MINISTRY OF EDUCATION
TE TĀHUHU O TE MĀTAURANGA

A learning from home pack

For learners in years 9–10

Theme: Change | Panoni – Is change a good thing?

Context 1: Adaptations

Context 2: Innovation – can I make a better ...?

Layout of the resource

This pack is filled with learning activities that can be used at school or at home. All activities are framed around the theme of change | panoni.

Suggestions are provided for starting the day with a karakia (see p. 8), check in with the teacher, and setting up the learning environment. You can replace these with how you want your learner to start their day. The pack is provided as a Word document so you can adapt it for your learners.

The activities follow an inquiry learning model (figure 1) exploring one theme through two contexts. Each day the learner will be work through one part of the model culminating with sharing their learning on days five and ten.

Figure 1 Inquiry learning model

Realities

You know your learners and have a good understanding of their learning situations. Many learners will be sharing space and materials. Some may have access to the internet and devices, and others may not. Learners will also have varying levels of adult support. This pack contains a mix of activities using materials found in most homes. Some activities will need support while others can be managed independently.

Resources

This pack uses resources from the Science Learning Hub. We would like to acknowledge their contribution.

You might want to send an exercise book home with the learner that they can bring back to class to share.

For learners without reliable internet access print and send home these resources to create a paper-based pack.

Resources to print/send home

- https://nzmaths.co.nz/resource/hypothermia
- https://nzmaths.co.nz/sites/default/files/NapiersBones.pdf
- https://instructionalseries.tki.org.nz/Instructional-Series/School-Journal/School-Journal-Level-2-September-2014/Poha-A-Clever-Way-of-Storing-Food
- https://instructionalseries.tki.org.nz/Instructional-Series/School-Journal/School-Journal-Level-4-May-2021/Reducing-our-Footprint
- https://nzmaths.co.nz/sites/default/files/SavingPower.pdf
- https://instructionalseries.tki.org.nz/Instructional-Series/Connected/Connected-2018-Level-4-Digital-Space/Emotional-Robots (Emotional Robots google slides print p. 1-3)
- https://instructionalseries.tki.org.nz/Instructional-Series/Connected/Connected-2018-Level-4-Digital-Space/Saving-the-World-One-Swipe-at-a-Time (Saving the world google slides print p. 2-3)
- https://nzmaths.co.nz/resource/inventive-thinkers
- Graph paper
- Exercise book
- Any stationery and craft materials

Setting up the learning environment

Encourage whānau to support learners to set up a space for learning at home. Learners might like to design their own space as a separate learning activity. Some materials they may need could include pen, pencils, paper, a notebook, colouring pencils, glue, scissors, and a device to access the internet.

Many of the suggested activities and experiences include the optional use of online resources which can be accessed and viewed using a Smartphone.

Overview of the learning in this pack

The theme of **change | panoni** will be explored through two contexts.

- Days 1–5 look at this idea through the context of **adaptation.**
- Days 6–10 look at this idea through the context of **innovation – can I make a better …?**

Learners will explore, investigate, discover, and make meaning as they go through each task. There are times where they look a little deeper into the topic. Some of the tasks may be independent hands-on tasks while some may involve connecting and sharing with others.

Day 1	Day 2	Day 3	Day 4	Day 5
Launching our learning about living things and how they adapt to their environments.	**Exploring** natural selection and the three types of adaptations.	**Making meaning** about the three types of adaptations and how they enable organisms to survive in harsh environments.	**Going deeper** into adaptations by applying critical thinking as we investigate artificial selection and genetics.	**Sharing our learning** as we create and innovate, applying our learning around the concept of change.
Day 6	**Day 7**	**Day 8**	**Day 9**	**Day 10**
Launching our learning about the concepts of innovation and invention.	**Exploring** different ways in which traditional practices responded to different needs through integrating innovative thinking and non-traditional materials.	**Making meaning** about different innovations that are helping humans reduce their impact on the environment	**Going deeper** by looking at advancements in digital technologies, how they have become a part of our lives and the impact they have on us personally and as a society	**Sharing our learning** by choosing an aspect from the week they would like to highlight through creating a design brief and prototype.

Daily timetable

Below is a possible daily timetable. We have allocated 30 minutes for each activity; your learner may take more or less time than this for an activity. We suggest your learner takes the time they need to complete an activity. This may mean they choose which activities they will complete for the day, rather than complete them all.

At the start of each day the learner will draw up their timetable for learning. You can adjust the timing to suit the other activities that might be happening throughout the day, such as Zooming with the class/teacher.

Time	Activity
9:00 am	Starting the day
9:30 am	Activity 1
10:00 am	Break
10:30 am	Activity 2
11:00 am	Fitness break
11:30 am	Activity 3
12:00 pm	Lunch time
1:00 pm	Activity 4
1:30 pm	Reflection time
2:00 pm	End of the school day

Daily fitness – Choose something each day

Please ensure that your learner includes fitness in their daily timetable. If possible, it would be great to do the fitness activity with your learner or have them complete it with others. Below are activities to choose from – or you can make up your own ideas!

> Tama Tū, Tama Ora; Tama Noho, Tama Mate.
> Through physical activity we thrive. Through inactivity we languish.

Your learner may prefer to go for a walk or run around your house. They could time themselves for fun! Maybe they'd like to go for a bike ride? Play a game with whānau? Have a boogie to a favourite song? Or do some yoga? It is up to you, just get active!

Please note you can change or modify the exercises (in addition to those suggested) if you are not able to do the ones we have suggested, get creative and change it up

Weekly fitness tracker

Keep daily track of your fitness. Can you improve your own record over time? Do as many repetitions of each exercise as you can. Count them and record below each day this week.

	# forward lunges	# high kicks	# push ups	# sit ups	# jump squats
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					

Playing Card Fitness

PULL a card from the deck of cards

The **suit** (♠ ♡ ♣ ♢) tells you how many repetitions to do.

The **number** of the card (or jack, queen, king) tells you what activity to do.

♠ 10 times ♡ 5 times ♣ 3 times ♢ 2 times

Ace – burpee	5 – push ups	9 – lunges
2 – walk on the spot	6 – arm circles	10 – squats
3 – sets of star kicks	7 – glute bridge lifts	Jack – high knees
4 – side plank lifts	8 – sit ups / crunches	Queen – star jumps
King, any suit – run or walk around your section while you count to 100		

Mahuru Dance

Go to https://music.youtube.com/watch?v=-BrdaUUTMBY&feature=share and watch Pere Wihongi sing Mahuru (earth Wind and Fire's song 'September' in Te reo Māori). Practice singing it in te reo and then make up a short dance or fitness routine. Maybe you have to jump up every time you 'Mahuru'? Maybe you have to squat every time you hear 'korero Māori'? Have fun with it and move your body!

Role of dice workout

One die represents an exercise and the other, the number of repetitions.

ROLL your die then DO the exercise represented on your first die.

