SCIENCE ROADSHOW

Resource BOOK

2018

Themes
- Astronomy
- Ecology and Environment
- Interpreting Representations
- Reflection and Refraction
- Sound
- Spinning and Whizzing

Shows
- Fire and Ice
- Am I Living?

Unit plan
- Biodiversity Bioblitz

science alive!

MINISTRY OF EDUCATION
TE TAHURO TEE KATAURANGA

The National Science-Technology Roadshow Trust
Introduction

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

GUIDE

PREPARATION

Before your visit

TEACHER
Making the most ... p 26
Hints p 27
Initiate ‘Biodiversity Bioblitz’ unit pp 15–25
Exhibits and Shows for 2018 pp 28–30

STUDENTS
Language front-loading puzzles linked to Roadshow Themes pp 3–8 (Answers on p 31)
‘Biodiversity Bioblitz’ unit pp 15–25

ADULT HELPERS
Hints p 27

During your visit

TEACHER
Organisation
Encouragement
Safety
Discipline

STUDENTS
View Shows, see p 30
Interact with Exhibits, see pp 28–29

ADULT HELPERS
Encourage and assist students

After your visit

TEACHER
Post-visit investigations pp 9–14 (Answers on p 31)
Continue ‘Biodiversity Bioblitz’ unit pp 15–25

STUDENTS
Post-visit science investigations linked to Roadshow Themes pp 9–14
‘Biodiversity Bioblitz’ unit pp 15–25

ADULT HELPERS

Further support

TEACHER
School Journals, Connected Series and BSC Books relevant to Roadshow Themes and Shows pp 28–30

Foundational Science Capabilities

We have incorporated many implicit and explicit Foundational Science Capabilities components (functional interpretations of the Nature of Science strand) both within our 80 minute Science Roadshow visit experience (exhibits and shows) and within this Resource Book. And, we have an exhibit theme called ‘Interpreting Representations’.

New resources to support science education

We would like to draw your attention to a new range of resources for science teaching made available through theTKI site at: www.scienceonline.tki.org.nz/Science-capabilities-for-citizenship/Science-capabilities-resources/Search-resources. More than sixty existing resources are adapted to meet the needs of the science curriculum based around the five Foundational Science Capabilities (that link to the key competencies of the New Zealand Curriculum) and relevant Nature of Science concepts.

Numeracy and literacy

Many numeracy and literacy opportunities exist within the Science Roadshow programme, both during the visit experience and within this Resource Book. In particular, shows, science experiments and investigations, challenges, interactive exhibits and the Unit of Work found in this Resource Book are all contextual frameworks within which the teacher can present integrated programmes.

Sir Paul Callaghan Science Academy endorsement

Research gives us very clear pointers to the components of best practice science instruction. Key aspects are incorporated within this resource book, namely: a strong emphasis on explicit teaching of the Nature of Science (through the Science Capabilities), the 5 Es Instructional Model that is based on a constructivist view of learning, good questions leading to good investigations, and, a student-directed learning approach in which students are coached towards more and more opened ended forms of scientific inquiry. These practices are endorsed by the Sir Paul Callaghan Science Academy and are fundamental to creating critical-thinking, innovative students who will become part of a science savvy public.

More information about the Sir Paul Callaghan Science Academy is found on the back cover of this book.
Unscramble the planet names and the name of our ‘local star’:
nurtsa  rams  nevus  heart  prteiju  uns  tepneun  ryrceu  sunaru

Now, label the diagram with the correct names. Hint: the third largest planet starts with ‘U’.

We only know who discovered two of the planets, since all the rest were visible to the naked eye and would have been known by ancient cultures, including the Romans whose naming we use today.

Unscramble these names of the two more recently discovered planets and who found them: USURAN (Discoverer in 1781: milWlia lehcsreH) and TUENPNE (Discoverer in 1846: ohJn dAmsa).
SCIENCE VOCABULARY PUZZLE

Bird names

Using a ruler, draw straight lines to link the native bird pictures with their common names. The names are scrambled and coded, so first you have to unscramble them. Make sure you join the dots carefully.

Circle the letter that each line passes through. Write these letters in their numbered space below to find the answer. Number 6 is done for you and the first and last letters are given.

Birds that are only found in New Zealand and nowhere else are called ..........  

Your answer: I 1 2 3 4 5 N 6 7 8 S

What are the Maori names for numbers 3, 4, 5, 6, and 7?

What are their scientific names?


Host the Science Roadshow

Each year we need approximately 100 host schools around the country. We set up in a ‘host’ school’s hall or gym and other schools from the surrounding area are invited to our pre-booked sessions.

Our stay at a host school varies between one and three days — depending on our itinerary, the location, and how many students may visit from the host and surrounding schools.

The Roadshow makes a commitment to a set itinerary and venues well in advance, so it’s really important that our host schools can commit to hosting the Science Roadshow.

Host Venue Criteria

✔️ The use of your school hall or gym
This is where we set up our exhibits and other equipment. Your hall needs to be approximately 20x30m. All our equipment is on trolleys and wheeled into the hall. As we have 60 cubic metres of equipment, the hall will need to be clear of any chairs, tables etc.

✔️ A group of students to be ‘Explainers’
We require 13 students (Yr 7+) daily who will be trusted with assisting on specific exhibits. Our staff will conduct an extensive explainer training session that includes health and safety aspects.

✔️ A member of staff to act as our co-ordinator/liaison
This person needs to book the hall and select student explainers. They will be our go-to person if we have any issues or questions.

⭐ Contact Maureen Jones for more info:
maureen@roadshow.org or 04 499 7865

Local school
group

Parent bringing their child

Home school

Local school

HOST SCHOOL

Local school

Local school
SCIENCE VOCABULARY PUZZLE

Crack the code!

We often record our science in written form. To do this, we write in a way that helps pass clear information onto others who are interested in what we have done or found. Try cracking this code to discover important aspects of good scientific writing. Write your answers on the lines below the code.

Beware, the code changes throughout! Keep up!!

When we write about our science we try to make clear about what we say.

Try listing the rules used in each style of code.

The academy opened my eyes to a whole new way of thinking.

www.scienceacademy.co.nz
Mirror image mania!

List the letters that label all the lines of symmetry for each letter or diagram. A line of symmetry is one where everything on one side of the line is the mirror image of everything on the other side. The first one is done for you. Finally, use your answers to complete the statement at the bottom.

Statement about mirror images

Everything on one side of the line of symmetry can be ____________________ onto the other side.
These picture tiles will make you think!
Solve each tile by using the words and clues. Hint: The positions and shapes of words and pictures within the tiles add meaning too.
The first one is done for you.

1. high pitch

2. 

3. 

4. 

5. 

6. 

7. 

8. 

9. 

10. 

11. 

Extensions
1. What other sound-related words do you know? Make your own personal word list.
2. Create a picture tile puzzle like the one above for one of your favourite science topics. Try it out on your friends.
Move it!

Find 24 hidden words in the grid below. Twenty are given in the word list. The words can be found diagonally, vertically and horizontally, and some words may be reversed. Can you find four extra mystery words?

Word list

PUSHES
CENTRIPETAL
FRICITION
MOMENTUM
ACCELERATION
FORCES
MOTION
KINETIC
FAST
FLIGHT
TURNING
TIME
INERTIA
SPEED
POTENTIAL
SLOW
MOVEMENT
ROLLING
ROTATING
DECELERATION

Extension
Most words we use today originated hundreds of years ago. Choose three of the words in the word search above, find out what they mean and research into when and how they were first used.

Mystery words

______________________

______________________

______________________
Learning intentions
Science Capabilities: Gathering & interpreting data, Interpreting representations (specifically models).
Planet Earth and Beyond: Movement of Earth around the sun and moon around the Earth.

What to do
Models help us to understand many aspects of science. They can be diagrams (a two dimensional model), computer models and simulations, ‘mind concepts’, or physical structures that behave in some ways like the real thing. An Orrery is a model of how the planets behave. You will start simply with the Sun, Earth and Moon and build it like a ‘mobile’.

Making an Orrery:
1. Follow the instructions on the picture below to build a simple Orrery.

How does it work?
2. Can you show how these things happen: a) the Sun rotates on its axis, b) Earth orbits the sun, c) Earth rotates on its axis, d) the Moon orbits Earth, and e) the same side of the Moon always faces Earth?
3. Can you show how a) a solar eclipse occurs, and b) how a lunar eclipse occurs?

Thinking about models
4. Which parts of your model help us to understand the behaviour of the Sun—Earth—Moon system?
5. What parts of your model are not like the real things?

Going further
6. Find out more (see ‘Things to investigate’ to the left).

Things to investigate
1. Why is a model never perfect?
2. How big is the Sun compared with the Earth?
3. Why does the same side of the Moon always face the Earth?
4. Find out more about Orreries.

How does it work?
2. Can you show how these things happen: a) the Sun rotates on its axis, b) Earth orbits the sun, c) Earth rotates on its axis, d) the Moon orbits Earth, and e) the same side of the Moon always faces Earth?
3. Can you show how a) a solar eclipse occurs, and b) how a lunar eclipse occurs?

Thinking about models
4. Which parts of your model help us to understand the behaviour of the Sun—Earth—Moon system?
5. What parts of your model are not like the real things?

