science Roadshow Programme

The Fonterra Science Roadshow aims to
• Generate enjoyment and enthusiasm for science and technology that can enhance your classroom programme.
• Increase students’ knowledge and skills over a range of topics from the New Zealand curriculum.
• Provide experiences in science and technology that are not generally available in the classroom.

Research tells us that
• The benefits from an educational visit are greatest when the visit forms an integral part of the classroom programme.
• The best learning outcomes for students are achieved when they are well prepared.
• Students’ learning is enhanced by opportunities for hands-on experience.
• The quantity and quality of students’ interactions with peers and adults has a significant effect on promoting students’ learning.
• Group work that includes discussion helps students to consolidate their learning.

What happens during your visit?
• You will be met outside the venue by a member of the Fonterra Science Roadshow team. (If at all possible please leave school bags at school or on the bus.)
• Your session begins with one of the fifteen minute demonstrations. During this time all students will be seated on the floor of the hall, possibly joining another group.
• Students will have approximately forty minutes to interact with the exhibits around the hall. (See exhibit details on pages 5 and 6).
• Roadshow staff will advise students when their exhibit time is over.
• Students will return to the demonstration area for the second fifteen minute demonstration. Your group may be joined by students from another group for this demonstration.
• Roadshow staff will direct your students to leave the hall at the end of the second demonstration.

Your role as a teacher
• Move amongst your students. Interact with them and help them to engage with the exhibits and talk with others. Emphasise that they should try and understand what the exhibits are showing.
• Remind adult helpers that the exploration and discussion process is more important for students’ learning than getting the ‘right’ answer (see next page).
• Please remember that classroom teachers remain responsible for their students’ behaviour at all times.

Theme emphasis
• Prior to your visit, you may wish to divide your class into six groups corresponding to the six exhibit Themes. Each group is responsible for reporting their understanding of 3–4 exhibits (selected from their Theme) back in class. Suggested ideas for reporting back:
  1. exhibit name, 2. what it looked like, 3. what it did, and 4. what science idea it demonstrated.
• Additional ideas: students take pen and paper for recording their selected exhibits; use digital camera or video camera to record selected exhibits for review back in class; do a project on the science behind one or more of the exhibits.
Hints for helpers

Thank you for helping students to learn during their school visit to the Fonterra Science Roadshow.

What is the Fonterra Science Roadshow?
The Fonterra Science Roadshow travels around the country teaching children about science and technology. At the Roadshow we like to give students opportunities and experiences that they would not usually have at school. On your visit you and the students will be able to experiment with at least 65 hands-on exhibits. You will also take part in two exciting demonstrations called *Sounding out waves* and the *Planet Earth show*.

How you can help students to get the most from their visit
• Encourage students to try things for themselves.
• Help students to read the information on exhibits.
• Talk to students about the exhibits.
• Ask students questions about what they are doing, for example:
  What do you think this is?
  How does it work?
  What can you find out from it?
• You might like to try asking a question, then:
  Pause (wait for an answer)...
  Prompt (give them a hint)...
  Praise (tell them they did well)...

How you can help the Fonterra Science Roadshow
The Roadshow team would love to know what you thought about your visit. At the end of your visit could you please take a few moments to answer the questions below and hand to one of the Roadshow staff.

Did you enjoy your visit to the Fonterra Science Roadshow? Yes/No

Did you think that the students have enjoyed their time? Yes/No

Did you learn anything from your visit? Yes/No

Did you think the students learnt anything from their visit? Yes/No

Did you think the visit was good value for money? Yes/No

Any other comments?

__________________________________________

__________________________________________

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Support for the New Zealand Curriculum (2007)
The Science Roadshow experience supports the New Zealand Curriculum at four levels, with respect to Principles, Values, Key Competencies and Specific Achievement Objects. The first three are outlined below, while Specific Achievement Objectives are covered within the Unit of Work found later in this booklet.

Principles
The Fonterra Science Roadshow experience embodies:
Inclusion: by recognising and affirming learning needs of all, through an array of sensory experiences
Learning: by giving opportunities for students to reflect on their own learning processes by free exploration of hands-on exhibits
Community engagement: by encouraging students to connect with real life experiences and activities in science research, technology, industry, the workplace and home
Coherence: by linking science-related experiences with language and communication, technology, careers and real life experiences
Future focus: by encouraging students to look at future-focused issues relating to science and technology, innovation, medicine and communications.

Values
The Fonterra Science Roadshow embodies:
Excellence: through perseverance to find the answer and to understand how things work
Innovation, enquiry and curiosity: by students thinking critically and creatively about ideas presented in demonstrations, and reflectively about how and why exhibits work
Equity: through access for all to an interactive experience
Participation: through encouragement of students by Roadshow Presenters, teachers and parents and by the feedback offered by interactive exhibits
Ecological sustainability: through specific exhibit thematic(s) (depending on the year) and wherever possible, environmentally friendly administrative and operational practices
Integrity: through respect for others by listening, sharing and waiting their turn.

Key competencies
All five key competencies are well supported by the Fonterra Science Roadshow experience; namely:
Thinking: by reflecting on demonstrations and about how and why exhibits work and their relevance to everyday life
Using language, symbols and texts: by student involvement with Roadshow Presenters, Explainers, peers and with self-guided interactive exhibits
Managing self: students decide who to work alongside, which exhibits to interact with and for how long
Relating to others: by students working alongside and communicating with other students, teachers, parents, Roadshow Presenters and Explainers as they interact with exhibits and during demonstrations
Participating and contributing: students participate and contribute to demonstrations, and interact enthusiastically with exhibits.

Fonterra Science Roadshow Exhibits

Each year we identify six conceptual Themes under which we group our exhibits. By ensuring that exhibits fit within a particular Theme we are able to provide a number of experiences that build on each other, ensuring students have the greatest opportunity to expand their knowledge base.

The following notes highlight the concepts that are covered within each of these Themes and may help you to focus pre- and post-Roadshow visit activities and educational opportunities for your students.

Although our primary focus is on objectives from the science curriculum, the exhibits also contribute across most other curriculum areas, particularly by providing students with opportunities to engage with others, to discuss what they are doing, and work co-operatively on a range of experiences not normally available to them within the school environment.