1	1 x 30 superman pose
2	2 x burpees
3	3 x squats
4	4 x crab walk steps
5	5 x crunches
6	6 x push ups

Dice fitness (complements the offline activity)

- https://www.youtube.com/watch?v=lS5OlT7eMYc or https://www.youtube.com/watch?v=l61ZO9Qxoao

Go for a Power Walk

Power walking is an exercise technique that focuses on your speed as well as how you move your arms. Power walking can really increase your overall fitness as it will increase your cardiovascular health over time and is easy on your joints. It will also improve your emotional wellbeing.

- Keep your eyes forward, shoulders back, and head upright.
- Tuck your tummy toward your spine as this will engage your core muscles.
- Try to keep relaxed and maintain good posture as you gently swing your arms by keeping them bent at a 90–degree angle.
- Your opposite arm and leg should be moving forward e.g. if your right foot is stepping forward, your left arm is swinging forward.
- With each step ensure that your foot lands on the heel and then roll your foot forward towards your toes.
- Increase your pace as you become more comfortable and have fun!

Daily wellbeing – Choose something each day

These activities are good to do at the beginning and end of the day but can be done anytime. They can help you get ready for learning, calm your mind and body, and can help you to reflect on your learning.

Hikitia te hā

This is a series of simple te ao Māori breathing exercises that anyone can learn. Focusing on our breathing calms the body and mind and is a very helpful practice for feeling more present and mindful. Hikitia Te Hā was developed by Rawiri Hindle.

Go to the website and follow along to the videos.
https://www.allright.org.nz/tools/hikitia-te-ha

Drawing to music

Choose a favourite song (either one that you can listen to while you draw, or one that you already know off by heart)

Spend some time thinking about what aspect of the song you want to communicate through your drawing and dance. Do the lyrics tell a story or is it the music (beat, rhythm, melody) that you want to portray?

Think about the colours, shapes, lines, and moves as you think about how to translate your chosen song into picture form.

Describe the whole feel of the song or a certain line/verse that you connect with.

Create an A–Z of self-care

What can you do to look after yourself today? Make an A–Z list. E**.g.**

A is for acknowledging how I feel

B is for belly breathing

C is for choosing healthy foods to eat

D is for drinking lots of water

E if for ....

Social and emotional wellbeing check-in

Consider doing a wellbeing self-check with your learner at the start of each day.

Checking in on how we feel is an important way to start the day.

Your learner could start the day by thinking about these questions and writing their thoughts in their reflective journal section of your notebook:

- How are you feeling today?
- How do you feel about your readiness to learn this morning?
- What do you need extra assistance with today? Who could you get to help you? What strategies could you put in place to help you make your learning more effective?
- What do you need to finish today from yesterday?
- What would you like to do as a quiet time activity to end your day?

Starting each day

Notes for teachers and whānau:

Starting the same way each day helps create a structure for your learner. Your school might have your own way to do this, for example starting the day together as a class on Zoom. In this pack we provide a karakia to settle into the day. Saying the karakia with your ***learner*** *a few times will help them be able to do this more independently tomorrow and beyond. As part of the start of the day and setting up the learning environment, help your learner look through the activities suggested for that day* ***and choose a fitness and wellbeing activity****. They could fill out their daily timetable and think of other activities they might like to do, like reading****.***

Remind your learner of when and how to check in with the teacher/you.

Karakia

Here is a karakia to welcome in the day

Whakataka Te Hau: Karakia video – https://www.youtube.com/watch?v=_uQqIGt3H2w

Whakataka te hau ki te uru, Whakataka te hau ki te tonga. Kia mākinakina ki uta, Kia mātaratara ki tai. E hī ake ana te atākura he tio, he huka, he hauhunga. Haumi e! Hui e! Tāiki e!	The wind swings to the west then turns into a southerly. making it prickly cold inland, and piercingly cold on the coast. May the dawn rise red-tipped on ice, on snow, on frost. Join! Gather! Intertwine!

Planning my day

- Have you chosen which activities you will do today and in which order?
- Remember to choose a fitness activity (See p. 5-6)
- Have you chosen a wellbeing activity? (See p. 7)
- Have you done a ‘Wellbeing check-in’?
    - How are you feeling today?
    - How do you feel about your readiness to learn this morning?
    - What do you need extra assistance with today? Who could you get to help you? What strategies could you use to help make your learning more effective?
    - What would you like to do as a quiet time activity to end your day?
- Remember to do your Reflection at the end of the day (see p. 9)

Ending each day

Please ensure your learner does this at the end of each day.

Reflection can be challenging for all learners, but it can also provide them with rich opportunities to think about how their learning is progressing. Use the questions below as prompts to encourage your learner to think about what they have learned so far and help them to plan out their next steps. If you have concerns with their learning or find that your learner is needing more help, contact their teacher for more support.

I am learning to: Reflect on my learning.

What do I need?

- A notebook or online doc that you can use each day for your reflection activity. We will call this your “reflective journal”
- Materials for your quiet time activity

Take some time to think about how you are feeling and after today’s learning activities.

Reflect on the following prompts in your reflective journal.

- What did you enjoy most about today?
- What is one thing you feel you learnt today?
- What is one strategy that helped you with your learning?
- What did you find challenging or distracting? (You ran out of time for some activities, or you finished them quite quickly and wanted to dig in a little deeper.)
- Is there anything you need extra help with? Who can you ask to help you with that?
- Is there anything you want to catch up on tomorrow?

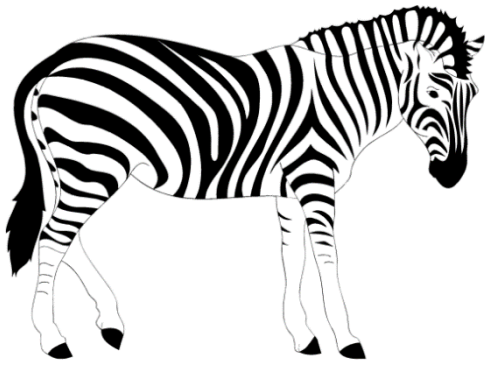
Remember to finish with a wellbeing activity and/or your chosen quiet time activity.

Context 1: Adaptation

The next five days investigate the theme of change by looking at adaptations – animals and humans.

Adaptations

Change | Panoni



Day 1 activity 1: Inquiry getting started

Notes for teachers and whānau

This activity introduces learners to the broader concept of change and how adaptation is a part of it.

Note that our Inquiry focus for today is "getting started" which includes generating questions, activating prior knowledge, and introducing the theme.

I am learning to: identify the ways in which living things respond to the changes in their environment.

What do I need?

- 30 minutes
- Access to a device to watch the *Living things change* video (or transcript below) https://www.youtube.com/watch?v=xDSFlRunlrU
- Materials for recording your responses (exercise book or an online document)

Instructions:

Watch or **read**, *living things change* and complete the tasks that follow.

Living things change!

Hopefully by now you realize that our world is always changing. Landforms change, weather changes, even molecules change. With all of that change going on, living things, had better be able to keep up.

And they do.