Going further
6. Find out more (see ‘Things to investigate’ to the left).
**Food for compost worms**

**Learning intentions** Science Capabilities: Gather and interpret data. Fair tests. Using evidence. Living World: Food choices and feeding in worms.

Refer also to pages 17 and 22 of the Science Roadshow 2017 Resource Book.

---

**Challenge 1**

**Fresh or unfresh — fair tests**

Offer a choice of fresh sliced potato or old sliced potato. Make sure you keep all other things the same, such as:

- they are equal sized bits
- they are equally moist
- they are the same variety of potato
- both trays are the same.

Make as many observations as you can. Count and record the numbers in each tray. Display the data so it is easy for others to understand.

**Challenge 2**

**Different foods**

Set up a fair test involving two foods to decide which they prefer. Here are some guidelines:

- Make sure they are kitchen scraps so they are ‘safe’.
- Do not use meat, fish or liquid products.
- Be kind and careful when handling your worms.
- Think about how many times you should repeat each test.

**Challenge 3**

**Food choice scale**

Based on lots of food choice experiments, can you make a scale showing which food is preferred the most, the second to most, and so on right through to the least?

**Give your recommendations**

Based on your evidence, can you make recommendations about the best foods for a wormery?

What food scraps should be used the least in a wormery?

If you were going into commercial production of compost worms, what types of foods would you feed them to get the greatest production?
Creating a force meter

Learning intentions Science Capabilities: Interpreting representations. Scales, units of force, calibration.

Challenge 1

Measuring pushes
Can you use your meter to measure the force needed to push small objects along a smooth desk? Now, measure the same objects on a rough surface. What happens? What other forces needing a ‘push’, can you measure?

Measuring pulls
Can you find a way of using your force meter to measure a pull force? [Hint: you may need to add a hook made from a paperclip onto the rubber band.]

Challenge 2

Measuring tiny forces and large forces
What if the forces you are measuring are tiny? How can you make your force meter more sensitive to measure these?
What if the forces you are measuring are larger? How can you make your force meter less sensitive?

Off the scale
What if the forces involved are way greater than your meter can handle? How can you create a meter that measures these large forces?

Challenge 3

Calibrate your meter
Use a real force meter, or even a set of electronic scales to ‘calibrate’ your own meter. Calibrating means to put an accurate scale on your meter using the values from another meter (the real force meter or the electronic scales). Draw suitable lines and numbers on your meter.

Test your calibrations
Find a way of testing if your meter measures the same values as the real meter or scales.

Representing your data
Find a way of displaying your measurement data.
Reflection and Refraction

CHALLENGE

Reflection of UV light

Learning intentions
Science Capabilities: Gather data using fair tests and use evidence to support claims.
Physical and Living Worlds: Reflection of UV light and the importance of being ‘sun smart’.
See 2017 resource book p17 and p22 for introductory activities with UV beads.

What you will need:
(per group)

★ UV beads (the 8 mm diameter ones are best).
★ Modelling clay or blu tack or plasticine.
★ x2 identical bottle top ‘UV meters’. (Squash some modelling clay into the bottom of each bottle top, then push UV beads into the clay so they don’t fall out if turned upside down.)

Challenge 1

Does UV light only come straight from the sun?
On a cloudless day, starting with white beads, try pointing your bottle top UV meter straight towards the sun. How quickly do the beads become colourful?

Does UV light come from other directions?
On the same cloudless day, starting with white beads, find out if UV light is coming from different directions (pointing away from the sun, at right angles to it, etc.).
Repeat on a bright cloudy day. Is there a difference? Why?

Challenge 2

Mixed bead colours or not?
By now you will have found that it is quite hard to judge how long it takes for the colours to change. Can you find a way of using only one colour of bead in your meters?

Does one colour change faster than others?
Set up a fair test to find if one colour of bead changes faster than others.
How might this finding be helpful?

Fair tests
Now, set up a fair test using two of your meters to find if more UV comes from one direction than another. For example, at the same moment, expose one towards the sun, and the other away from it.

Challenge 3

Can you find how Connor got sunburn?
Try some experiments and use evidence to support your ideas.
Here is a starting point....

Setting the scene
UV (ultraviolet) light is important for our health, but if we have too much we can get sunburn, and this might lead to skin cancer in later life. On summer holiday Connor got sunburn, even though he stayed under shelter all day while at the beach. How did this happen?
Clearly, we can get sunburn even when not directly in the sun, but how?
Start by creating two or more ‘bottle top UV meters’ shown above. Test them under direct sunlight. What happens? What happens when you go back inside?

Key School Journal References:
Gifts from the sun O’BRIEN, John Article Connected 1 1998.
Gifts from the sun O’BRIEN, John Article 4 02 3 1995.
Coathanger clanger

Learning intentions
Science Capabilities: Gathering and interpreting data. Fair tests.
Physical World: Sound, resonance and transmission of sound.

What to do

1. Make up the string as shown in the picture. Repeat with the wire and the elastic. They should all be the same.
2. Place one ‘end loop’ of the string over the index finger of your right hand and the other over the index finger of your left hand. Hang the metal coathanger on the middle loop. Now, stand up and lean forward and place one index finger in each of your ears. The coathanger should be hanging freely without touching anything.
3. Now, swing the coathanger so it hits a desk or chair. (Make sure the string is not touching your body.) What does it sound like? Ask someone to gently hit the coathanger with a range of different objects, some hard, some soft. Compare the sounds.

Doing fair tests
4. Now that you have a basic set-up, repeat, but change one thing only, to find how the sound changes. Examples:
   a) replace the metal coathanger with the plastic one
   b) replace the string with the wire, then the elastic.
5. With each change you make, record observations that show what difference it makes to the sound. What inferences can you make?
6. What things did you keep the same when doing the fair tests? (In other words, what variables did you need to keep the same?)
7. Make up some ‘laws’ about how well sound travels through different materials.

Share your observations and laws
8. Through discussion, compare your fair tests, observations and what you infer from these, with those of another group.
9. State your laws and describe the evidence you found that supports them. Did others find the same?

What is an inference?
“A conclusion reached on the basis of evidence and reasoning”
Example
Observation: “I feel the two magnets push apart.”
From past experience: “I know that when ‘like’ poles of a magnet are pointed at each other, e.g. north facing north, they will push apart.”
Inference: Like poles must be facing each other. The poles could be either: north facing north, or, south facing south.

What is a Law?
“A law is a general rule or principle that applies to many different situations.”

**Spinning and Whizzing**

**INVESTIGATION**

**Solar buggy**

**What you will need:**
(Per group)
- Little solar car (buggy, about 4 cm long), available online.
- Boards, 1 m rulers, blocks, etc. to make tracks and ramps.
- Protractor.
- A timing device.
- Chalk.

**Learning intentions**

**Science Capabilities:**
Observations. Gathering and interpreting data.
Using evidence.

**Physical World:**
Transforming solar energy into electrical energy, then energy of movement.

**What to do**

**Setting the scene**
Solar power is becoming increasingly important in our world because it is a clean source of cheap energy. One form of solar uses photovoltaic cells to convert light energy from the sun into electrical energy.

Little toy solar cars that use photovoltaic cells (on the top of the car) are very useful for investigating solar energy.

1. Start by exploring how the solar car works by using it outside in sunshine on a paved area, e.g. concrete or asphalt. BE CAREFUL. IF YOU STAND ON ONE IT WILL BREAK!

2. **What conditions are best?** Try the car in different lighting conditions: full sunlight, dappled light, bright cloud, dull cloud, shade and under a lamp. When does it go fastest? What do you infer about the electricity being generated by the photovoltaic cells under these different conditions?

3. **What speed does it travel?** Use a timing device and chalk lines to measure how far the car travels in 5 seconds. (You may need to ‘fence’ your car in using rulers so it goes in a straight line.) Divide this distance by five to find the speed in metres per second. Repeat several times to find the average. Now, measure what speed it travels in the different conditions in 2) above.

4. **Make it go faster:** Can you use something shiny (like a large mirror or reflective board), to make your car go faster? What is your evidence to support your claim?

5. **Controlling your car:** Can you start, stop, slow down, or speed up your car without touching it? How? Using some of these methods, can you make it go exactly 5 metres in 10 seconds?

6. **Ramps:** Find out how steep a ramp it will climb. What is the maximum angle and why?

7. **Control the direction:** Using cardboard, rulers and so on, create race tracks, hills, jumps, gates or mazes for your car to travel through.
### Science Concepts

Key concepts relating to biodiversity, including:

- there is great variety in the living world
- plants, animals, fungi, algae and microbes are just some groups of living things
- each group has features that they share in common
- within each group, there are many different species
- each species has its own special features (called adaptations) that distinguish it from others and help it to survive
- a species is a ‘type’ of living thing that can reproduce with its own type, but not with others
- careful observations, inferences, drawings, experiments and the use of instruments like magnifying glasses, microscopes and binoculars are all important in studying the biodiversity of living things
- a bioblitz is a useful way of engaging people in their local biodiversity.

### Key Competencies

**Thinking**

Students will use creative, critical and metacognitive processes to make sense of information and experiences gained during this unit. They will contribute to discussion with the teacher and peers and think about and reflect on their experiences in order to shift their ideas closer to the scientific ideas.

**Values**

**Innovation, Inquiry & Curiosity**

These values will be promoted through both teacher and student discussion and questioning. The investigations planned give opportunity for students to make their own choices and setting concepts in a relevant context will promote students’ curiosity about science concepts in their everyday lives.