Themes

Astronomy Te mātauranga tātai arangi
Exhibits in this theme address specific learning outcomes relating to the following: sunrise is the result of the Earth's rotation; if the distance between you and a light source doubles, the strength of light is ¼; the seasons are due to the Earth's tilt on its axis; a black hole has a huge gravitational pull; patterns of stars make up constellations; tides are caused by the moon; the larger a planet, the stronger its gravity; weather is caused by turbulence in the atmosphere due to the Earth's spin. Exhibits include:

- Black hole
- Brightness
- Constellations
- Ebb and flow
- Ellipses
- Moire Patterns
- Planetary weights
- Sunrise
- The Seasons
- Turbulent planet

Contexts
Astronomy, Space, Space travel, The Universe.

This theme links with the following key resources from Learning Media: Building Science Concepts Book 8 The Moon, Book 20 Our Star, the Sun, Book 27 Exploring Space and Book 28 The Night Sky.

Gravity Te tū-ā-papa
Exhibits in this theme address specific learning outcomes relating to the following: the force due to gravity; buoyancy is related to density; spinning objects have a form of artificial 'gravity' due to centrifugal forces; gravitational potential energy and how it is transformed into kinetic energy; and, the path that a falling object takes does not affect how quickly it reaches the ground. Exhibits include:

- Balancing Pins
- Bowling Ball Piston
- Buoyancy
- Chain Siphon
- Impact Point
- Local Gravity
- Potential Energy
- Roller Can
- Rotating Chair
- What Weighs What?

Contexts
Earth science, Space; Movement and forces, Forces around us, Space travel.

This theme links with the following key resources from Learning Media: Building Science Concepts Book 17 Flight, Book 34 Parachutes, Book 37 Floating and Sinkin, Book 38 Understanding Buoyancy and Book 51 Standing up.

How Things Work He pēhea te māhi o ngā hanga o te ao
Exhibits in this theme address specific learning outcomes relating to the following: a gearbox is used to 'increase' turning force or speed, or reverse the direction of travel; how a lock works; how a centrifugal pump works; the differences between a two and four stroke engine; how a differential works; unequal forces are used by a yacht's sail; a wind generator converts wind energy into electricity; how a clutch works; examples of aquaculture; and, how a toilet and cistern work. Exhibits include:

- 2 and 4 Stroke Engines
- Aquaculture Exhibits
- Gear Box
- Lock and Key

• Awesome Augers
• Centrifugal Pump
• Clutch
• Differential
• Sailing Away
• Steering Wheel & Brakes
• Toilet
• Wind Generator 2

Contexts
Our car, Machine, Energy transfer, Transportation.

Investigating Life  Te tūhura i te koiora
Exhibits in this theme address specific learning outcomes relating to the following: healthy eating; how much of our bodies are water and fat; how much calcium we should have in our bones; how much fat certain foods contain; heart beat rates with exercise; our predicted adult heights; how a cow makes milk; food web interactions; plant variety at the microscopic level; types of milk; different animal footprints show design for a purpose; x-rays reveal details of bones and joints. Exhibits include:
• Balancing Joule Intake
• Body Analyser
• Body X-Rays
• Calcium in Bones
• Compost Worms
• Fat in Food
• Footprints
• Heart Monitor
• Height Predictor
• Milking
• Pollinators, Partners & Pests
• Plant Diversity
• Size of Servings
• Sugars in Foods
• Types of Milk

Contexts
Our back yard, The web of life, My body, Healthy Body, Food and Health.

Light Reflections  Ngā whakaatatanga aho
Exhibits in this theme address specific learning outcomes relating to the following: reflections are symmetrical because angles of reflection equal angles of incidence; mirrors create reverse images; curved reflectors distort images and can make them larger or smaller; lasers produce narrow, intense beams of light that can be reflected around corners; periscopes can be used to view around corners; multiple reflections are created inside a kaleidoscope; and, reflection illusions. Exhibits include:
• Angles and Images
• Flexible Mirror
• Giant Kaleidoscope
• Laser Zig-Zag
• Magic Cylinder Picture
• Periscope
• Silvered Mirror
• Spherical Reflectors
• Symmetry
• Three Corner Reflector

Contexts
Light, Is seeing believing?, Reflections, How things work, Simple technology.

Measurement  Te inenga
Exhibits in this theme address specific learning outcomes relating to the following: estimating quantities and distances; measuring forces; using a Vernier scale; estimating lengths, areas and volumes; converting decimal numbers to binary numbers; measuring fibre strength; using different devices to measure distance; how big is the number 1,000,000; and, density of objects? Exhibits include:
• Age of Living Things
• Bendy Beams
• Binary Numbers
• Briefcase of Money
• Digital Calculator
• Estimating Sizes
• Linear Measurement
• M&Ms
• Million Book
• Tensile Testing
• Vernier
• Walking Measure
• What Weighs What?

Contexts
Investigating Life
Web of Life
Prey, insects, decomposers, fly, nectar, pollinate, fungi, plants, oxygen.
Recycling.

Comparing Milk with other Drinks
1. Milk.
2. Milk.
3. Milk.
4a. Not milk.
4b. Sugar.
5. Usually milk.
6. Milk (especially Anchor Super Blue)

Extension

Gravity
Gravity crossword
ACROSS: ramps, pressure, fall, cork, accelerates, fly, weight, pull, mass, floats, erosion. DOWN: stronger, forces, gravity, navel, triangle, arches, Jupiter, scales, balance.

Meteorite craters
1a. Becomes deeper.
1b. Becomes wider.
1c. Flour is splattered more widely.
2. Yes.
3. The hole is oval and the splatter is all away from the direction of the impact.
4. It shows how the surface and lower layers behave during an impact.
5. Yes. By showing how all the parts work in miniature. It removes guesswork.

Astronomy
Space, the final frontier
Extra words: Earth, Milky Way, tilt, sky, Apollo.

Ellipse drawing machine
1. It becomes longer and thinner, i.e. more 'squashed' in appearance.
2. A circular ellipse.
3. You still create an ellipse, but in some cases it is 'shunted' sideways.
4. The orbit is nearly circular, so the distance between Earth and Sun doesn't change very much; it takes around 365 days to orbit the Sun; Earth travels through space at about 107,000 km/hr.

Light reflections
Bouncing light around
Reflects, kaleidoscope, silver, image, mirror, periscope, magnified, pond. Reversed.

Laser maze
1. A powerful, narrow beam of light that remains parallel as it passes through the air. It is usually red.
2. Very still.
3. They are equal.
4. The red dot disappears.

How things work
Everyday technology
gears, motor, toilet, plane, clutch, diesel, engine, photography, fly, bicycle, lever, key, robots.
Rotating lever.