When the world around them changes, living things change too. Sometimes in a big way. So, what can happen to living things when the world around them changes? If you think about pineapples, they are picky because they only grow in lovely, lush tropical climates. No pineapples at the poles, right? That's because the environment in the tropics is perfect for growing pineapples.

An environment is made up of the conditions around the living thing. Now that might sound kind of like the definition of the word **Ecosystem**, but the word environment is usually used to talk about non-living things in an ecosystem, like temperature, or the amount of rain, or even how much pollution there is.

So, while the environment at the poles isn't great for growing pineapples, it suits other living things just fine, like penguins in Antarctica, and polar bears at the North Pole. If we put these animals into a pineapple field, they'd get pretty hot and unhappy. That's because they have adaptations for the cold, and adaptation is a **characteristic** that helps an organism live in its environment.

But sometimes when an environment changes, it upsets the delicate balance of the food chains in an ecosystem. For example, about 360,000,000 years ago the Earth looked a lot different than it does now. It was much warmer, and the land was covered with lots of forests and swamps. There were centipedes that were 2 m long, **amphibians** over 6 m long, and dragonflies larger than birds. Clearly, none of these creatures are still around. So, what happened? The environment changed.

Over several million years, the **climate** became dryer and cooler, and many plants didn't have adaptations that helped them to survive in this new, cool, dry environment. So they became extinct, and that was a problem.

Plants are at the bottom of the food chain. They make chemical energy through **photosynthesis**, and release oxygen. All of those plants made lots of oxygen. There was more oxygen in the Earth's atmosphere then than there is now. Enough to support all of those giant insects, so when the plants became **extinct**, the animals that depended on all of that oxygen could no longer survive.

Let's look at how **adaptations** can help a living thing fit into its environment using an insect. Meet the peppered moth. Cute right? And it comes in two types, light and dark. As you can probably tell, the dark coloured moths are a lot easier to see when they're resting on trees, and easier to see means more likely to become snacks for birds and other predators. That means the light moths have an adaptation that helps them live in their environment.

So, if we went through the woods looking for moths, we would expect to catch more dark moths than light ones. Now what would happen if the environment changed?

It did, true story!

A couple 100 years ago people started burning a lot of coal for fuel and this made a lot of pollution which coated the trees, turning them dark with soot and dirt. The dark moths had the adaptation that helped them fit into the environment, they blended in with the trees which were now dark too. The moths that were lighter though, not so lucky. In the polluted environment they couldn't blend in as well, so they got eaten more often than the dark moths. The dark moths reproduced to make more dark moths. The results? After the environment had been polluted for a long time there were more dark than light moths.

Fortunately, we've gotten a lot smarter about pollution. Over the last 50 years the environment has changed to be less polluted, and the trees aren't covered with dark dirt anymore. What do you think will happen to the moth population now?

All living things have characteristics that help them fit into their environment called adaptations. If the environment – the conditions in which something lives – changes, then the living things change too. The living things might gain different adaptations that help them survive in the new environment, or the result might be more **severe** and affect the whole **food chain**.

Your task:

Use the text to complete the following tasks.

1. Change can be both visible and invisible (or not easily seen by the naked eye). Give one example for each from the text above.
2. What is the difference between an **environment** and an **ecosystem**?
3. What are two reasons that the dark peppered moth numbers increased more than the light peppered moth numbers?
4. Think critically – what is a different kind of environmental change that could cause the dark and light peppered moths to need to adapt again?

Optional digital: https://askabiologist.asu.edu/peppered-moths-game/

Day 1 activity 2: What is adaptation?

Notes for teachers and whānau

In this activity learners focus in on specific types of adaptations and how these help organisms to survive individually and as a species. There may be new terms used in this task that the learner may be unfamiliar with. In this case, it is important they find the meanings of these words and understand how they fit into the context of the task.

I am learning to: identify 3 main types of adaptations and understand how they contribute to an organism's survival.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Instructions:

Read about the different types of adaptations then complete the tasks that follow.

Types of adaptations

An adaptation is a feature of an organism that gives it some benefit or advantage that could help it build a shelter, find, and hunt for food, protect itself or compete against others for mates, food, and resources. Organisms are generally well adapted to the environments in which they live. These adaptations are a result of the genes inherited from its parents and increase their chances of survival and reproduction.

Behavioural	***Physiological***	***Structural/Physical***
The way an animal acts or behaves to improve its chances of survival and reproduction.	A body process that helps an organism to survive/reproduce.	A physical feature of an organism's body or structure that helps it to survive/reproduce.

Your task:

Think about the examples of different organisms using their adaptations, then identify which category each example fits into by ticking the corresponding column.

Add another example for each of the columns.

Example of animal/plant adaptation	**Behavioural**	**Physiological**	**Structural**
Birds flying north for the winter			
Hedgehog rolling into a ball when frightened			
Horns growing on a bull			
Brightly coloured flowers			
Elephants travelling in herds			
Cows producing milk			
Snails retracting into their shells			

Day 1 activity 3: “What’s that word...?”

Notes for teachers and whānau

This activity is designed to introduce the learner to the range of vocabulary they will encounter over the week. Some of these words and terms may be new to the learner. Therefore they should be encouraged to become familiar with their definitions and how they fit into the context of the unit, by creating a glossary and/or using a dictionary.

I am learning to: identify and understand topic words that are related to the concept of adaptation.

What do I need?

- 30 minutes
- A dictionary (can be an online version)
- Materials for recording your responses (exercise book or an online document)
- Graph paper to use as the base for the crossword puzzle

Instructions:

In this activity you will use all of the words in **bold** lettering from Activity 1. Compile these words into a list and then complete the task that follows. You may even want to add in any words that are new to you, or ones that you do not fully understand yet.

Your task:

Design a crossword puzzle using the word list you have compiled.

1. Start with making a clue set from the list of the words you compiled. The key to designing good clues is to keep it short and not too obvious (too easy or putting the answer in the question). The first one is done for you as an example.

**Tip*: using synonyms or antonyms is another clever way of designing clues for a crossword puzzle. Just don’t overuse this strategy!*

Crossword answer (new word/term)	**Crossword clue**
Severe	Something that is very bad or critical
Ecosystem	

Continue this list yourself, either in your book or online document.

2. Use the grid below to map out where and how your answers (the words from your compiled list) could be placed as a crossword. Remember that crossword puzzles have both a *Down* and *Across* category – try and make sure you have a balanced set for each side.

Tip*: **All words **must** connect. You can’t have words out on their own.*

3. Don’t forget to give your crossword puzzle a title.

Day 1 activity 4: “Hot dogs”

Notes for teachers and whānau

The following activity is designed for learners to practice using formulae related to calculating surface area and volume, to problem solve.

I am learning to: select and use appropriate metric units for length, area, volume, and capacity.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Instructions:

Read through the questions carefully and complete the tasks in the following worksheets. Remember to ask for assistance if you don’t fully understand the task.