### Key aim

**To gain an appreciation of the variety of life (biodiversity)**

Throughout the unit, students work toward creating an inventory of all the living things present at their school using an extended ‘bioblitz’ process:

- by recording the species of plants, animals, fungi and others found
- by studying where they live, their lifestyles and their special features.

NB This unit is best done in late Spring–Summer–early Autumn.

### Achievement Objectives

**Nature of Science (NoS)**

The five Foundational Science Capabilities are the main focus within NoS and are emphasised within this unit. It is suggested that one component of a given Capability is foregrounded at any one time. However, most of the five Capabilities are inherent within most activities.

### Contextual Objectives

**Contextual Living World: Ecology**

Levels 3&4

- Explain how living things are suited to their particular habitat and how they respond to environmental changes, both natural and human-induced.

**Living World: Evolution**

Levels 3&4

- Begin to group plants, animals and other living things into science-based classifications.

### Resources

**School Journals and Building Science Concepts books as outlined for given activities.**

**Websites and YouTube demonstrations as outlined in specific activities.**

### Answers and teacher guidance for pages 19–23

**Soil Minibeasts**

- *p19: Challenge 1. Answers will vary. Note that the different ‘types’ are different species. Challenge 2. Data tables are useful for this part. Biodiversity is measured by the number of different species. The higher the number, the greater or richer the biodiversity. There is often greater biodiversity in compost and humus rich soils that are moist because the compost/humus is food for many soil animals, and most soil animals prefer damp (though not wet) soil so their bodies don’t dry out. Challenge 3. The grand total of different species is the total of all the different types of creatures the class has found. The grand total of animal numbers could be estimated. (By working out the average number of animals in a spaghetti can of soil, then estimating how many cans of soil there would be throughout the whole school. So, the answer will be a BIG number!)*

**Water critters**

- *p20: Challenge 1. It is likely that samples from different locations will contain different types and numbers of animals, and the number of types (species) and totals of each will serve as evidence for such a claim. Shading, vegetation, etc. create different mini habitats for different types of animals. Challenge 2. Investigations will vary. Challenge 3. Observations and descriptions will vary.*

**School bird survey**

- *p21: 7) and 8) Answers will vary. However, see the NZ’s top 10 garden birds over the years 2007–2016 at www.landcareresearch.co.nz/science/plants-animals-fungi/animals/birds/garden-bird-surveys/celebrating-ten-years. Also look at the Factsheets, New Zealand Garden Bird Atlas and video clips.*

**Trapping flying insects:**

- *p22: 5) Usually the yellow trap, evidenced by the number of species and total numbers of insects caught. 6) Often, the best areas for total numbers of insects and variety are near vegetation and flowering plants, especially those with tiny flowers, (e.g., Phacelia and buckwheat). 7) Critiquing involves positive and negative aspects of your set-ups which were intended to be fair tests. Fair aspects might include: the containers used were all the same size, they contained the same amount of fluid and they were left out for the same period of time. Unfair aspects might include: one container received more sun (or shade) than another; the containers weren’t identical; one container might have been disturbed by an animal, etc.*

**Plant find**

- *p23: Challenge 1. Conditions to consider include: soil moisture, soil quality, shelter from wind due to the presence of other plants and buildings, aspect (growing in a north facing garden or a south facing garden), etc. Challenge 2. In pavement cracks, in roof guttering, perched on other plants, growing on rock, logs and fences, etc. They can be tiny, e.g., the size of a fingernail or less. Challenge 3. Main features of mosses, ferns, conifers and flowering plants are found on p 18. An example of a plant-like specimen that doesn’t fit under these headings is a lichen. (A lichen is a close partnership between a fungus and an alga or cyanobacteria living together in the same structure.) Algae (like seaweeds) are not true plants, but are now classified as Protists. Lichens and algae do however photosynthesise. Fungi, including toadstools, rusts, puffballs, mildews, etc. are not plants and do not photosynthesise.*
**Biodiversity bioblitz**

**SCIENCE UNIT PLAN**

### Specific learning intentions and activities

**Endorsed by the Sir Paul Callaghan Science Academy, the following assumptions apply:**

- a) The 5Es instructional model is used in all sections (see details on previous page).
- b) Student-directed learning is encouraged through teaching key techniques and approaches at the start of lessons/sections, then allowing students to build on these techniques through their own open-ended lines of inquiry.
- c) Nature of Science (NoS) components (and therefore the recently launched Five Foundational Science Capabilities) are inherent — as they are mandatory — and here we treat them in an explicit manner. Aspects of Science Capabilities are emphasised using **bold italic script.**

A combination of these approaches encourages skill development and Nature of Science (NoS) understanding, while the ‘Biodiversity’ context plays a supporting role. That is, the emphasis is less on traditional content coverage, and more on the Nature of Science and Capabilities.

Note, you do NOT need to cover all sections — as there are a large number of ideas presented here. The most valuable learning occurs when some areas are pursued deeply. This is especially important for Years 7 & 8 and older students.

#### Specific Learning Intentions

**Foundational Science Capabilities**

Examples for this unit include:

- **Gathering and interpreting data**
  - making careful observations
  - grouping and classifying
  - identifying characteristics
  - data collection
  - using biological keys and picture keys
  - creating charts, diagrams, photos and videos
  - inferring the presence of animals from the clues they leave.

- **Using evidence**
  - using evidence to support claims about organism identification
  - using observations to infer something about animal or plant lifestyles
  - inferring the function of a special body feature from its form
  - using similarities in flower or leaf characteristics as evidence to suggest that two plants are related.

- **Critiquing**
  - setting up fair tests and critically appraising them
  - appreciating the weaknesses strengths of a biological key
  - appreciating the variation within a species can make it hard to identify all individuals.

- **Interpreting representations**
  - biological drawings
  - scales and proportions
  - displaying and summarising data
  - extrapolating numbers of plants or animals by selective sampling.

- **Engaging in science**
  - hands-on doing; fascination
  - understanding the importance of biodiversity to Earth’s future.

**Learning Activities through 5Es model**

#### ENGAGE and EXPLORE

**Ignition activities**

Explore some of these simple investigations relating to biodiversity (the variety of living things). These types of activities are meant to prime thinking about what types of living things exist and where, how to distinguish them and what survival features they possess.

- **Leaf drawings**: Supply students with five different leaf types. **Observe** carefully, then make **drawings**, paying particular attention to size (include measurements), shape (lightly trace around margin as a starting point), leaf margins (smooth, toothed, etc.), vein pattern (parallel or branching, etc.). Add characteristics like smell (when crushed), texture, and, differences between top and bottom side of leaf. [Suggestion: lightly draw with pencil, then darken the lines, then shade with coloured pencils. Label and add measurements.]

- **Pressing flowers or leaves**: Select some small flowers and leaves, carefully make **observations** about them, then press between layers of blotter paper. Interleave these with occasional layers of corrugated cardboard which allow air to circulate, and weigh the pile down with books (or use a plant press). Change the blotter paper every couple of days for up to two weeks. Once flat and dry, use PVA glue to mount them onto light cardboard, label and display on the wall.

- **Signs of attack or disease**: Using a magnifying glass, **inspect** different types of leaves carefully for signs of damage or disease. Can you find what caused the damage?

- **Look for spiderwebs**: This is best done on a foggy or misty day when water droplets adhere to spiderwebs. However, an alternative is to use squirter bottles (used kitchen cleaning product bottles, well rinsed) to mist a shrub, or hedge or other vegetation. Try different habitats such as a vegetable garden, a native planting, a hedge. **Make observations** of the webs, their position, shape, size and draw the pattern of silk.

- **Observe pond animals and plants**: Sit quietly and observe the plants and animals in and around a pond or a permanent body of water. Spend time looking very closely and record what you **observe**.

- **Visit a museum, zoo, or botanical gardens**: Observe animals or plants. **Animals and plants**: What important body features (called adaptations) do they have? Infer what these are used for and how they help them survive. How do they behave? **Infer** why they do these things. What is the difference between the male and female animals? Back at school, find out more about the animals and plants, where their country of origins are, what they are related to and what their importance is.

#### EXPLAIN AND ELABORATE

Each of the following activities gives opportunity for children to **explore**, **seek explanations** and then **elaborate** by branching out into student-lead investigations based around their own questions. Remember that the overall aim is to create an inventory of all the living things at your school (within reason), found in the soil, water, above ground, etc. (See ‘Creating an inventory’ below).