Unraveling technology
Challenge 1: A spring holds them in a chamber. Lifting the top releases the spring. Continuous pressure from the spring.
Challenge 2: The 'tongue' is only thick enough to push on one staple at a time and the delivery slot is only wide enough for one staple to pass through. Your hand. The holes in the foot guide the staples to bend over and around.
Challenge 3: The spring-loaded arm goes up allowing the staples to be shunted forward, thus positioning another staple for delivery.

Extension
1. Other types of staplers include: electric staplers for powerful and quick stapling while freeing both hands to hold things in position; long reach staplers for reaching to the centre of a book; staple guns with heavy duty staples to go into wood; builder's staplers for use on building paper; and, compressed air staplers for joinery and picture framing.
2. Answers will vary.

Measurement
Measurement madness
length, hectares, subtract, trillion, nano, odd, decimal, litres, speed, digit, ten, number, round, divide, estimating, graph, higher, ruler, repeat, time.

Measuring density
1. Fishing sinker, lead (if this was available to test).
2. No, steel is more dense.
3. Density is how much matter there is packed in a given amount of space.
4. Gold will be more dense than fool's gold. Every different mineral has a different density. (More advanced: compare specific gravities with known values for minerals.)

Extension
Specific gravity is the ratio of an object's density to the density of water. For example, gold has a density of 19 g/ml, water's density is 1 g/ml, so gold's specific gravity is 19. The specific gravity of minerals such as granite are in the range of 2.5–4.0.
Web of Life

Find the missing word in the italics statement below. To do this, read the questions and write their answers on the spiders web, starting from the centre. The first one is done for you. The answer is in the shaded circles.

We can help the Earth every day by ______ our wastes.

Clues
1. Predators feed on ______
2. These creatures have six legs.
3. Organisms that break down dead plants and animals.
4. An insect scavenger that is unhygienic in the house.
5. A substance that honey bees collect from flowers.
6. Honey bees do this to flowers.
7. Mushrooms and toadstools are types of ______
8. These living things have roots and take carbon dioxide from the air.
9. Animals use ______ from the air when they breathe.
Comparing Milk with other Drinks

What you need:
- Access to the labels on several types of drink bottles. One of these must be ‘Anchor Blue Top’ milk (the bottle has a dark blue top). The other drinks could include: lemonade, coke, fruit juice, ginger beer, etc. and other types of milk like Anchor Super Blue.

What to do
1. Study the label of ‘Anchor Blue Top’ milk. Now find its nutritional values per 100 mL for energy, protein, fat, carbohydrate, sodium, calcium, and vitamin D. Write the values in a table like the one below:

<table>
<thead>
<tr>
<th>Nutritional content of drinks (per 100 mL)</th>
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<tr>
<td>Blue Top milk</td>
</tr>
<tr>
<td>Energy</td>
</tr>
<tr>
<td>Protein</td>
</tr>
<tr>
<td>Fat</td>
</tr>
<tr>
<td>Carbohydrate</td>
</tr>
<tr>
<td>Sodium</td>
</tr>
<tr>
<td>Calcium</td>
</tr>
<tr>
<td>Vitamin D</td>
</tr>
</tbody>
</table>

2. For each of the other drinks read their labels and write the nutritional information (per 100 mL) into the table too.

Questions
1. Which drink contains the most energy per 100 mL?
2. Which drink contains the most protein per 100 mL?
3. Which drink contains the most fat per 100 mL?
4a. Which drink contains the most carbohydrate per 100 mL?
4b. Look at all the labels. What do the carbohydrates consist of?
5. Which drink is highest in each of the following: sodium, vitamin D and calcium?
6. Which drink has the greatest nutritional value?

Extension
1. Find out the main functions of the following food components: proteins, fats, carbohydrates, calcium and Vitamin D.
2. Nowadays there are many different types of milk such as Anchor Super Blue, Blue Top, Lite, Trim, Super Trim, Xtra and Mega. Find out how each of these are different and who they might be best for.
Gravity

Use the clues to solve this crossword about gravity. Some letters have been given.

Across

1. Ancient Egyptians used ____ (slopes) to help build the pyramids.
6. When air is pulled downwards by gravity it creates air _____.
8. If something is not supported, it will ___ due to the pull of gravity.
9. Which is pulled downwards less strongly by gravity, cork or water?
11. A falling object ____ (speeds up) towards Earth.
12. When birds ___ they have to fight against gravity.
13. The force of gravity acting on an object is called its _____. We measure it with scales.
14. Gravity is a ____ force (not a push).
16. A better name for 'centre of gravity' is 'centre of ____'.
19. When something is very buoyant it ____ easily.
20. Gravity acting on mountains is an important cause of _____.

Down

2. The bigger a planet, the ____ its pull of gravity.
3. An astronaut has to suffer huge g-____ at take-off.
4. In space there is little ____, so objects just float around.
5. Our body's centre of mass is near our ____ (belly button).
7. This special shape gives great strength to buildings and other structures. Not a square or circle.
10. Bridges and curved doorways often use ____ to give them strength.
15. Which has the greater pull of gravity, Earth or Jupiter?
17. We can measure weight using ____.
18. Without ____ we would fall over.
Meteorite craters

What you will need:
- A tray with sides, about 300 x 400 x 100mm deep (or larger)
- Flour to fill the tray to around 50mm deep
- Ruler
- Marbles
- A 1-2m tube that a marble can run through (optional)
- Iron sand or iron filings (optional)

Aim: To investigate and ‘model’ impact craters made by meteorites hitting the Earth’s crust.
Key ideas: Meteorites, craters, impact craters, collisions.

What to do
1. Pour the flour into the tray and smooth it out using the ruler.
2. From set heights such as: 25 cm, 50 cm, 75 cm, 100 cm, and so on, drop marbles into the flour. Observe the craters you create. Smooth out the surface between tests.
3. Carefully observe what happens and record
   a) the hole depth
   b) the hole width
   c) splatter distance (how far the flour is blasted sideways).
   Draw and label your craters.
4. Try gently throwing a marble sideways into the flour. Better still, let it roll down the inside of a one metre tube into the flour. Record your findings.
5. If available, sprinkle black sand over the smoothed flour surface. Create a single impact from straight above and one from an angle. Carefully observe and record what you see.

An impact crater, using black sand.

Questions
1. What happens to each of these as the marble is dropped from higher positions:
   a. hole depth, b. hole width and c. splatter distance.
2. Do you see a crater rim (like seen around craters on the moon)?
3. How does the shape of the crater change when the impact is side-on?
4. How does the black sand give you more information about the impacts?
5. Does modelling of impacts help us understand real meteorite impacts? How?