Your task:

Jacinta read that a small dog nearly died of overheating after being left in a hot car for 15 minutes. She knew that all mammals lose heat into the air on cold days and gain heat from the air on hot days. They do this through their skin. She wondered if a small dog was more in danger of overheating that a large one.

1. She made a small ‘dog’ with multilink cubes

Her dog had a volume of 8 cubes. She worked out its surface area by counting the faces of the cubes exposed to the air. Look at Jacinta’s dog and work out its surface area.

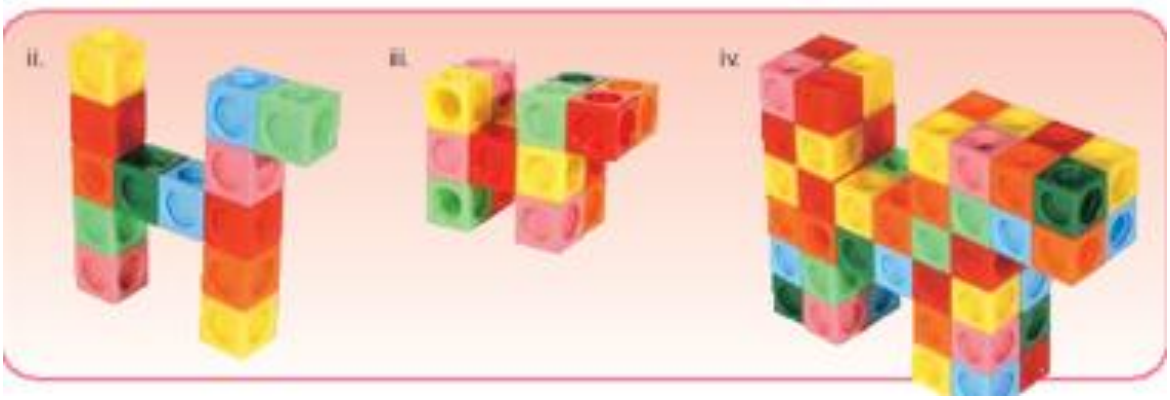
2. Jacinta decided to build some bigger dogs.

She wondered what would happen to their surface area as the volume increased.

She began a table to record her results.

Dog	Volume in cubes	Surface area (number of exposed cube faces)	Ratio of surface area to volume (to 2 decimal places)	
I	8		34 : 8	4.25 : 1
ii				

Here are Jacinta's next three dogs:



A. Copy Jacinta's table. Count the number of cubes and faces for each dog and enter this information into the table.
B. For each dog, calculate the ratio of surface area to volume. So that the ratios can be compared, make the volume 1 in each case.
C. What do you notice about the relationship between the surface area of a dog and its volume?
D. Give a reason why small dogs are more in danger of overheating than large dogs.

Extra if you are interested: You might want to do some investigation about hypothermia. What conditions make it a danger? Are some people more at risk of hyperthermia than others? How can people protect themselves from it.?

Remember to do your end of day reflection and wellbeing activities (see p. 7&9).

Day 2 activity 1: "Survival of the fittest" – Natural Selection

Notes for teachers and whānau

Learners will explore the Darwinian theory of "Natural Selection" and how it relates to an organism's survival. This may be new to them, so you may need to discuss the concept and talk through any queries they have.

Note that our Inquiry focus for today is "explore, investigate, and discover" which includes choosing and evaluating information, and thinking critically.

I am learning to: relate how an organism is able to survive and reproduce due to their inherited traits.

What do I need?

- 30 minutes
- *Darwin's theory of natural selection* video (or transcript below) https://www.sciencelearn.org.nz/videos/1199-darwin-s-theory-of-natural-selection
- Materials for recording your responses (exercise book or an online document)

Remember to start your day right (see p. 8).

Instructions:

Watch or **read** *Darwin's theory of natural selection*, then complete the tasks below.

Read the following short presentation by Sir Paul Nurse

I want to talk about evolution by natural selection. So where did this come about? Well, it came about because of this Victorian gentlemen here, Charles Darwin. Now Darwin had two ideas: that evolution took place, and that it took place by natural selection.

The first of those ideas was not his. It actually has its origins with the ancient Greeks who talk a little bit about evolution. Early church fathers like Augustine argued a lot about evolution. And most interestingly for this talk, Charles' grandfather, Erasmus Darwin, 70 years before was a great **advocate** of evolution. Charles then did not invent the idea of evolution. What he did do was **marshal together** a huge amount of data, particularly on fossils, to indicate that he thought evolution had taken place.

Secondly, and most importantly, he proposed the idea of natural selection – evolution by natural selection. So he provided a **mechanism**, a very powerful mechanism, for how life could actually evolve. And to think about that, I'm going to define the properties of life that are needed for natural selection to take place. There are three. The first is that life must reproduce.

Thirdly, life has a **hereditary** system whereby information defining how that living organism works is copied or inherited during the reproductive process.

Lastly, that hereditary system must **exhibit** some variability. And it's that **variability** upon which natural selection can work – because the clever idea about natural selection is that those organisms which are most successful because they have genetic variations that make them successful, will breed better and provide more offspring to the next generation. So, the population, the next generation's population, is more likely to have those **favourable** varieties represented at a higher level. So gradually the **composition** of the population will change. That leads to evolutionary change, and eventually to the **formation** of **species**.

Your task:

Vocabulary: This text has a number of context specific words (jargon). These have been made **bold** in the text to draw your attention to them for this task.

1. For any of the **bolded** words that are new or unfamiliar, add them to your glossary, then try and write the definition in your own words.

Answer the following questions:

1. What are the three properties of life that are needed for natural selection to take place?
2. What does **hereditary** mean? What properties or characteristics can humans pass on through hereditary? Give two examples.
3. According to Darwin's theory, what properties or genetic traits are more likely to be passed on to the next generation?

Let's get curious!

There are a number of animals that have been interbred by humans to 'create' new animals, like the Liger and the Tion. However, these breeds are not considered "subspecies". Why not?

Day 2 activity 2: Adaptations and the Plant Kingdom

Notes for teachers and whānau

The following activity branches off to look at how other organisms, such as plants, use adaptations to defend themselves.

I am learning to: identify different ways that plants use adaptations to defend themselves.

What do I need?

- 30 minutes
- *The amazing way plants defend themselves* video (or transcript below) https://www.youtube.com/watch?v=Hja0SLs2kus&t=32s
- Materials for recording your responses (exercise book or an online document)

Instructions:

Watch or read '*The amazing way plants defend themselves'*.

Unlike animals, plants do not have the ability to move (note: some plants can position themselves closer to the sun, their energy source), nor the physical structures such as teeth or claws to defend themselves. However, plants are not defenceless. Plants have a range of adaptations that help deter other animals from making them into food as well as using animals to help the survival of the species by spreading their seeds.

The amazing way plants defend themselves
By Valentin Hammoudi

This aphid is slowly killing the tomato plant by sucking the juice out of its leaves. The plant is putting up a fight using physical and chemical defences to repel the attack. But that's not all. The tomato is also releasing compounds that signal nearby tomato plants to release their own insect repellent.