**Soil minibeasts**

- Use at least two ways to find what is in soil, compost or leaf litter:
  1. soil pitfall traps (see www.ypte.org.uk/factsheets/minibeasts/print), and
  2. soil inspection. [Soil minibeasts Challenge sheet]

- Careful, accurate drawings of animals. Drawings are a form of data collection:  
  - www.youtube.com/watch?v=TogFh8Ap30
- Identifying animals found in soil: [http://soilbugs.massey.ac.nz/oligochaeta.php](http://soilbugs.massey.ac.nz/oligochaeta.php)
- Picture key to identifying soil animals: [https://slowfastsoil.wordpress.com/living-soil/](https://slowfastsoil.wordpress.com/living-soil/)
## Specific Learning Intentions

<table>
<thead>
<tr>
<th>Content</th>
<th>Learning Activities through 5Es model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Leaf drawings:</strong> key features of leaves such as colour, shape, texture, vein pattern, hairiness.</td>
<td><strong>Water critters</strong>&lt;br&gt;• Discover animals in standing water (ponds, water troughs, streams, etc. [Water critters Challenge sheet]&lt;br&gt;• Set up an aquarium or large jars to keep your own freshwater critters such as water boatmen and Daphnia (<a href="http://www.youtube.com/watch?v=sD9TgqOQw-Yg">www.youtube.com/watch?v=sD9TgqOQw-Yg</a>). Identify the things you find and make observations. Make notes on their behaviour, where and how they swim, if they are attracted to light or dark, etc. Photograph, video or draw them.</td>
</tr>
<tr>
<td><strong>Pressing flowers or leaves:</strong> e.g. key features of flowers including petals, sepals, stamens, pistil, ovary.</td>
<td><strong>Animals above ground or in the air</strong>&lt;br&gt;<strong>Vertebrates</strong>&lt;br&gt;• Find out what 'vertebrates' and 'invertebrates' are: <a href="http://www.pinterest.co.uk/pin/563794447079920650/">www.pinterest.co.uk/pin/563794447079920650/</a></td>
</tr>
<tr>
<td><strong>Signs of attack or disease:</strong> Insects, mites, earwigs, snails, slugs, fungi and many other organisms attack plants causing damage and lesions.</td>
<td><strong>Invertebrates</strong>&lt;br&gt;• Find invertebrates (insects, spiders, snails, slugs, etc.). Use insect nets to catch larger flying insects and to sweep across long grass. Tap or shake branches above a net. Hunt for spiders using their webs as clues to their whereabouts. Hunt deep in vegetation for snails, slugs, beetles, millipedes, woodlice, etc. Research keys and books to help identify them. Document and release.</td>
</tr>
<tr>
<td><strong>Look for spiderwebs:</strong> Spiders arrange their webs to trap prey that might be crawling on land or over vegetation, or flying. Different species have distinct types of webs and locations for building them.</td>
<td><strong>Vegetation</strong>&lt;br&gt;• Assess the variety of flying insects. [Trapping flying insects Investigation sheet]</td>
</tr>
<tr>
<td><strong>Observe pond animals:</strong> There are macro and micro pond animals. Some live in the mud, some above it, some amongst vegetation and some are free-swimming.</td>
<td><strong>Animals above ground or in the air</strong>&lt;br&gt;<strong>Vertebrates</strong>&lt;br&gt;• Find out what 'vertebrates' and 'invertebrates' are: <a href="http://www.pinterest.co.uk/pin/563794447079920650/">www.pinterest.co.uk/pin/563794447079920650/</a></td>
</tr>
<tr>
<td><strong>Visit a museum, zoo or botanical gardens:</strong> There is a huge variety of living things. Some are native, some are introduced, some are herbivores, some carnivores, others are scavengers, etc.</td>
<td><strong>Invertebrates</strong>&lt;br&gt;• Find invertebrates (insects, spiders, snails, slugs, etc.). Use insect nets to catch larger flying insects and to sweep across long grass. Tap or shake branches above a net. Hunt for spiders using their webs as clues to their whereabouts. Hunt deep in vegetation for snails, slugs, beetles, millipedes, woodlice, etc. Research keys and books to help identify them. Document and release.</td>
</tr>
<tr>
<td>Other Activities and Challenges list their own Specific Learning Intentions.</td>
<td><strong>Vegetation</strong>&lt;br&gt;• Find as many different types of plants as possible in the school grounds. Find a way of minimally damaging them, while recording what they are and where they are found. Check first with the caretaker before removing any vegetation. Start with trees, and work your way down to shrubs, grasses, herbs, ferns, mosses, etc. Find the names to some that are of interest and find out more about them, e.g. are they deciduous, evergreen, annuals, biennials or perennials, etc? How might some of them be useful to us? Do any attract birds and insects? [Plant find Challenge sheet]</td>
</tr>
<tr>
<td>[Theory notes titled ‘Biodiversity bioblitz,’ see over page.]</td>
<td><strong>Animals above ground or in the air</strong>&lt;br&gt;<strong>Vertebrates</strong>&lt;br&gt;• Find out what 'vertebrates' and 'invertebrates' are: <a href="http://www.pinterest.co.uk/pin/563794447079920650/">www.pinterest.co.uk/pin/563794447079920650/</a></td>
</tr>
<tr>
<td><strong>Vocabulary:</strong> NoS: see keyword list on p24.</td>
<td><strong>Invertebrates</strong>&lt;br&gt;• Find invertebrates (insects, spiders, snails, slugs, etc.). Use insect nets to catch larger flying insects and to sweep across long grass. Tap or shake branches above a net. Hunt for spiders using their webs as clues to their whereabouts. Hunt deep in vegetation for snails, slugs, beetles, millipedes, woodlice, etc. Research keys and books to help identify them. Document and release.</td>
</tr>
<tr>
<td><strong>Content:</strong> algae, amphibia, bioblitz, biological keys, birds, carnivores, characteristics, conifers, disease, family, features, fern, fish, fungi, groups, habitat, herbivores, insects, inventory, invertebrates, leaf margins, mammals, microbes, mulluscus, moss, niche, paramecium, parasites, petals, pistil, pitfall trap, reptiles, sepals, species, spiders, spiderwebs, stamens, veins, vegetation, vertebrates.</td>
<td><strong>Vegetation</strong>&lt;br&gt;• Find as many different types of plants as possible in the school grounds. Find a way of minimally damaging them, while recording what they are and where they are found. Check first with the caretaker before removing any vegetation. Start with trees, and work your way down to shrubs, grasses, herbs, ferns, mosses, etc. Find the names to some that are of interest and find out more about them, e.g. are they deciduous, evergreen, annuals, biennials or perennials, etc? How might some of them be useful to us? Do any attract birds and insects? [Plant find Challenge sheet]</td>
</tr>
</tbody>
</table>

## Integration

It is recommended that you integrate your science with other learning areas. Use science activities, investigations and challenges to engage students and where relevant, build links to English, the arts, health and physical education, languages, mathematics and statistics, social sciences and technology.
A bioblitz is an intense period of biological surveying in an attempt to record all the living species within a given area. This unit extends this process over longer than the usual day, and includes investigation into habitats, adaptations and biological classification.

Plants, animals and other living things are grouped in ways that show how closely related they are. Traditional ways of grouping them use:

- similarities in external body form and features like the feathers of birds
- similarities in internal structures like the shape and form of the skeleton inside mammals
- similarities in behaviour, life cycles and breeding strategies.

More recently genetic fingerprinting has been used to sort out how closely related different species are.

Characteristics of big groupings*

[Students could research these and list more examples of each.]

* Simplified and only lists the main groups likely to be found at a school.

Vertebrates — animals with a backbone

- Fish: cold-blooded, fins, breathe with gills, have scales, live in water.
- Amphibia: eggs without shells, smooth porous skin, carnivorous adults, prefer damp areas, cold blooded (cannot control their own body temperature), larvae develop in water or damp areas and undergo metamorphosis.
- Reptiles: scales on skin, produce hard-shelled eggs but some give birth to live young, cold-blooded.
- Birds: feathers, wings, beaks without teeth, scales on skin, warm-blooded, lay hard-shelled eggs.
- Mammals: fur, live birth, warm-blooded, females have milk glands.

Invertebrates — animals without a backbone

- Protozoa: Made of one cell, microscopic, able to move by themselves, found in moist habitats, e.g. Paramecium.
- Annelids (segmented worms): body segments, long and tube-like, body stretches and contracts, e.g. earthworm.
- Myriapods: many pairs of legs, one pair of antennae, simple eyes, two body sections — head and trunk (made of many sections), e.g. millipede and centipede.

- Insects: 6 legs, three body parts (head, thorax, abdomen), external skeleton (exoskeleton), two main eyes, jointed legs, e.g. housefly.
- Crustaceans: external skeleton made of calcium, two pairs of antennae, e.g. slater.
- Molluscs: unsegmented body, have a shell (can be hidden), has a radula, e.g. garden snail and slug.
- Spiders and mites: Two body sections, eight legs, no wings or antennae, simple eyes, exoskeleton, e.g. orb web spider.

Plants — things that photosynthesise

- Mosses and allies: small, no vessels to carry water, reproduce by spores, no seeds or flowers, e.g. moss.
- Ferns and allies: can be large, have vessels to carry water, no flowers or seeds, reproduce by spores, e.g. hen and chicken fern.
- Conifers and allies: often large, produce cones, reproduce by seeds, wind pollinated, e.g. pine tree.
- Flowering plants: produce flowers that form seeds, insect or wind pollinated, often produce ‘fruit’, e.g. a daisy and a corn plant.

Habitat

The natural home where an animal, plant or other organism lives, e.g. the habitat of some types of frogs is a pond; the natural habitat of a cactus is usually a desert.

[Students give other examples.]

Adaptations

Special features that help a plant or animal survive, e.g. thorns protect a rose from being eaten by herbivores.

[Students give other examples.]

---

Soil minibeasts

**Learning intentions**

**Science Capabilities:** Observations, gathering data, fair comparisons/tests  
**Living World:** Types of invertebrate animals found in soil.

---

**Challenge 1**

**Grouping and counting things**

Using tweezers, gently place the animals you find from the first soil sample into jars, grouping them by what they look like, e.g. all worms in one jar, all beetles in another. How many **different types** of animals did you find? How many **of each type** have you found? A magnifying glass might help. Record where your sample came from.