Key resources from Learning Media: Book 17 Flight, Book 34 Parachutes, Book 37 Floating and Sinking, Book 38 Understanding Buoyancy and Book 51 Standing Up.
Space, the final frontier

Find the 24 words about space in the grid below. The words can be found diagonally, vertically and horizontally, and some words are reversed.

Word List: asteroids, comets, craters, eclipse, exploration, galaxy, lunar, orbit, meteorites, moon, observatory, planet, poles, rocket, rotate, satellite, shuttle, stars, tides.

There are five more words about space that haven’t been listed. Can you find them in the grid?
Ellipse drawing machine

What you will need:
- a piece of customwood about 300x200 mm and 18 mm thick. Rule a straight line down the centre in both directions and drill small hole every 1 cm like this
- small nails to fit the holes in the board
- string (about 25 cm long) tied into a loop
- a pencil
- a4 paper

Aim: To draw ellipses like the path taken by planets traveling around the sun.
Key ideas: Ellipses, orbits, planets and their movement, the solar system.

What to do
1. Place a piece of paper on the board, then push two nails through the paper into the holes in the board.
2. Put the loop of string over both nails and place the pencil in the loop, pushing it outwards so the string is pulled tight.
3. Draw an ellipse.

4. Try positioning the nails in different holes and drawing ellipses of difference shapes.
5. Try using only one nail.
6. Try using three nails in line and then out of line.

Questions
1. As you move the nails further apart, what happens to the shape of the ellipse?
2. What type of ‘ellipse’ do you create using only one nail?
3. Describe what happens when you use three nails.
4. Research and describe features of Earth’s orbit around the sun.
Bouncing light around

Use the clues to help you answer the question below. (The missing word that is the answer will appear in the middle column.) Some letters are already given.

When we see ourselves in the mirror, everything is _____________

1. Light bounces back.
2. We look inside this toy and see pretty colours.
3. A metal that is very shiny and is used in mirrors.
4. We see an ______ of ourselves when we look in the mirror.
5. Helps a lot when we put on make-up or brush our hair.
6. Used by submarines to see above the surface.
7. A __________ image is larger than the original object.
8. Before mirrors were invented humans could still see their reflections in a smooth ______ (a tiny lake).

k _______ _______ c ______

s ______
i _______

____ o ______

____ p ______
f _______

--- --- --- --- ---
Laser maze

Aim: To build a light maze using a laser and mirrors.
Key ideas: Angle of incidence and angle of reflection, lasers, parallel light rays.

What to do
Warning: At no stage should anyone look directly at a laser's beam. It will cause eye damage!

1. Use blu tack to attach the target to the wall.
2. Partially darken the room (it shouldn't need to be totally dark).
3. Have a student point the laser at the target. Discuss the nature of the beam. That is, it is very narrow and powerful, travels in a straight line and is usually red.
4. Issue a challenge to three students to hold a mirror each so they reflect the beam three times and hit the target.
5. Add more mirrors and repeat the process.
6. Finally, can they use blu tack to attach several mirrors to walls and other surfaces to create a 'permanent' maze?
7. Investigate what happens when people move around the room with the maze in place.

Questions

1. Describe what the laser beam is like.
2. How still do you have to hold the mirrors to complete the maze?
3. What do you notice about the angle that the beam hits the mirror compared with the angle that it reflects back?
4. What happens to the red dot on the target when people walk through the beam?
Everyday technology

The answers to the questions have become mixed up. Unscramble the words, then use the boxed letters to complete the sentence at the bottom of the page.

1. Change down ___ ___ ___ ___ to drive up a hill.

2. A ___ ___ ___ ___ uses petrol as an energy source.

3. Its old fashioned name was a water closet, designed by Thomas Crapper.
   ___ ___ ___ ___ ___ ___

4. Another name for a ramp is an inclined ___ ___ ___ .

5. We put our foot on the ___ ___ ___ ___ to stop energy being transferred from the motor to the car’s wheels.

6. A common form of energy used by trucks is ___ ___ ___ ___ .

7. Another name for a car’s motor. ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ .

8. Digital ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ has taken over from the use of films.

9. An aeroplane is able to ___ ___ ___ when upward forces are greater or equal to the pull of gravity.

10. A two-wheeled vehicle. ___ ___ ___ ___ ___ ___ .

11. “Give me a long enough ___ ___ ___ ___ ___ and I can move the Earth”.

12. Make your home safe by use of a lock and ___ ___ .

13. Today’s car-making industries use ___ ___ ___ ___ ___ ___ to assemble cars.
Unravelling technology

**Aim:** To investigate how the different parts of a stapler work.
**Key ideas:** Form and function, levers, springs, bending metals.

---

**Challenge 1**

What holds the staples in place?
Open the stapler. How are the staples held in place? How do you get new lots of staples in and out? What causes the staples to shunt forward?

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**Challenge 2**

Staple a piece of paper. Also deliver a staple without it going through anything.
Why is only one staple ejected at a time? Where does the force come from to push the staple through the paper? What causes the staple to fold over on the back of the paper?

---

**Challenge 3**

Preparing to deliver another staple.
Describe what happens as the stapler prepares to deliver another staple.

---

**Extension**

1. Describe other types of staplers and what they are designed to do.
2. Describe how another item of technology works. Choose from one or more of: ballpoint pen, binoculars, light bulb, thermometer, 4-stroke engine, vacuum flask, barometer.
Measurement madness

This puzzle uses the last letter of each answer as the first letter of the next answer. The first answer and some clues are given.

Clues
1. From nose to tail is its length (like ‘long’).
2. His property is five _____ in area.
3. The opposite to ‘add’.
4. A thousand times bigger than a billion.
5. One thousand times smaller than ‘micro’.
6. The numbers 3, 7, and 9 are ____ (not even).
7. The numbering system using 10s, not binary.
8. We measure petrol volume in ____.
9. How fast something moves (like velocity).
10. The first ____ in the number twenty is ‘2’.
11. New Zealand’s currency system is based on the number ____ , not twelve.
12. The smallest ____ is zero.
13. A circle is _____, not square.
14. Opposite to multiply.
15. Taking a guess based on rough values.
16. A picture that shows data, e.g. a histogram.
18. Used to measure distance.
19. Over and over.
20. Measured in hours minutes and seconds.
Measuring density

**Aim:** To find out the density of various substances.
**Key ideas:** weight, volume, density, measurement, calculation.