Plants are constantly under attack. They face threats ranging from **microscopic** fungi and bacteria to small **herbivores** like aphids and caterpillars, up to large herbivores like tortoises and elephants. All are looking to devour plants to access the plentiful nutrients and water in their leaves, stems, fruits, and seeds. But plants are ready with a series of internal and external defences that make them a less appealing meal or even a deadly one.

Plants defences start at their surface.
The bark covering tree trunks is full of lignin, a rigid web of compounds that's tough to chew and is highly **impermeable** to **pathogens**. Leaves are protected by a waxy **cuticle** that **deters** insects and **microbes**. Some plants go a step further with painful structures to warn would-be predators. Thorns, spines, and prickles discourage bigger herbivores. To deal with smaller pests, some plant leaves have sharp hair like structures called trichomes. The kidney bean plant has tiny hooks to stab the feet of bed bugs and other insects. In some species, trichomes dispense chemical **irritants**. Stinging nettles release a mixture of histamine and other toxins that cause pain and inflammation when touched.

For other plant species, the pain comes after a herbivores first bite. Spinach, kiwifruit, fuchsia, pineapple, and rhubarb all produce microscopic needle shaped crystals called raphides. They can cause tiny wounds in the inside of animal's mouths, which create entry points for toxins.

The mimosa plant has a strategy designed to prevent herbivores from taking a bite at all.

Specialized mechano-receptor cells detect touch and shoot an electrical signal through the leaflet to its base, causing cells there to release charged particles. The build-up of charge draws water out of the cells, and they shrivel, pulling the leaflet closed, the movement scares insects away and the shrunken leaves look less appealing to larger animals. If these external defences are **breached**, the plant immune system springs into action. Plants don't have a separate immune system like animals, instead, every cell has the ability to detect and defend against invaders. Specialised **receptors** can recognize molecules that signal the presence of dangerous microbes or insects. In response, the immune system initiates a battery of defensive manoeuvres. To prevent more pathogens from making their way inside, the waxy cuticle thickens, and cell walls get stronger. Guard cells seal up pores in the leaves and if microbes are devouring one part of the plant, the cells can self-destruct to quarantine the infection.

Compounds toxic to microbes and insects are also produced, often tailor made for a specific threat. Many of the plant molecules that humans have adopted as drugs, medicines, and seasonings, evolved as part of plants immune systems because they're antimicrobial or **insecticidal**.

An area of a plant under attack can alert other regions using hormones, airborne compounds, or even electrical signals. When other parts of the plant detect these signals, they ramp up production of defensive compounds and for some species like tomatoes, this early warning system also alerts their neighbours.

Some plants can even recruit allies to adopt a strong offense against their would-be attackers. Cotton plants under siege by caterpillars release a cocktail of 10 to 12 chemicals into the air. This mixture attracts parasitic wasps that lay eggs inside the caterpillars.

Plants may not be able to flee the scene of an attack or fight off predators with teeth and claws, but with sturdy armour, a well-stocked chemical arsenal, a neighbourhood watch, and cross species alliances, a plant isn't always an easy meal.

Your task:

Vocabulary: This text has a number of context specific words (jargon). These have been made **bold** in the text to draw your attention to them for this task.

Match the word on the left to its meaning on the right.

Word	Meaning
microscopic	not allowing a liquid or gas to pass through
herbivores	an area of hard plant skin
impermeable	an extremely small living thing that you can only see under a microscope
pathogens	a substance that makes part of your body painful
cuticle	a thing that causes disease
microbes	chemicals used to kill insects
irritants	an animal that only eats plants
breached	a sense organ in a plant that reacts to changes
receptors	so small as to be invisible
insecticidal	break into, get around defences

Day 2 activity 3: All puffed up! – Literacy

Notes for teachers and whānau

The following activity is designed as a mini case study to help the learner identify how puffer fish utilise the three different adaptation types to survive.

I am learning to: identify how a puffer fish users behavioural, physiological, and structural adaptations to survive.

What do I need?

- 30 minutes
- *What's inside a puffer fish?* by Science Insider video (or transcript below) https://www.youtube.com/watch?v=XhgvWTP3zuU&t=28s
- Materials for recording your responses (exercise book or an online document)

Instructions:

Watch the video or **read** the text on puffer fish and **complete** the tasks that follow.

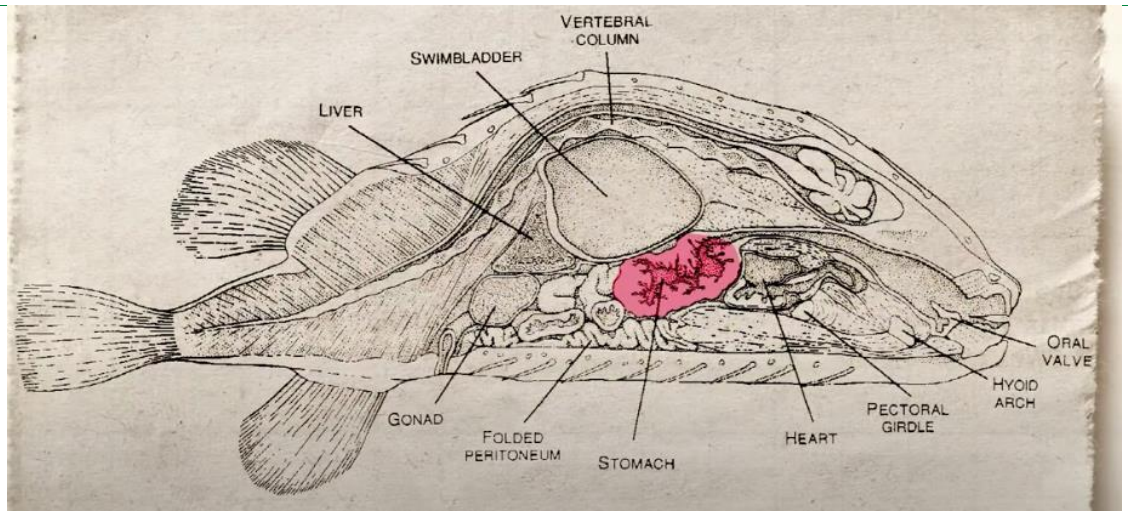
What's inside a puffer fish?

Science Insider

If there's one thing you know about puffer fish, it's that they can do this. When aggravated by a predator, they, puff up. Some puffers like the porcupine fish, become a spike ball moving through the water seemingly out of control, but if you peer inside a puffer, you'll learn that puffing up isn't the only trait that makes these fish one of the most threatening creatures in the sea.

Contrary to what it looks like, puffer fish are not like balloons, what's normally inside them isn't air, it's water. They actually take in a big mouthful of water, and then pump it down into their stomach and they do that anywhere 10 or 15 times, until they inflate completely. Then they hold it and just be a big spiny ball and this requires some pretty sophisticated biology.