**Repeat for each soil sample**

Keeping your results separate, repeat the above for each of your soil samples.

---

**Challenge 2**

**Record your data**

Find a way to record what you have found in the soil samples. Draw pictures to show what each of your different animal groups look like.

**Which sample is “richest” (most biodiverse)?**

Make a claim about which sample is the richest in animals. Use your observations and data to support your claim.

**Describe where each soil sample came from**

For each soil sample, give details of soil dampness, amount of shade, amount of humus or compost on/in the soil, vegetation cover, etc. Use this information to explain why you think one soil sample is richer in animals than another.

---

**Challenge 3**

**Share your findings**

Collect all the class’ findings to make a list of what types and how many animals are found in soil around your school. Use this data for your ‘grand totals biodiversity tally’.

---

**What you will need:**

* A spaghetti can with both ends cut out.
* A plastic tray.
* Small pots or jars.
* Magnifying glass.
* Plastic tweezers (forceps).
* A lever, e.g. a large screwdriver.

**Setting the scene**

Soil contains many, many living things. The better the quality of the soil, the more variety and greater numbers it will contain.

In this challenge you will search for living things that are visible to the naked eye (called ‘macroscopic’ animals, as opposed to microscopic). However, you will use magnifying glasses to see more detail.

To take a soil sample, find some soft soil and push the spaghetti can fully into it. You may need to push it in carefully with your foot. When you lever it out it should be full of soil. Place the soil in a tray, and carefully tease it apart. Observe.

---

Key School Journal Reference: Wonderful worms  
Bk 6 Soil Animals L3-4.

---

© 2018 The National Science-Technology Roadshow Trust.
Setting the scene

Water often contains a rich variety of living things — plants, animals and microbes. They form an important part of the biodiversity of our world.

What’s in pond/river water?
Using a net or plastic jug, scoop water from a pond, the margins of a stream or any well-established body of water. Put what you find into containers of water. Make sure the water is from the same place, else many of the animals may die.

Use magnifying glasses to search for creatures. Separate them out into different jars.

Challenge 1

Group, count and record
Repeat similar steps as in the ‘Soil Minibeasts’ Challenge sheet to document what you find.

Compare
Take samples from a different part of the pond or river. Do these samples contain different numbers or types of animals? What evidence do you have to support your answer? Record how the areas you collected from were different. (Hint: Think about shading, vegetation, water movement, amount of waterweed and bottom mud.)

Challenge 2

Good questions for an investigation
Once you have observed pond animals, ask a question and investigate to find an answer. Here are some simple examples:

• Do more animals like to be near the surface or near the bottom?
• Do water boatmen feed at the surface or near the bottom?
• Do goldfish like to sun themselves on a warm day?
• Do Daphnia like the dark or the light?
• Are more animals found amongst weed or in clear water?

Challenge 3

Set up an aquarium
Set up a home for animals you have collected. Use an aquarium or large container with mud, rocks, waterweed and water from the pond you collected at. For one animal, identify it then observe and describe its movement and feeding behaviour.

The water boatman (left, about 4 mm long) and Daphnia (right, about 2 mm long) are good pond animals for investigations.
School bird survey

What you will need:
(per class, arranged into surveying groups)
★ Binoculars (optional).

Learning intentions
Science Capabilities: Gathering and interpreting data through observation, identification and counting.
Living World: Survey local bird populations through use of a standard surveying technique.

What to do

The aim is to survey the types and numbers of birds seen around your school on any one day.

1. View the 'How to take part: Years 1–8 video (see link to left).

Before you start surveying:

2. Learn to identify the birds found on the tally sheet, showing the most likely birds you will see. Note that males and females of the same species can sometimes look quite different, especially with the blackbird, chaffinch, greenfinch, sparrow and yellowhammer.

3. Test each other on all the birds. For a challenge, can you recognise a female sparrow from a female chaffinch, female greenfinch, female yellowhammer or a dunnock? (See pictures A–E to the left.) What about in real life?

4. Practise watching the birds you see around the school. Record how they behave: movements, feeding behaviour, flight patterns. This way you will become better at identifying the birds.

Begin the survey:

5. Choose a day, set up your groups and begin. Use the survey tally sheets (x2) from Landcare Research.

6. If time, repeat on another day.

7. List how many different species you saw.

8. Create a bar graph that ranks the birds from most common to least. How do your findings compare with country-wide findings? (Google search ‘Landcare the story so far’.)

9. Add the names and numbers to your school 'grand totals' biodiversity tally.

Apply the survey idea elsewhere

Try out the garden survey at home. Repeat on the official New Zealand Garden Bird survey day, usually conducted in June–July. See www.landcareresearch.co.nz/science/plants-animals-fungi/animals/birds/garden-bird-surveys.
INVESTIGATION

Trapping flying insects

Learning intentions

Living World: The diversity of flying insects.

What to do

This investigation involves surveying flying insects, many of which are attracted to the colour yellow. We can use this attraction to trap the insects in order to document and count them.

1. Create your trap: Put 4 cm of water in the bottom of a yellow plastic 2 L ice cream container. Add a few drops of detergent and a few drops of antifreeze. These liquids will trap and kill the insects*. Label your container.

*Note, we are only trapping a tiny number of the flying insects from the environment and these traps are the best way to find unknown and often tiny insects.

2. Repeat for a 2 L container of a different colour, e.g. blue.

3. Place both containers alongside each other in a safe place near flowering plants and leave for a week. If you have another pair of containers, use the same set-up, but place them in a different location.

4. After a week, inspect your catch. Draw and record the different types of insects and how many you have trapped. You may need to use a magnifying glass. Examples are shown to the left.

5. Which colour is better at attracting insects? What evidence do you have for this?

6. Which location had the most flying insects in total? Which had the greatest number of different species?

7. Critique your investigations, saying how they were ‘fair’ and if there were any things you were unable to make ‘fair’.

8. Add the names and numbers of species to your school ‘grand totals’ biodiversity tally.

Find out more

Research into how to use the colour yellow in other ways to attract insects (try Google Images to get ideas), then set up some investigations. Also, research and make your own traps for nuisance insects, blowflies or aphids.


**Plant find**

**Learning intentions** Science Capabilities: Gather and interpret data. Observations, comparisons, interpreting representations.

Living World: Biodiversity amongst plants. Grouping plants.

---

**Challenge 1**

**Find the big plants**

How many different types (species) can you find? How many of each type are there? Decide on ways you can record them. **Caution:** If picking leaves, etc. check with your teacher first. Record where the plant was found and under what conditions. (One example is the amount of light reaching the plant. What others are there?)

Do other groups agree with your sorting of the different species? What aspects are difficult to decide on? Research the names of some of your favourites.

---

**Challenge 2**

**Find smaller plants**

Repeat as in Challenge 1. Look very carefully for all sorts of plants (usually greenish living things). Some don’t even live in soil, so where else can you find them? How small can they be?

---

**Challenge 3**

**Which main groups do they belong to?**

Find out the main features of these four groups of plants:

1. Mosses
2. Ferns
3. Conifers
4. Flowering plants.

Group the plants you have found under these headings. Do some of your specimens not fit into these groups?

Find out about other groups like lichens.

Investigate into any aspect of plants you may be interested in.

Add the names and numbers of species to your school ‘grand totals’ biodiversity tally.

---

**What you will need:** (per group)

- Plastic bags.
- 2 L ice cream containers.
- Scissors.
- Tweezers (forceps).
- Magnifying glass.

---

**Setting the scene**

Plants come in a very wide range of types, shapes and sizes. And, some like heat, some cool, some dryness, others damp, some shade and some full sun. In this activity we try to discover all the plants in the school and to group them according to features they have in common.

You will need sharp eyes to find some plants! So, it’s easiest to start from the biggest first — like trees, shrubs and tree ferns. Then, work your way down to smaller and smaller types.

---

Plants have different shapes. The overall shape is called its ‘form’.

For all the plants you find, first look at its ‘form’ (see picture). Draw it. Then look at it’s colour, trunk or stem, then its branching pattern or leaf arrangement. Then move onto details like leaf, bud and flower shapes, etc.

---

One way of pre- and post-testing the knowledge of students on this Biodiversity Bioblitz Unit 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 *Biodiversity is about* — since this is the core of the unit — before they begin the unit. They repeat the same mind map after they have completed the unit and the scores are compared.

Depending on the experience and ability of your students, it may be best to demonstrate how to create a mind map or two on a different topic before you begin.

**The students will need**

An A4 sheet of paper. (The next page can be photocopied.)

Coloured pens, pencils, felts.

**Drawing and assessing a mind map**

### Instructions to students

Write the words ‘*Biodiversity is about*’ 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 meaningful ways, branching out from the centre. When you have written as many relevant words as you can, draw colourful thumbnail pictures and symbols alongside them that also help to explain your ideas.

### Assessing the mind map

Give one tick for each word (or variation of the word, e.g. animal, animals, animal kingdom) 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 keyword list.)