**What to do**

1. Tie a 20 cm length of cotton to one of the objects.
2. Use the scales to measure the weight (actually mass) of the object in grams.
3. Add water to the measuring cylinder so it is about 2/3 full. There must be enough water to cover the object chosen above.
4. Record the volume of water in the cylinder, then gently lower the object into the cylinder. Again record the volume. Subtract the first value from the second to work out the object’s volume in millilitres.
5. Record your data in a table like the one below. Calculate the density (last column) by dividing the object’s mass by its volume.

<table>
<thead>
<tr>
<th>Object</th>
<th>Substance object is made of</th>
<th>Mass in grams (g)</th>
<th>Volume in millilitres (mL)</th>
<th>Density (in g/mL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>bolt</td>
<td>steel</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Questions**

1. Which object had the greatest density? What substance was it made of?
2. Is rock material more dense than steel?
3. What is density?
4. How could you use this technique to tell the difference between gold and fool’s gold, or between one mineral and another?
While being exciting and entertaining, our demonstrations provide a great opportunity to enhance student ‘knowledge’ in two science areas each year. The demonstrations for 2009 are Sounding out waves, a look at how sound is generated and how it behaves and the Planet Earth show, focusing on Earth’s resources and how to best preserve them.

To assist you in preparing for your visit, we’ve developed a unit plan called Sustainability that complements the Planet Earth show. This makes up the remainder of the kit. If time permits within your classroom programme, you may like to use notes from the Sounding out waves show outlined below to develop your own pre- and post-visit unit to complement that demonstration.

**Sounding out waves**  **Te ine ngaru puoro**
This demonstration covers specific learning outcomes relating to how sound is created and how it behaves including the following:
- vibrating objects create sound
- sound passes through the air as waves of molecules compressing and expanding
- frequency (and pitch), amplitude (and volume)
- sound does not travel through a vacuum, but it does travel through steel, water and other matter
- the Doppler effect
- sound is measured in decibels.

**Planet Earth**  **Te Aorangi Papa-tū-ā-nuku**
This demonstration covers specific learning outcomes relating to Earth’s mineral cycles including:
- what is matter
- the water cycle
- the carbon cycle
- CO₂ in the atmosphere and global warming
- energy flow through ecosystems
- life webs.
Sustainability
Te kaka ki te tiaki i te tāiao
Science unit plan

Contexts
- Planet Earth
- Global warming
- Recycling
- Think globally, act locally

Unit Aim
To investigate ways of reducing our personal impact on Earth’s limited resources and environments. This Unit has been aligned to the Ministry of Education’s Education for Sustainability document.

Aims of Education for Sustainability
This unit provides opportunities for students to develop:
- awareness and sensitivity to the environment and related issues;
- knowledge and understanding of the environment and the impact of people on it;
- attitudes and values that reflect feelings of concern for the environment;
- skills involved in identifying, investigating, and problem solving associated with environmental issues;
- a sense of responsibility through participation and action as individuals, or members of groups, whanau, or iwi, in addressing environmental issues.
Environmental issues related to a sustainable future are often complex. Multidisciplinary holistic teaching and learning approaches are therefore appropriate for meeting the aims of education for sustainability.

Achievement Objectives and Levels
Level 3
Making Sense of the Living World
- Investigate local ecosystems and understand the interdependence of living organisms, including humans, and their relationship with their physical environment.

Making Sense of the Material World
- Research the use and purpose of technology in the disposal or recycling of some common materials.

Making Sense of Planet Earth and Beyond
- Investigate the major features, including the water cycle, that characterise Earth’s water resources.
- Justify their personal involvement in a school or class-initiated local environmental project.


Key science concepts
1. The human population continues to grow, but the Earth has limited resources to sustain us.
2. At the same time humans want more material things, often well beyond what we need for a comfortable existence.
3. Renewable resources will be available for future generations, but we still need to limit their use. Non-renewable resources must be conserved.
4. We can act locally by ‘reducing’ ‘re-using’ and ‘recycling’.
5. We need to manage resources and ecosystems to protect our future and that of the planet.

After completion of this unit children will be better at explaining and describing:
- The effects of population growth.
- The causes and effects of ‘wants’ materialism.
- How we are intimately tied to Earth’s ecosystems.
- Ways of acting locally within schools, homes and communities to: reduce use of resources; effectively re-use resources and recycle resources.
- Ways of minimising our personal use. They will also have begun implementing sustainable and environmentally responsible practices in their lifestyles.

Timing
- Specific Learning Outcomes: 8 to 10 hours in class.
- Roadshow visit: 80 minutes plus traveling time.

Assessment
- Pre-assessment—Mind mapping exercise explained on page 30.
- Post-assessment—Repeat of mind mapping exercise explained on page 30.

Answers for activity sheets (pages 25–29)
Human population growth
Missing graph values: 300, 500, 1600, 3900, 6034,
1. In the last two to three centuries.
2. It could either stabilise or decline steadily or ’crash’. Examples: The Earth could run out of resources; it could ’poison’ itself; global warming might lead to famine; nuclear war might lead to a nuclear winter; etc.
3. The industrial revolution.
4. 5 million, 1 million, 1 million; the figures can only be estimates.
5. Agriculture. Before, this humans were hunter-gatherers.

Possessions
1. Decreased (on average).
2. More (on average, usually).

Reduce, re-use, recycle from the supermarket
1. Buy products with less packaging, buy local produce, even grow your own, e.g. vegetables.
2. Use boxes for storage, use wrapping paper as mulch around plants, use plastic bags for lunch wrapping, etc.
3. Glass bottles, Weet-Bix boxes, toilet roll inners, plastic milk bottles, aluminium coke cans, etc.

Reduce energy used for transport.
1. Answers will vary.
2. Car pool, don’t use them if an average is available.
3. One person in a large car — one person in a smaller car — more people per car — hybrid car — petrol motor cycle — electric motor cycle — public transport like bus and train — biking — walking
## Specific learning outcomes and activities

Perform the Learning Activities on the right to achieve the Specific Learning Outcomes on the left. Answers (where relevant) are given in rounded brackets, i.e. (answers). Square brackets [] indicate items that are supplied in this Unit.