Their stomach is made of dozens of tiny folds, kind of like an accordion. These folds are important because when the stomach fills up with water, it can expand without rupturing, and puffer fish expand up to three times their size. That's like if an average human could inflate their middle to a circumference of 3m. But there is a drawback to these amazing skills – Brainerd suspects that puffer fish stomachs have actually lost the ability to digest food, which means their intestines have to do all the work. "You know, given the apparent importance of this defence mechanism, they've given up the advantages of having a stomach, where some digestion can start." But the stomach is just one of many bizarre features inside a puffer. For example, they have specialised muscles – some in their mouth, which pump all that water into their stomach, some in their oesophagus to seal off their stomach like a plug once it's full and some in the base of their bellies, which contract to squeeze out water to deflate.



But what you won't find inside is even more bizarre. There are characteristics that are helpful in their ability to puff up, and one of those is that they don't have any ribs, and another one is they don't have a pelvis. In other words, puffers are essentially missing bones, and that's a good thing, because otherwise they would get in the way of inflation.

In fact, according to Brainerd, if it weren't for these missing bones, puffer fish would probably have never evolved this way in the first place, and that would be a shame, since puffing up really is a good defence.

Consider one old study in which researchers watched birds go fishing. The birds caught 11 puffer fish, but they dropped nearly half of them because the fish started to inflate, but what's more surprising is that the birds left with empty beaks might have been the lucky ones, because puffers have another more potent defence up their sleeves.

Their bodies are laced with a neurotoxin called tetrodotoxin. It's up to 1200 times more poisonous than cyanide. So poisonous that one puffer fish can kill 30 adult humans. So poisonous that puffers are reportedly the second most poisonous vertebrae in the world, which is why it's also surprising that us humans – we actually eat them.

That's right. In Japan, puffer fish is actually a delicacy called fugu, which only trained chefs can prepare. And considering that these fish are basically spike balls filled with poison and were still serving them in restaurants, they must be seriously delicious.

Your task:

Recreate the table below and fill it out with examples from a puffer fish. Try and find at least two examples for each adaptation. Refer back to the information table in Day 1 Activity 2 if you need to be reminded of what each adaptation means.

**Hint* you can re-read the text above, watch the video or do your own research.*

Adaptation	Example from the puffer fish	Example from another creature
Behavioural		
Physiological		
Structural		

Day 2 activity 4: “All puffed up!” – Numeracy

Notes for teachers and whānau

The following task is a continuation of the previous task, exploring what happens when puffer fish engage the adaptation of being able to “puff up” (increase in size). The learner will be required to select and apply appropriate formulae or skills and perform calculations for given problems.

I am learning to: select and apply appropriate formulae to perform calculations on properties of a circle and raw enlargements.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Instructions:

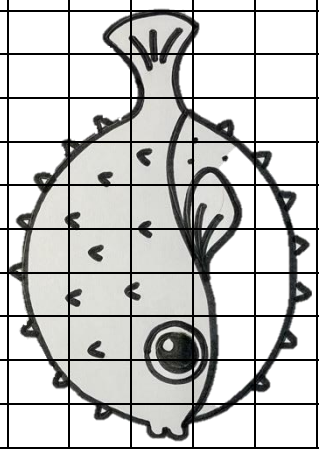
Select the appropriate formulae or maths skill to complete the series of tasks below.

Your task:

Lagi was curious about how large her pet puffer fish got whenever it puffed up. She wanted to calculate the changes in its size and roundness.

She noticed that her pet puffer fish appeared to swell to the size and shape of a tennis ball when it got frightened. Using the tennis ball as her reference, and a measuring tape, how could Lagi work out the following?

1. Describe the process Lagi would go through to find how wide the fish gets (its diameter). Use the correct formula in your description. You can also sketch diagrams to help explain your thinking.
2. Lagi measures her tennis ball and finds it has a circumference of 20.6 cm. What would the radius of the puffer fish’s body be? Show your working and give your answer up to 2dp (decimal points).
3. On the grid, enlarge the picture of the puffer fish by a scale factor of 3. You will need to turn your paper and work in landscape orientation for this task.



Remember to do your end of day reflection and wellbeing activities (see p. 7&9).

Day 3 activity 1: Life in the freezer – solving the problem of hypothermia

Making meaning

Notes for teachers and whānau

Today's activities help the learner focus on how organisms adaptations are finely tuned to their environments and consider what might happen if these environments change. This task looks at how animals are able to survive extremely cold or freezing temperatures.

Note that our Inquiry focus for today is "making meaning" which includes analysing data, organising and sorting information, summarising, synthesising, making connections/conclusions, building deeper understandings, and thinking critically.

I am learning to: compare and contrast individual organisms and the adaptations they have that enable them to survive extreme temperatures.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Remember to start your day right (see p. 8).

Instructions:

Read the article below, highlighting different animals that call the Antarctic home and how they manage to survive in such extreme conditions, then complete the tasks.

Adaptations for life in the freezer

Text adapted from https://www.sciencelearn.org.nz/resources/326-antarctic-life-and-ecosystems

Antarctica is the highest, whitest, driest, coldest, and windiest continent on Earth. It's so cold that creatures often retreat to the sea to warm up. Add 24 hours of darkness during the winter months, and it's a wonder anything lives there. Yet, Antarctica has thriving ecosystems on land and in the water. Animals and plants that live in Antarctica have special adaptations that allow them to survive in the extreme conditions.

Cold blooded residents of Antarctica

The Antarctic fish fauna is small, with only around 325 species known and only about 135 in the Ross Sea region. By comparison, coral reefs support large fish communities from about 400 species in the waters around Fiji to more than 2,000 in Indonesia. However, the fauna of fish from the Ross Sea have not been thoroughly sampled so, we expected to find new species not known to scientists.

An Antarctic silverfish

The Antarctic silverfish (*Pleuragramma antarcticum*) can withstand very cold temperature and is the main food for many larger fish, seabirds, penguins, seals, and whales living in the Ross Sea. They grow to about 25 centimetres long and live up to 10 years. The most common group of fish we expected to find are called notothenioids.

This is a group of about 125 diverse marine fish species, most of which are found in Antarctic and sub-Antarctic waters. One of the remarkable adaptations of these fish is their ability to withstand very cold temperatures. The average sea temperature in the Ross Sea is –1.9°C. Most fish would freeze at this temperature, but some Antarctic notothenioids have 'antifreeze' proteins in their bloodstream that prevent them from freezing.

Warm blooded mammals of Antarctica

Penguins have thick, windproof, and waterproof feathers. Penguins, whales, and seals have thick layers of fat called blubber. Blubber acts as an insulator, helping to keep the animals warm. Antarctic animals often have small extremities (flippers and feet) to reduce heat loss.

An emperor penguin huddle

By huddling together, emperor penguins use less energy and conserve their fat stores. They constantly gently change position from the outside to the inside, so no penguin is exposed to the bitter outer edge conditions for too long.