### Sample mind map

This is a student’s mind map ‘pre-test’ on *Biodiversity is about*. Ticks are given to show how marks are allocated. This student’s pre-test score was 6.
Mind map on ‘Biodiversity is about’

Name __________________________ Date ______
Year level ______ School ________________________

Biodiversity is about
Making the most of learning opportunities

The 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 hands-on experiences in science, technology and innovation 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 have a significant effect on promoting students’ learning.
• Group work that includes discussion helps students to consolidate their learning.
• Numeracy and literacy are important so we aim to incorporate these learning areas within the programme.

What happens during your visit?

• You will be met outside by a member of the 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 shows (see details p. 30). 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 set up in the hall. (See exhibit details on pages 28 and 29.)
• Our Presenters will advise students when their exhibit time is over.
• Students will return to the show area for the second fifteen-minute show. Your group may be joined by students from another group for this show.
• Staff will direct your students to leave the hall at the end of the second show.

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 organise groups who will be responsible for reporting back on specific themes or selected exhibits. 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 a digital camera or video device to record selected exhibits for review back in class; do a project or inquiry-based investigation on the science behind one or more of the exhibits.

Managing junior groups

• Free exploration of exhibits by children of all ages is ideal. However, it is advisable to organise adults to at first supervise small groups of children of Years 0–1 (sometimes even Year 2 children) as they move around exhibits. As soon as children gain sufficient confidence they may be encouraged to freely explore exhibits in pairs or small groups. This way they are able to choose the exhibits they are most interested in while minimising time waiting in queues.

Support for the New Zealand Curriculum

The Science Roadshow experience supports the New Zealand Curriculum at four levels, with respect to Principles, Values, Key Competencies and Specific Learning Intentions. The first three are outlined below, while Learning Intentions are covered within the Unit of Work found earlier in this book.

Principles

The Science Roadshow experience embodies:

Inclusion: by recognising and affirming learning needs of all, through an array of sensory experiences

Learning to learn: 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, industries, the workplace and home

Coherence: by linking science-related experiences with language and communication, technology careers and real life experiences

Future focus: by thinking and investigating through a Nature of Science / Science Capabilities lens and encouraging students to look at future-focused issues relating to science and technology, innovation, medicine and communications.

Values

The Science Roadshow embodies:

Excellence: through perseverance to find answers and to understand how things work

Innovation, inquiry and curiosity: by students thinking critically and creatively about ideas presented in shows, and reflectively about how and why exhibits work

Equity: through access for all to an interactive experience

Participation: through encouragement of students by 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 Science Roadshow experience; namely;

Thinking: by reflecting on shows and about how and why exhibits work and their relevance to everyday life

Using language, symbols and texts: by student involvement with 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, Presenters and Explainers as they interact with exhibits and participate in shows

Participating and contributing: students participate and contribute to shows, and interact enthusiastically with exhibits.

A visit to the Science Roadshow isn’t only for your students. We hope you will also see it as a great opportunity for your own professional development.

Further science PLD opportunities are available through the Sir Paul Callaghan Science Academy — details on the back cover.
Hints for teachers and helpers — during the visit and at home

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

What is the Science Roadshow?
The Science Roadshow travels around the country teaching children about science, technology and innovation. At the Science 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 60 hands-on exhibits. You will also take part in two exciting shows.

Welcoming the science barrier

A room full of exhibits can be daunting to the nonscientist and you may feel unqualified to assist students with their understanding of an exhibit when you don’t understand it yourself. However, you don’t need to know any of the science yourself.

Instead, consider this approach.

- Stand alongside students who are experimenting with an exhibit.
- Show some interest in the exhibit and ask the student(s) what it does.
- 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)…
- Tell them you don’t know about it yourself, but you want to know and you are relying on them to be the expert.
- Encourage them to investigate and try things. The first level of understanding may simply relate to ‘making things happen’ on the exhibit.
- Get them to tell you what they have found and show you how it works. Use questions to encourage them to investigate further. What science is it showing? How do we use this in real life?
- Ask them what the Context Board (the instructions board beside or on the exhibit) says. Assist the students to read it and repeat back to you what it means.

By these simple steps you will encourage active involvement and learning ownership by the students that will carry forward as they move onto other exhibits.

Symptoms of a kid who loves science:

- shows curiosity about the natural world
- likes experimenting and trying things out
- takes things apart and rebuilds them
- asks lots of questions about why things are the way they are.

Why does science matter? The late Professor Sir Paul Callaghan noted that the average person in the world today is better off than the richest aristocrat of 200 years ago — they will live longer, be healthier, happier, safer and more productive. Why is this? It’s largely because of science and the improvements in quality of life it has brought to millions of people around the world.

Which isn’t to say that humanity doesn’t still face a great many challenges, from climate change to food and water shortages to disease. Science will play a leading role in how society responds to and overcomes these challenges, so that life as we know it today can be sustained in the future.

Every New Zealander needs to be science savvy!

Science at home

- Spend time with your child pulling things apart to find out how they work, or building things like kit set radios. For even more fun, try engaging your child in real-life science experiments at home. You can find good ideas on the internet, and many toy shops sell relatively cheap experiment sets.
- Take advantage of what’s out there in the community. Visit your local library to find books about science. Play with interactive displays and exhibits at places like museums and planetaria.
- Develop a love of reading in your child — it builds a love of knowledge.
- Maths is the basis of all science, so make it fun, encourage it.
- If a child asks a question, don’t be afraid to say you don’t know but, importantly, show them how they can find out; do it together.
- Latch onto opportunities whenever your child displays interest, and give practical and real examples of things.
- The natural world is usually a child’s first interest; it helps if parents are a little ‘wide-eyed’ too.
EXHIBITS

Themes

Astronomy – Te Mātaí Arorangi

Exhibits in this theme address specific learning intentions relating to the following: groupings and patterns of stars; light spectra; elliptical orbits; phases of the moon; gravity; sunrise and sunset; the seasons; and, weather patterns on planets. Exhibits include:

- Constellations
- Phases of the Moon
- The Seasons
- Creating a Spectrum
- Spiralling Vortex
- True Star Positions
- Ellipses
- Sunrise
- Turbulent Planet

Contexts — Astronomy, Space, Gravity, Weather


Ecology and Environment — Te Hauropi me te Taiao

Exhibits in this theme address specific learning intentions relating to the following: plants for fuel; river pollution; features of fossils; genetically modified organisms; identifying animals; characteristics of mussels and seaweeds; water uses and availability; adaptations of plants and animals; and, species interrelationships. Exhibits include:

- Biofuel
- GMOs
- My Personal Water Use
- Seaweed
- Worm World
- Fixing the Waiaupu
- Identifying Organisms
- Plant Adaptation
- Water Availability
- Fossils
- Mussels
- Pollinators, Partners
- Whitebait

Contexts — Living things, Habitats, Adaptations

Key School Journal References: ADAPTATIONS: The cat's whiskers Article 4 2010 Pt 01 No. 3 10-15, PATES, Janet; Catch My Own Article 5 2012 Pt CN 4-13, WILCOX, Sarah; Featherly friends Story 2001 Pt CN No. 1 Pgs 2-7, BINNIE TAIKIHU, Minnie. The secret underground Article 2007 Pt CN No. 1 12-17, LOVELESS, Mary; Who's Eating Who? Article 7 2012 Pt CN No. 4 14-21, WALL, Bronwen. FOSSILS: Bird land Article 2008 Pt CN No. 12 8-14, LOWE, Sarah; Bunded treasure Article 2008 Pt CN No. 12 12-27, OWEN, Dylan; Finding an ammonite Article 7 1981 Pt 04 No. 1 Pgs 8-14, STEVENS, Graeme. A fossilised forest Article 4 1978 Pt 01 No. 5 Pgs 12-13, RICHARDS, Grace. Fossils Article 4 1993 Pt 02 No 4 Pgs 20-21, CROOK, Gillian / SHANNON, Gillian. On the dinosaur trail Article 7 2011 Pt 04 No. 1 8-13, GIBBISON, Sue; Rock doc Article 3 1999 Pt 01 J1 No. 2 Pgs 8-13, ANDERSON, K. E.; The Dinosaur Hunter Article 5 2012 Pt L3 Sep 18-23, BULBROOK, Normarn; What are fossils? Article 4 1978 Pt 01 No. 1 Pg 7, CROOK, Gillian / SHANNON, Gillian. ECOLOGY: The bat detective Article 2002 Pt CN No. 0 1 Pgs 20-23, MOORE, Geraldine; Bat maths Article 2002 Pt CN No. 1 Pgs 24-25, MOORE, Geraldine; The call of the conch Article 7 2010 Pt 03 No. 2 28-32, MACGregor, Jill; The compost heap Article 7 1986 Pt 03 No. 1 Pgs 42-49, LEONARD, Jane Walker / WALKER, June; Coral makers Article 7 1982 Pt CN No. 3 Pgs 31-40, CROOK, Gillian / SHANNON, Gillian; Deer, oh deer Article 7 2010 Pt 04 No. 1 13-19, CAMPBELL, Mary; The frog pond Story 2002 Pt CN No. 1 Pgs 8-13, ALCHIN, Rupert; A Gym from Ear to Ear Story 4 2011 Pt L2 Oct 12-17, WATSON, Tiperene; Hukarai: EnvisiSchool Article 2002 Pt CN No. 3 Pgs 16-21, ALCHIN, Rupert; The mangrove community Article 8 1985 Pt No. 1 Pgs 41-45, DARBY, Mary; Marine worms: the weird and the wonderful Article 2006 Pt CN No. 10-17, HUBER, Raymond; Moss Story 2002 Pt CN No. 3 Pgs 2-5, BAGNALL, Alan; Tiakia a Tangaroa - Protect Our Seas Article 4 2011 Pt L2 Oct 21-22, MACGregor, Jill; Save our sand dunes Article 4 2010 Pt 02 No. 3 11-17, WERRY, Philippa; Saving Possum's Stream Article 6 2010 Pt CN No. 3 1s-31, LILLEYBE, Maggie; The secret life of estuaries Article 2006 Pt CN No. 3 18-25, INNES, Andrew; Seeds for the birds Article 4 2007 Pt 02 No. 4 7-13, GIBBISON, Sue; Taking the Bait Article 7 2012 Pt CN No. 4 24-25, POTTER, Kate; The Bitten Story 4 2012 Pt SL No. 2 12, NOONAN, Diana; Wear a possum - save a tree Article 5 2002 Pt 04 No. 3 Pgs 28-32, MACGregor, Jill; The wild deer debate Article 11 Pt SL No. 2 2-16, TRAFFORD, Ian; Wind power: the debate Article 2010 Pt CN No. 3 10-15, BENN, Ken; The world of a tree Article 7 1986 Pt 01 No. 1 Pgs 8-11, COOK, E. M.; Wyrbitz at risk Article 4 2008 Pt CN No. 1 4-9-15, BUKTON, Jane.