<table>
<thead>
<tr>
<th>Specific Learning Outcomes:</th>
<th>Learning Activities:</th>
</tr>
</thead>
</table>
| **1. Students will understand how the human population grows at an ever-increasing rate which puts more pressure on Earth’s resources.** | Human population growth is the main cause of depletion of Earth’s resources. More people need more materials and energy to survive.  
   1. On the board show how doubling numbers creates an ever-steeper increase in the slope of a graph. e.g. $1 \times 2 = 2, 2 \times 2 = 4, 4 \times 2 = 8, 8 \times 2 = 16, 16 \times 2 = 32$, etc. Graph these numbers. If each doubling represents a generation, the graph would be: (Get students to graph points and draw in the curve). This is called exponential growth.  
   2. Track population growth over time: select either your school, a local town or city and research population numbers for the last few decades, e.g. 1930, 1940...2000, 2010 (estimate this last figure). Graph these numbers. What have been some of the causes of growth? (Things like local industry growth, immigration, natural population growth, etc).  
   3. How many people live on Earth today? (6 billion) How did we get to this stage? [Human Population Growth activity sheet]  
   4. Research the New Zealand population from Māori colonisation to today and graph. Attempt to explain why there was a drop in numbers when pakeha people arrived (largely due to Māori deaths through introduced diseases).  
   5. Find out why one or more ancient civilisations collapsed, e.g. Romans, Greeks, Persian. (Key ideas — resource depletion due to population growth and / or stretched supply chains and / or territorial wars).  
   6. Discuss and brainstorm ideas on the board as to what impacts increased populations have on planet Earth’s resources. Students create a mind map in their books. Ideas include: more housing, roading, food, transport needed, over-use of water, pollution of land, air and water, damage to our atmosphere, etc.  
   [Theory notes titled Human population growth.]  
   Vocabulary: population, human, growth, graphing, resources, doubling, million, billion, civilisation, collapse, crash, pollution, atmosphere, etc.  
   **Use a visit to the Fonterra Science Roadshow to see the Planet Earth Show in order to reinforce concepts relating to Earth’s renewable and non-renewable resources.** |
| **2. Students will appreciate how humans today want more material things and want to do more in their lives than previous generations did. This adds to the pressure on Earth’s resources.** | 1. Discuss and make a list of the personal possessions a young NZ person might have today. For homework students interview their parents or caregivers to find out what a typical person of the same age had in their generation. Grandparents could be interviewed too.  
   2. In groups: Of the items listed above, which ones are really needed (for good health and well-being)? These things are described as ‘needs materialism’. They are ‘necessary’. Which items do we ‘want’ but not need? These things are described as ‘wants materialism’.  
   3. Compare what material things students have now with what their parents had at the same age. [Possessions activity sheet]  
   4. Why do we want more ‘stuff’? In groups, brainstorm the reasons why we might want to have more things. (Peer pressure, advertising on TV, magazines, etc., what we see in TV programmes, on the Internet, etc.) Discuss how these things ‘get inside your head’.  
   [Theory notes titled Wants and needs.]  
   Vocabulary: materials, needs, wants, materialism, travel, advertising, peer pressure, health, well-being, possessions, Internet. |
| **3. Distinguish between renewable and non-renewable resources and investigate best uses for the future.** | 1. Discuss and give examples of natural resources, renewable resources and non-renewable resources.  
   2. Students collect items from home to make a classroom display of things using renewable resources e.g. food items, water, wood, willow basket, paper, cardboard, etc) and non-renewable resources (e.g. ballpoint pen, cell phone, bicycle, CDs, etc.) Discuss and label items with the sources of materials used in these items, e.g. renewable: wood, paper and cardboard from trees; meat from sheep; water from the ground via the ‘water cycle’; non-renewable: plastic from oil; cell phone from many resources such as oil, iron, copper, silicon; etc. |
3. Study renewable and non-renewable energy resources. [Energy resources—charts project sheet.]

Discuss the importance of saving non-renewable resources. For example, oil is the raw material for many products like paints, plastics, cosmetics, etc. Burning it as petrol and diesel is therefore very wasteful.

4. Alternative transport

In buzz groups discuss better transport alternatives to 'one person driving a big car' from point A to point B, e.g. to and from work that is 5 km away. Draw a mind map from their ideas on the board. Examples include: driving a small car and car pooling with others; using a hybrid car which is very fuel efficient; walking, running or biking (for fitness too); a motor bike, especially an electric version; and, use of a bus or train.

[Theory notes titled Natural resources.]
Vocabulary: natural resources, renewable, non-renewable, alternative transport, car pooling, hybrid cars, energy, future generations.

4. Individuals can be effective by ‘acting locally’ to do their bit to conserve resources.

Acting locally to conserve resources

By 'acting locally' we do our bit to conserve Earth's resources. The efforts of many individuals are multiplied up to have a collective positive effect.

Three key strategies in order of importance, for saving resources are 'reduce, re-use and recycle'.

Reduce — This means we use less, e.g. we buy only the things we 'need' and not 'want'. We buy items with less packaging, we walk instead of driving, etc.

Re-use — This means we re-use as item after its first intended use, e.g. a baked bean can is used to store nails, we write notes on the back of paper that went through a printer, and, plastic bags are used over and over for our lunches.

Recycle — This means that products containing useful materials are re-processed for the same or different purpose, e.g. waste glass is melted down to make new glass products, plastic bottles are converted into drainpipes, etc.

Students analyse supermarket purchases to find how they might 'reduce, re-use or recycle'. [Reduce, re-use and recycle from the supermarket activity sheet.]

Students analyse forms of transport to better use what we have and to find out about alternatives to the family car. [Reduce energy used for transport activity sheet.]

[Theory notes titled Reduce, re-use and recycle]
Vocabulary: local, conserve, conservation, reduce, re-use, recycle.

5. Careful management of ecosystems will ensure they are still there for future generations.

Students will help to conserve ecosystems through changes in their lifestyles.

Acting locally to conserve ecosystems

An ecosystem is a place where plants, animals, fungi and microbes live along with the physical environment they live in. Examples of ecosystems include: a lake, a forest, a tropical reef and a rotting log.

Have students draw a picture of an ecosystem of their choice, labeling the living and non-living things found there.

How do we harm ecosystems?

Students choose one environmental issue that causes harm to ecosystems. Example: clearing forests for farming; nitrogen pollution of lakes; over-fishing; introduced pests; reduction of rain forests; drying up of rivers; acid rain; carbon dioxide levels in the atmosphere; the ozone hole; oil spills.

They then brainstorm and research 1) what causes the problem, 2) what happens to the ecosystem, 3) how in turn it can affect us, and 4) how to fix the problem.

Students present their ideas to the class. As part of their presentation they must make practical suggestions to their classmates about how they can change their own behaviour in order to reduce harm to ecosystems.