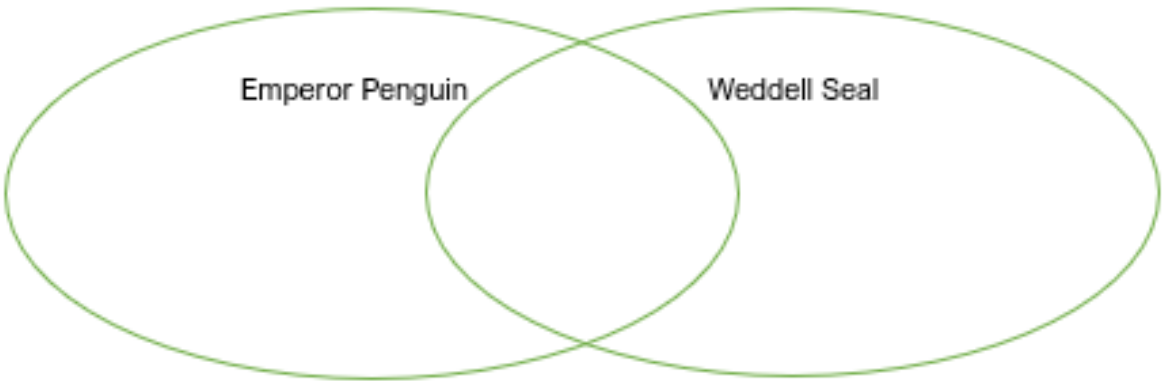
Weddell seal

The weddell seal's claim to fame is that no other mammal lives further south. With a thick layer of blubber and short dense fur, this species of seal can swim in water with temperatures of –2ºC. Weddell seals can dive down to depths of 600 metres and can hold their breath for up to an hour, by collapsing their lungs.

Weddell seals have specially adapted teeth that they use to scrape the ice to create holes. The ability to find and maintain holes deep within the ice gives Weddell seals access to the water to feed, and for breathing when in the water. The downside of this adaptation is that life expectancy of the weddell seal is limited by tooth wear.

Your task:

Recreate the Venn diagram in your exercise book or online document. Compare and contrast the emperor penguin and the weddell seal and how they use their adaptations to survive in the frozen south.



1. What type of adaptation would a penguin huddle be? (Behavioural, Physiological or Structural?)
2. What type of adaptation would a the 'antifreeze' proteins in an Antarctic silverfish be? (Behavioural, Physiological or Structural?)

Day 3 activity 2: Life in the desert – solving the problem of water loss.

Notes for teachers and whānau

Similarly to the previous activity, this set of tasks is designed to encourage learners to focus on the adaptations that enable organisms to survive in extreme temperature, in particular extremely hot and dry areas. Learners will also be tasked to consider the implications of organisms having to adjust to sudden environmental changes.

I am learning to: think critically about the types of adaptations desert animals need to conserve water.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Instructions:

Read the text below then complete the tasks that follow.

Life in the desert

Written by Lynette Hay – used with permission

All living things need water to survive, but what happens when access to that life giving elixir is in short supply? Deserts are well known for being environments that have very little water and very little life. Or so it may seem. Despite the lack of rainfall and limited water sources, a wide variety of animals and plants can be found surviving in the desert, thanks to their adaptations that enable them to survive on very little water. Here a few interesting examples.

Desert Hedgehog

The desert hedgehog is the smallest species in the hedgehog family. It survives in the desert by burrowing during the day to escape the heat and does its hunting at night. The desert hedgehog gets its fluids from its prey, eating everything from insects and invertebrates to bird eggs, snakes, and scorpions. This enables the hedgehog to go for long periods without water.

Dorcas Gazelle

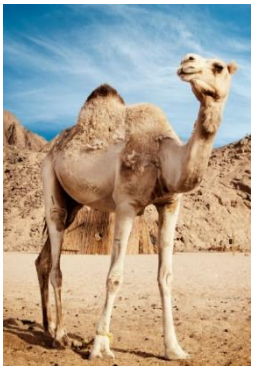
Dorcas gazelles are highly adapted for life in the desert. They can go their entire lives without drinking water! These mammals get almost all the moisture they need from the plants in their diets; however, they do drink when water is available. The Dorcas gazelle has another very unique adaptation that enables it to conserve water… They don't actually pee! In fact, rather than wasting water as liquid urine, these little gazelles will excrete solid white pellets of uric acid.

African Bullfrog

The desert is probably the last place you would think of being the natural habitat for a frog right? However, this particular bullfrog can thrive in the desert and even live in the mountains 1200m above sea level!

The African bullfrog beats the long hot and dry seasons of the desert by burying itself in the ground until the weather changes. It enters a hibernation like state while underground and can stay that way for long periods of time – even longer than a year. The bullfrog creates a cocoon made from its own skin to hold the body's moisture and absorb the water stored in the bladder.

The Camel



Perhaps the animal associated the most with living in the desert. Camels have several adaptations that enable them to survive in the desert and more importantly, on very little water. Camels can go up to 15 days without water. This is because they sweat very little and are able to stand high body temperatures, meaning they can retain the water they drink for long periods of time.

Your task:

Answer the following questions in your exercise book or online document.

1. All these animals have adaptations which enable them to conserve water. Which two animals have a common behavioural adaptation that enables them to stay hydrated and what is it?
2. Of all the animals listed above, which ones can go *indefinitely* without having an actual drink of water?
3. Choose an animal from the examples in the text then think critically about the following scenario: *"What do you think would change in the animals adaptation if they were to be relocated to a different environment that had more water and/or species with different adaptations".* Record your thinking.

Day 3 activity 3: Hypothermia – Maths in Science

Notes for teachers and whānau

The following activity brings together maths and science concepts that have been covered in today's tasks. The learner will look at factors that cause hypothermia – a dangerous and potentially fatal state humans have no natural adaptation for surviving.

I am learning to: measure and record data relating to two variables and use data to decide which clothing will guard best against hypothermia.

What do I need?

- 30 minutes
- A copy of "Hypothermia" maths task https://nzmaths.co.nz/resource/hypothermia
- Materials for recording your responses (exercise book or an online document)

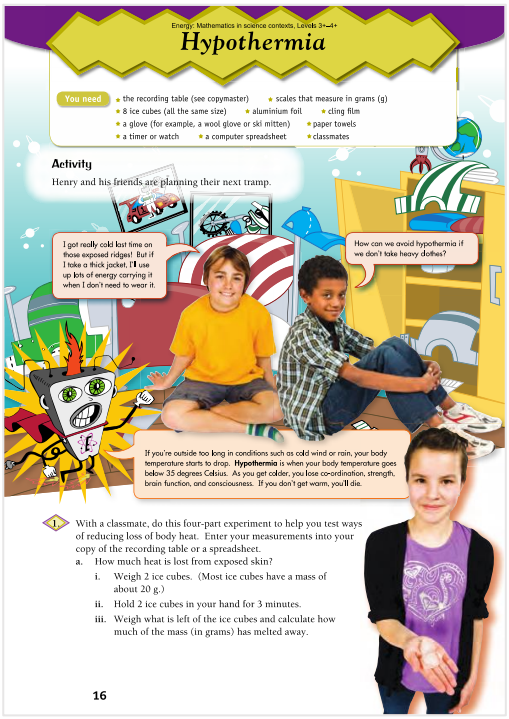
Instructions:

Look in your pack for the Hypothermia worksheet.