Interpreting Representations — Te Whakamārama in ēgā Ārāi

Exhibits in this theme address specific learning intentions relating to the following: reading, interpreting and understanding scales, graphs, oscilloscope screens, graphical representations, units of measure, models, colours codes, scales; and, using instrumentation Exhibits include:

- Acoustic Discs
- How Deep are Oil Wells?
- Lock and Key
- Best Stack
- InfraRed Camera
- Maps
- Cereals
- Insulating with Batts
- Road Friction

Note: While every effort is made to have these exhibits on offer, we cannot guarantee that all of them will be on display at any one time.

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 notes on this page and the next page highlight the concepts that are covered within each of these Themes and may help you to focus pre- and–post 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 cooperatively on a range of experiences not normally available to them within the school environment.

Effective use of Explainers

Explainers are students selected from the host school to assist with explaining and demonstrating exhibits to visiting students. (They also play a vital role in assisting with setting up exhibits and later packing them away in the truck!) To prepare Explainers for their involvement we ask that before the Roadshow visit, teachers outline the following key aspects of the role with the chosen students. Explainers are there to:

- Assist others to learn (and in doing so, they will learn a lot themselves).
- Give hints and suggestions about how to use exhibits.
- Show enthusiasm and encourage involvement from visitors.
- Ensure safe use of equipment.
- Prevent mistreatment of Roadshow equipment.

All in all, we hope that students enjoy their experience as Explainers and maximise their own learning by active, positive and enthusiastic involvement.

Extras for experts

The purpose of this challenge is to stretch more able and/or determined students and encourage active learning through involvement with exhibits.

How it works: Each year three or four exhibits are chosen for more detailed study. These are ‘flagged’ to identify them so that during the ‘floor session’ when students are using exhibits, they know which ones are for the ‘extras for experts’ challenge.

At any time during this part of their visit, students have the opportunity to use and study these exhibits in detail, then to explain how they work to nominated adults (who have model answers). If they explain a given exhibit correctly, they have a card clipped. They repeat this process with the other exhibits and once they collect at least two clips, they are eligible for a prize drawn at the end of their visit.

© 2018 The National Science-Technology Roadshow Trust.
Curiosity probe

At the end of their first show, our Presenters will introduce an experimental scenario that will probe into student understanding of a science idea. The necessary equipment will be displayed on the front bench for students to think about and respond to with their predictions. The correct outcome (shown below) will not be displayed, but students can go onto the Roadshow website to see cumulative student responses. Students and teachers are encouraged to discuss and/or perform the investigation back in class.

Back in class
Repeat the setup in class and run the experiment in order to discover the outcome. This should lead to discussion around relevant key concepts and further questions could lead to student lead investigations.

Probes like this can be used as a diagnostic or formative assessment tool.

Setup
Using two identical thermometers, place one inside a mitten (or oven mitt) and leave one alongside the mitten. Check both their temperatures one hour later. (Ensure that the room temperature has not changed significantly over that period.)

Question. Which of these outcomes will occur?
1. The thermometer inside the mitten will show a lower temperature than the one outside.
2. The thermometer inside the mitten will show a higher temperature than the one outside.
3. Both thermometers will show the same temperature.

Ask the students to explain their thinking.

Outcome
Both thermometers will show the same temperature. This is because over the period of one hour, all items involved — the mitten and the two thermometers — will settle to room temperature, say 21°C. There is no heat source like a warm hand inside the mitten, so there is nothing to heat up the inside. The common misconception that it will be warmer on the inside comes from the fact that when your hand is inside the mitten it feels warmer than when it is outside the mitten. However, it is only the heat from your hand, trapped by the insulating fabric of the mitten, that elevates the temperature inside.

This probe explores energy, heat and temperature. For more detail, download the Mitten Problem from the Classroom Resources page on our website.

Reflection and Refraction — Te Whakaataanga me te Whakahakoko

Exhibits in this theme address specific learning intentions relating to the following:
- angles of incidence and reflection; interpreting reflections; refractive index; magnification; lasers; lenses; virtual images; light transmission; total internal reflection; image inversion; and, symmetrical reflections.

Exhibits include:
- Angles and Images
- Disappearing Glass Rods
- Infinite Images
- Magic Cylinder...
- Rotating Rings
- Symmetry
- Box Mirror Puzzle
- Flexible Mirror
- Laser Zig-zag
- Mirror Patterns
- Shake Hands...
- Dioxide Glass
- Giant Kaleidoscope
- Lenses
- Pepper’s Ghost
- Silvered Mirror

Contexts — Light, Reflection and refraction

Key School Journal References: Make a periscopic Article 5 1999 Pt 03 No. 1 Pgs 30-32; FULLER, Sue. The riddle of light Article 5 1993 Pt 04 No. 2 Pgs 20-23; CAMPBELL, Rob. What is light? Article 2006 CN No. 2 24-27; BELL, Alison.

Sound — Te Oro

Exhibits in this theme address specific learning intentions relating to the following:
- harmonics; vibrations creating sounds; voice and music; seismic waves; sonar for distance measurement; how a speaker works; sound waves; amplitude and pitch; amplification; and, sound reflection.

Exhibits include:
- Pluck String
- Sonar
- The Seismic Method
- Whisper dishes
- See Your Own Voice
- Speaker Cone
- Theremin
- Seismic Surveying
- Standing Wave
- Tin Can Amp

Contexts — Sound, Music


Spinning and Whizzing — Te Tawhirohiro me te Rorohi

Exhibits in this theme address specific learning intentions relating to the following:
- conversion of linear movement into rotational movement; rotation; pendulums; gears and cogs; centripetal forces; angular momentum; friction; and, centre of mass.

Exhibits include:
- Air Muscles
- Gearing
- Rotating Chair
- Weird Wheels
- Bones on a Bike
- Local Gravity
- Rotating Table
- Zozotrope
- Chaotic Pendulum
- Loop the loop
- Uphill Roller

Contexts — Movement, Motion, Rotational movement

Key School Journal References: Friction Article 1999 Pt CN No. 2 Pgs 16-19; ANDERSON, K.E. Make a spinner Article 1999 Pt CN No. 1 Pgs 6-7; BUXTON, Jane; The Wall of Death Article 5 1993 Pt 04 No. 2 Pgs 40-44; MEDCALF, John; Watching the world go round Article 5 1978 Pt 04 No. 2 Pgs 34-35; ROBERTS, F. Neil.
Shows

While being exciting and entertaining, our shows provide a great opportunity to enhance student knowledge in two science areas each year. The shows for 2018 are *Am I Living?*, all about what constitutes ‘life’ (with specific reference to humans), and the *Fire and Ice* show, focusing on temperature and combustion.

To assist you in preparing for your visit, we've developed a unit plan called Biodiversity bioblitz — found in this book — that complements the *Am I Living?* show and the exhibit thematic Ecology and Environment.

If time permits within your classroom programme, you may like to use notes from the *Fire and Ice* show outlined below to develop your own pre- and post-visit unit to complement that show.

**Am I Living? — *Kei te Ora Ahau?***

This show covers specific learning outcomes relating to characteristics of living things, including the following. Humans and other animals:

- move, using muscles in combination with a skeleton
- breathe (or respire), using lungs
- are sensitive to their environment, using sense organs like eyes and ears
- grow, in predictable ways
- reproduce, producing on average more offspring than is needed to replace the parents
- excrete, producing waste products like urine
- feed (undergo nutrition), taking in food and processing it for energy and building blocks.

**Fire and Ice — *Te Ahi me te Tio***

This demonstration covers specific learning outcomes relating to chemical and physical change including the following:

- hot and cold
- boiling and freezing
- how things burn
- physical changes of melting and freezing
- fuels and heat sources
- the importance of oxygen in combustion
- chemical changes with combustion.