[Theory notes titled Conserving ecosystems.]
Vocabulary: ecosystems, microbes, alien species, water table
Friction is a nuisance when

At some point this will have to level out or even ‘crash’ due to lack of natural resources.

Wants and needs
The problem is made worse by everyone wanting more things like students list and draw pictures, e.g. cars, TVs, cellphones, etc. and bigger homes. This is called ‘materialism’.

Humans also travel more today, so more fuel is needed per person too.

We seem to want more ‘stuff’ (material things) because of pressures from advertising on TV and radio and because of peer pressure. Most people need fewer material things than they have.

Natural Resources
Earth is a giant life support system. It has all the things we need to survive like air, water, soil, minerals and other living things; along with energy from the sun and from resources underground. All these things are called natural resources.

A. Renewable resources
These are natural resources and can be used and replaced over a short period of time like water, trees and fish stocks. [students draw examples]. However sometimes humans use these faster than nature replaces them. Examples of items made from renewable resources in use in everyday life are: ________ (students list, e.g. paper, cardboard, food items, water, etc.)

Renewable forms of energy can easily be replaced or are always present, like solar power, hydroelectricity and wind power.

B. Non-renewable resources
These are resources that once used, cannot be replaced at all or take thousands or millions of years to replace. Examples are: __________ (students list: oil, natural gas, iron ore, coal, bauxite for making aluminium).

Once these are used up they are no longer available for future generations. Examples of items I use in everyday life that are made from non-renewable resources are: ________ (students list, e.g. ballpoint pens, CDs, cell phones, TVs, cars, etc.). Non-renewable energy resources include: oil, natural gas and coal. These resources are also valuable for making many everyday products like plastics, paints, cosmetics, etc.

Reduce, re-use, recycle
This slogan means, to help the environment we should try to first reduce what we use. Examples include: buying fewer clothes, having smaller homes, using less packaging and owning less fuel-hungry cars. (Students could add ideas). Secondly, we should try to re-use things over and over for as long as possible. Examples include: re-using bread bags for lunches, keeping a car till it is absolutely worn out, using newspaper to mulch the garden (students list more). Lastly we should try to recycle everything we use, which may mean only buying things that can be recycled. Examples include: aluminium drink cans, glass jars, plastic milk bottles and cardboard boxes, that all go to the recyclers, and butcher’s paper that can be composted (students list more examples and draw pictures).

Conserving ecosystems
Ecosystems are the ‘homes’ where plants, animals, fungi and microbes live and feed on one another.

If we remove parts of ecosystems e.g. by clearing forests for farmland, we destroy these homes and there is nowhere for the living things to go. They die out. We can also damage ecosystems by:
• polluting them
• introducing new ‘alien’ pests (plants and animals)
• fire, flood and changes in the water table due to human activities.

Once plants and animals are gone, they are gone for ever! They become extinct!

We can personally help prevent ecosystem damage by: students make list, e.g. not buying imported hardwood; being careful not to pollute air and water and not litter; reduce demand on land by reducing our ‘purchases’; cycling and walking or using public transport; buying locally-produced food; being careful in natural ecosystems, e.g. not driving over sand dunes and riverbeds; etc.)
Human population growth

Time for activity: 20 minutes

Aim: To graph the world’s human population from early times up to today.

Key ideas: population growth, growth rates.

What to do

The following table shows the world’s human population over the course of history, but some values are missing. Use the Internet to find out the missing values. Put in more data points if you wish.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total human population (in millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD 0</td>
<td>500</td>
</tr>
<tr>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>1000</td>
<td>3,000</td>
</tr>
<tr>
<td>1500</td>
<td>5,000</td>
</tr>
<tr>
<td>1800</td>
<td>9,000</td>
</tr>
<tr>
<td>2100</td>
<td>14,000</td>
</tr>
<tr>
<td>1950</td>
<td>2,000</td>
</tr>
<tr>
<td>1970</td>
<td>3,000</td>
</tr>
<tr>
<td>2000</td>
<td>6,000</td>
</tr>
<tr>
<td>2018</td>
<td></td>
</tr>
</tbody>
</table>

Plot these points on a graph like the following:

Challenge:

1. Find out how a. agriculture and b. the industrial revolution allowed the human population to grow.
2. Why did the Maori population fall rapidly when early Europeans arrived in New Zealand?

Questions

1. When did the human population really start to increase rapidly?
2. What do you think will happen to the world’s population in another 200 years? Why?
3. What major development began around 200 years ago that allowed the world’s population to grow ‘explosively’?
4. Use the Internet to find out world population numbers in BC5000, BC10,000 and BC20,000. How accurate do you think these figures are?
5. What new development occurred 10,000 years ago that helped the human population grow? Why was the population so low before this?
Possessions

What you need:  
- a time to discuss and share memories with your parents

Extension
Discuss with your parents, grandparents or other older people how much they have traveled. Compare this with what you know about peoples' travel today.

Time for activity: 30 minutes at home and 30 minutes in class

Aim: To compare what material things students and their families have now compared with what their parents had at the same age.

Key ideas: material possessions, consumerism, material 'needs' versus 'wants'.

What to do

Where possible if you are a boy, compare yourself with your father. Girls compare themselves with their mother. If this is not possible, compare with other adults that you are able to interview. Now, find out what material things they and their families had when they were the same age as you now. For example, if you are 13 years old now, compare with them at 13 years of age.

<table>
<thead>
<tr>
<th></th>
<th>Then (Parents)</th>
<th>Now (mine)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How many people in household?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Number of rooms in house (not including garage; count the kitchen, lounge and dining rooms as separate)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Number of TV sets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Number of cars owned</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Size of house (approximate, in square metres)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. List material things you have in your household now that your parents didn’t have when they were your age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. List material things your parents had in their household that you don’t have in yours today</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Back in class
8. Combine and average the class findings and use these to make notes in your book.

Big question
What two main things mean that humans today are consuming the Earth’s resources

Questions
1. Has the average number of people per household increased or decreased?
2. Are the material possessions owned per household more or less now than in your parents’ time?
Energy resources — charts

Time for activity: One week (in class and for homework)
Aim: To study one renewable form of energy and one non-renewable form of energy.
Key ideas: Renewable and non-renewable energy resources, uses

What to do

Use the Internet, library and other information to help with your two charts.

Chart 1
Choose one renewable energy resource such as hydroelectricity, wind power, solar power, solar heating, tide power, biodiesel, etc. and show:
1) where the energy comes from
2) how the energy is ‘captured’ and made into an easily used form
3) the different ways the energy is then used.