---

**Key School Journal References:**

- Bendy bones Article 2000 Pt CN No. 3 Pgs 20-21,
  VAUGHAN, Marcia. *Blood in the bank* Article 6 1987 Pt 04 No. 1 Pgs 20-24,
  KEIR, Bill. *Bones on the mend* Article 3 2001 Pt JJ No. 23 Pgs 6-12,
  GOULD, Margaret. *Filling a tooth* Article 4 1983 Pt 02 No. 3 Pgs 9-15,
  THOMSON, Jane. *Mighty muscles* Article 5 2011 Pt 01 No. 2 26-31,
  GIBBISON, Sue. *Sleep tight* Article 4 2001 Pt 02 No. 1 Pgs 20-23,
  HILL, David. *At the glass factory*, by SOUTHGATE, Brent, 8-9 years, Pt 03 No. 3 1979 Pgs 38-45,
  BenN, Ken, CN No. 1 2010 28-32,
  Article; Investigating insulation, by HINCHCO, Selena, CN No. 1 2010 23-27, Article;
  It’s snowing - again! by PYE MARRY, Jan, 8.5-9.5 years, Pt 02 No. 2 2006 13-18, Article;
  it’s snowing - again! by PYE MARRY, Jan, 8.5-9.5 years, Pt 02 No. 2 2006 13-18, Article;
  Strange white world, by CARTWRIGHT, Pauline, CN No. 2 1999 Pgs 2-4, Article;
  Warming up, cooling down, by WALL, Bronwen, CN No. 1 2010 2-13, Article.

---

**Key ‘Building Science Concepts’ references:**

- Book 39 *Is This an Animal?: Introducing the Animal Kingdom* L1-4.

---

**General Learning Outcomes relating to Shows**

After attending the shows students will have improved:

- interest and enthusiasm understanding and knowledge of scientific and technological principles and processes
- greater understanding of the Nature of Science and Science Capabilities.
Answers to pages 3–14

**Planet naming** page 3
Saturn, Mars, Venus, Earth, Jupiter, Sun (our local star), Neptune, Mercury, Uranus. (Sun is the bottom right picture; Uranus is bottom left picture, Neptune is middle right. All the rest are easily named.) URANUS (Discoverer: William Herschel), NEPTUNE (John Adams).

**Bird names** page 4
Bird names (Māori names in brackets. Note: It could be argued that these are also the ‘common’ names): tui, bellbird (korimako), morepork (ruru), black-backed gull (kororo), pukeko, kea, yellow-eyed pigeon (hoiho), fantail (piwakawaka). Answer: INDIGENOUS.

**Crack the code!** page 5
When we write about our science we try to be clear about what we say. We try to:

- Be logical [swapped words]
- Be clear [letter sequence in whole phrase is reversed, but letters till facing the correct way]
- Write things in a step-by-step order [letters replaced by numerals]
- Use as few words as possible [mirror image phrase]
- Use facts and avoid emotions [letters and spaces squared up]
- Use technical language [first and last letters of each word are the same, but other letters within them are mixed up]
- Avoid using personal pronouns like ‘I’ and ‘we’ [most vowels left out]
- And, spell things correctly, tee-heel [words misspelt].

**Mirror image mania!** page 6
Missing word: reflected.

**Mystery sound tiles** page 7
2) low volume, 3) echo, 4) mid frequency, 5) flat note, 6) vibration, 7) microphone, 8) sound wave, 9) middle C, 10) rock music, 11) eardrum.

**Move it!** page 8

<table>
<thead>
<tr>
<th>Wire</th>
<th>Pulls</th>
<th>Elastic</th>
<th>SPINNING</th>
<th>VELOCITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>•</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mystery words: DRAG, PULLS, SPINNING, VELOCITY.

**Orrery mobile** page 9
2. a) Spin the Sun while holding the Earth and Moon still. b) Using the long kebab stick, move the Earth around the Sun, c) d) and e) Hold the long kebab stick still and spin the Earth. As a result, the Moon will orbit the Earth and the same side of the Moon will always face Earth. 3. a) Solar eclipse: the Moon moves between the Sun and Earth, blocking sunlight from reaching parts of the Earth. b) Lunar eclipse: The Moon moves into the shade that the Earth creates. 4. The relative positions of Sun, Earth and Moon, their orbits, how all of them spin on their axes. 5. There are no ‘things’ like strings and swirls in space; the relative sizes and distances are not correct; the Earth’s and the Moon’s orbits are elliptical, not circular; the moon does not orbit Earth in the same time that Earth rotates on its axis.

**Food for compost worms** page 10
Challenge 2: Tests should be repeated at least two or three times, or, the same tests could be performed by different groups and the results pooled. Challenge 3: The end results might look something like:

Most preferred: Least preferred
- carrot
- apple
- lettuce
- tea leaves
- coffee grounds
- bread
- lemons/citrus
- onions

The most preferred foods above would be recommended for any wormery. The least preferred should be avoided. Similarly, for greatest commercial production, use the preferred foods.

**Creating a force meter** page 11
Challenge 1: Measuring pushes When pushing against a heavier object, the rubber band will deflect more. Rougher surfaces will create more friction, so the rubber band will deflect more. Measuring pulls Create a hook and attach it to the middle of both sides of the rubber band. Use this to pull objects along and find how much the rubber band stretches. Challenge 2: For tiny forces Using a thinner rubber band makes the meter more sensitive. For larger forces Using a thicker rubber band makes the meter less sensitive. Be careful not to use too thick a rubber band, as this will cause your force meter to collapse. For much bigger forces Make a similar force meter out of wood or metal and use thicker rubber bands. Challenge 3: Calibration Place an object (e.g. a lead fishing sinker) onto electronic scales and find their weights. Hang the same objects on your scales and draw lines to where the rubber band stretches, then add numbers to show the weights measured. Note, to measure force in Newtons (N) and not weight, use this approximate conversion: 100 g = 1 N (or 1000 g = 10 N).

**Reflection of UV light** page 12
Challenge 1: Cloudless day They change colour quickly when pointed at the sun, and barely at all when pointed away from or at right angles to the sun. Bright cloudy day They change colours fairly quickly no matter which direction they are pointed because clouds scatter the UV light in all directions. Challenge 2: Expose the beans to sunlight, then when fully coloured, select the colours you want. Perform fair tests by pointing a meter with (say) purple beads and a meter with (say) yellow beads at the sun at the same time and seeing which changes more quickly. The colour that changes quickest is most sensitive and therefore useful for experiments on a dull day, while the one that changes slowest is better for a bright day. For a fair test, both meters need the same coloured beads. Challenge 3: Pointing your meter at reflective surfaces like a light-coloured wall or white sand will show that some UV light reflects off these, which could reach Connor under the shelter. Similarly, if there were some cloud, UV could be reflected off them and under the shelter.

**Coathanger clanger** page 13
3) A bell-like ringing sound. Metal objects result in a clearer ringing sound. Softer materials like plastic, wood and rubber create a duller ring. 4) a) Plastic Duller ring. b) Wire An even clearer ringing sound. Elastic The dullest ring. 5. Inferences Harder objects and materials make a brighter, clearer sound. Softer ones make a duller sound. 6. Examples: Same length of hanging wire/string/elastic; hit the coathanger with the stick, move the Earth around the Sun. c) d) and e) Hold the long coathanger stick still and spin the Earth. As a result, the Moon will orbit the Earth and the same side of the Moon will always face Earth. 3. a) Solar eclipse: the Moon moves between the Sun and Earth, blocking sunlight from reaching parts of the Earth. b) Lunar eclipse: The Moon moves into the shade that the Earth creates. 4. The relative positions of Sun, Earth and Moon, their orbits, how all of them spin on their axes. 5. There are no ‘things’ like strings and swirls in space; the relative sizes and distances are not correct; the Earth’s and the Moon’s orbits are elliptical, not circular; the moon does not orbit Earth in the same time that Earth rotates on its axis.

**Solar buggy** page 14
2) In bright sunshine (at midday in mid-summer). Inference The brightest light conditions generates the most electricity, the duller the least. 3) Answers will vary. 4) Yes. Evidence Adding reflected light results in the buggy travelling further in 5 second trials. 5) By using shade and/or reflected light. 6) About 20° to the horizontal. Any steeper and the buggy flips backwards.
The Sir Paul Callaghan Science Academy runs intensive, four day professional development programmes that aim to build excellence in the teaching of science. Our vision is to create primary and intermediate teachers who celebrate science and inspire their students to explore and engage with the world through science.

www.scienceacademy.co.nz

“\You don’t need to teach a child curiosity. Curiosity is innate. You just have to be careful not to squash it. This is the challenge for the teacher — to foster and guide that curiosity.\”

Sir Paul Callaghan

The Academy Programme
A variety of excellent facilitators present the Academy programme. It is insightful, dynamic and interactive, as well as practical and hands-on, bringing a variety of best practice techniques and experiences to the fore. The following is a snapshot of some key themes that will be the focus over the four days:

- Learn how to target all types of learners by developing practical investigations that will stimulate all the senses.
- Introduce more science to other areas of your teaching.
- Unit selection and planning.
- Investigate the cultural differences in learning styles and how teaching can be adapted to meet the needs of all learners.
- Discover that you don’t need to be an expert in science to teach science well.
- Being a Science Champion within your school or area and inspiring science learning in all classrooms.

The National Science-Technology Roadshow Trust
“Providing quality interactive learning experiences in science, technology and innovation to Aotearoa, New Zealand.”

We specialise in developing and delivering nationally, quality science, innovation and technology education programmes and exhibitions for students, teachers and their wider communities.