Use pictures, diagrams, arrows, text and labels to show your answers to these questions.

Finally, write a summary paragraph on your chart explaining why this resource is renewable.

Chart 2
Choose one non-renewable energy resource such as coal, oil or natural gas and answer the same questions as in Chart 1.

Write a summary paragraph on your chart explaining why this resource is non-renewable.
Reduce, re-use, recycle from the supermarket

Time for activity: 2 hours at home and in class
Aim: To discover practical ways to reduce, re-use and recycle what we buy at the supermarket
Key ideas: reduce, re-use, recycle, careful resource use.

What to do

1. Go supermarket shopping with the person who normally buys your household groceries. From the things being purchased, select 10 different types of items, e.g. one meat, one vegetable, one canned food, etc. that you think are not sold in an environmentally friendly fashion (keeping in mind the ideas ‘reduce, re-use, recycle’). List the items in the table and write notes on why they’re not environmentally friendly under some or all of the headings ‘reduce’, ‘re-use’ or ‘recycle’. Three examples are given. Add your ten items.

<table>
<thead>
<tr>
<th>Grocery Item</th>
<th>Not environmentally friendly with respect to ‘reduce’</th>
<th>‘re-use’</th>
<th>‘recycle’</th>
<th>Better Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicken wings</td>
<td>On polystyrene tray and wrapped in plastic cling film equals too much wrapping</td>
<td>Plastic tray could be re-used, but only after thorough cleaning</td>
<td>Wrapping and tray can’t be recycled</td>
<td>Buy fresh and have them wrapped in butcher’s paper which can be composted</td>
</tr>
<tr>
<td>Canned apricots</td>
<td>Imported from China equals too many ‘food miles’</td>
<td></td>
<td></td>
<td>Buy NZ grown</td>
</tr>
<tr>
<td>Soap</td>
<td>Wrapped in plastic then in box equals too much wrapping</td>
<td>Little reuse for any of the wrapping</td>
<td>Only box can be recycled</td>
<td>Buy soap with only one layer of wrapping (or no wrapping at all)</td>
</tr>
</tbody>
</table>

2. Look for and think about better alternatives and write down your ideas in the last column of the table.

3. Convince whoever buys the groceries that they should select more environmentally friendly items!

Questions

1. What are some of the most common ways we can ‘reduce’ when buying groceries?
2. Give three examples of how you can reuse packaging.
3. Give five examples of materials you can recycle from what comes home from the supermarket.
Reduce energy used for transport

Time for activity: 2 hours at home and in class
Aim: To investigate better energy-saving alternatives to normal family car use.

What to do

A Better use of the family car
1. Stand by a busy road near an intersection where cars are slowing down. For every car that passes you, count the number of people in the car. Do this for 100 cars, and find the average number of people per car. While you do this think about how we could make better use of the cars we already use.

B Investigate more efficient forms of transport
1. Starting from the idea of ‘one person driving a big car’, draw a mind map showing more efficient ways of traveling. Discuss your ideas with others to build a wide range of alternatives branching out from the central starting point.
2. Choose one of your better alternatives and find out about it in detail. In a two page project:
   a. describe how it is powered and how it works
   b. use numbers to show how efficient it is
   c. describe how it is re-fuelled
   d. briefly describe the history of its development, what stage it is at now and what its potential might be.
   Add pictures, labels and diagrams to your project.

Questions
1. What was the average number of people per car in your survey?
2. How could we make better use of the cars we already have?
3. List in order of ‘best for environment’, several types of transport, starting from ‘one person in a large family car’ and finishing with walking.
Changes in student knowledge

One way of pre- and post-testing the knowledge of students on the unit of work *Sustainability*, is to use ‘mind mapping’. You can measure student knowledge by counting the number of words they use in their map that correspond with the list of keywords we supply to the right.

Students draw a mind map on sustainability (sustainable practices they can apply in their everyday lives) before they begin the unit, then again after they have completed the unit. The scores are compared.

The students will need
An A4 sheet of paper used side-on, i.e. landscape format. (The next page can be photocopied.)
Coloured pens, pencils, felts.

Drawing and assessing a mind map
*Instructions to students*
- Write the word ‘sustainability’ in the centre of the page, then write as many words as you can about this idea. Arrange these in related groups and use lines to connect them in a meaningful way, branching out from the centre. When you have written as many relevant words as you can, draw colourful thumbnail pictures and symbols alongside them.

Assessing the mind map
Give one mark for each word (or variation of the word, e.g. petrol, petroleum, gasoline) the student has written that is also in the keyword list. If instead of a keyword, the student has drawn a symbol or picture that clearly represents one of the keywords, also give a mark. (You could give a bonus mark for each relevant word they use that is not in the key list.)

Sample mind map
This is a student’s mind map ‘pre-test’ on sustainability. Ticks are given to show how marks are allocated. This student’s pre-test score was 9.
Mind map on Sustainability

Sustainability

Name: ___________________________ Date: _______________________
Year level: ___________ School: _________________________
Boy or Girl: ___________________
**The Programme**

“Crash Course” facilitates the development of research and presentation skills amongst Year 10.

The learning context is a non-injury car crash. This topic has been selected because of its practical relevance for Year 10 students, many of whom will be about to undertake driving tests within a relatively short time frame.

As students undertake the research to establish the cause of the crash they will focus on the large number of variables and conditions which can affect a driver at any time. There is no one prescribed solution. Students must draw their own conclusions substantiated by the research they have undertaken.

As they examine the consequences of a crash, they will also indirectly become more aware of the responsibilities involved when driving a vehicle.

**What are the main objectives of the programme?**

- To introduce students to the skills required for good research including data gathering, measurement, analysis, interpretation, evaluation and presentation via a variety of different media;
- To provide a quality, contextualised, cross-curricula learning resource, presenting a relevant life experience topic from a wide range of angles and perspectives;
- To inform students of the complexities of traffic hazards and crash potential (carefully positioned to complement other road safety initiatives).

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**2009 Itinerary**

May  
Wellington/Hutt Valley  
Wairarapa

June  
Hawkes Bay  
Gisborne  
Rotorua  
Tauranga

July  
Waikato

August  
Auckland

**Prices**

*Minimum booking is two class groups (max 33 students per class)*

- **Book 5 classes** — pay $180 per class
- **Book 4 classes** — pay $195 per class
- **Book 3 classes** — pay $210 per class
- **Book 2 classes** — pay $225 per class

For more information visit our website

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**For more information and bookings:**  [www.roadshow.org](http://www.roadshow.org)