Your task:

Complete the maths tasks in your exercise book or in an online document.

Copy this table to record your information:


Energy: Mathematics in science contexts, Levels 3–4+

Hypothermia

You need
- the recording table (see copymaster)
- scales that measure in grams (g)
- 8 ice cubes (all the same size)
- aluminium foil
- cling film
- a glove (for example, a wool glove or ski mitten)
- paper towels
- a timer or watch
- a computer spreadsheet
- classmates

Activity

Henry and his friends are planning their next tramp.

I got really cold last time on those exposed ridges! But if I take a thick jacket, I'll use up lots of energy carrying it when I don't need to wear it.

How can we avoid hypothermia if we don't take heavy clothes?

If you're outside too long in conditions such as cold wind or rain, your body temperature starts to drop. **Hypothermia** is when your body temperature goes below 35 degrees Celsius. As you get colder, you lose co-ordination, strength, brain function, and consciousness. If you don't get warm, you'll die.

1. With a classmate, do this four-part experiment to help you test ways of reducing loss of body heat. Enter your measurements into your copy of the recording table or a spreadsheet.
   a. How much heat is lost from exposed skin?
      i. Weigh 2 ice cubes. (Most ice cubes have a mass of about 20 g.)
      ii. Hold 2 ice cubes in your hand for 3 minutes.
      iii. Weigh what is left of the ice cubes and calculate how much of the mass (in grams) has melted away.

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Clothing type	2 ice cubes starting mass (g)	2 ice cubes final mass (g)	Mass lost (g)	Energy transferred (J)	Clothing mass (g)	Insulating effect (J)*	Energy savings by mass**

* Energy from bare hands minus energy for this type.

** Insulating effect + clothing mass

Day 3 activity 4: Mastering invisibility

Notes for teachers and whānau

This task is a creative way at looking at how animals use camouflage adaptations to protect themselves or catch their food. Information is drawn from https://www.canr.msu.edu/news/why-do-animals-have-different-color-patterns

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I am learning to: identify and describe the four types of camouflage and use this knowledge to create a camouflage design

What do I need?

- 30 minutes
- *Can cuttlefish camouflage in a living room?* https://bit.ly/3invUoK
- Colouring items – such as pencils, pens, felts or crayons
- A4 plain white paper

Instructions:

Read about the different types of camouflage adaptations OR **watch** *Can cuttlefish camouflage in a living room?* by Richard Hammond. As you read or watch, take some notes about what you notice and learn.

Your task:

Camouflage is another example of an adaptation that helps animals to survive in their environment. Animals use their physical (structural) adaptations to avoid being seen by predators, as well as their prey. Animals can use their adaptations to mask their movements, locations and even their identity.

There are 4 basic types of camouflage:

- **concealing coloration** – an animal is the same colour as its natural background
- **disruptive colouration** – an animal has patterned colouration like spots or stripes that make it hard to determine its outline
- **disguise** – an animal has colouration and physical structures where it looks like another non-food object in its surroundings
- **mimicry** – colouration that makes a harmless animal look like one that is dangerous, poisonous or tastes bad.

Design your own camo!

1. Select a small section in your home surroundings, either inside or in the garden.
2. Observe colours, shapes, shadows, and light in that area. Think about how you might use these to design your custom camouflage for your chosen area.
3. Plan out your pattern on a piece of A4, then colour it to match.
4. Test your pattern out by hiding an object behind your paper while it's in place.
    a. Does it work even when the shadows move or the light increases?
    b. Make changes to your pattern if you need to.

Remember to do your end of day reflection and wellbeing activities (see p. 7&9).

Day 4 activity 1: Artificial selection

Notes for teachers and whānau

Today's tasks look deeper into the way that humans have copied or used natural adaptations to make innovative changes to the way we live. For this activity, learners will look into how humans use different methods to ensure the reproduction of organisms with desirable traits.

Note that today our Inquiry focus is "going further, deeper". This may include promoting opportunities to engage further and dive deeper through discussions, provocations, exploring further contexts, taking action, or thinking critically and drawing conclusions.

I am learning to: think critically about the pros and cons of humans manipulating the natural selection process.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Remember to start your day right (see p. 8)

Instructions:

Read the text below then complete the tasks that follow.

Artificial selection

Humans have been manipulating living organisms for thousands of years. Examples of early biotechnologies include domesticating plants and animals and then selectively breeding them for specific characteristics.

Earliest examples of biotechnology

The earliest example of biotechnology is the domestication of plants and animals. Domestication began over 10,000 years ago when our ancestors started keeping plants as a reliable source of food. Rice, barley, and wheat were among the first domesticated plants. Wild animals were tamed to provide milk or meat or help with ploughing or guarding the farm. The dog, sheep and goat are thought to be among the first animals that were domesticated.

Examples of selective breeding

Teosinte and maize

Teosinte is an ancient grain thought to have been selectively bred into maize 6,000 to 10,000 years ago. It has few kernels, and they are enclosed in a hard casing.

Early pioneers of selective breeding mated organisms with desirable traits to enhance these traits in their offspring. Selective breeding pioneers were manipulating the genetic makeup of organisms, without even realising it.

Corn is a dramatic example of a plant that has been enhanced by selective breeding to become a better source of food. Early teosinte plants (about 5000 BC) had small cobs with few kernels, but by 1500 AD, the corn cobs were more than 5 times the size and packed full of sweet, juicy kernels.

Dog breeds are another example of selective breeding. There are more than 100 breeds of dog, all resulting from selective breeding. Dogs were bred for specific jobs and to enhance traits such as size, shape, agility and colour, resulting in breeds from the tiny Chihuahua to the Great Dane.

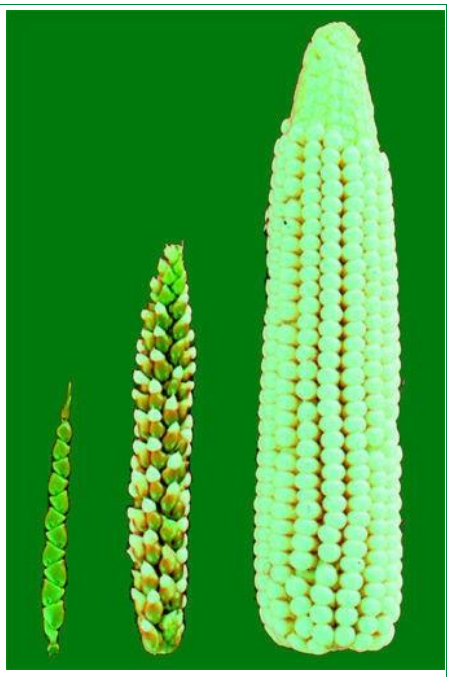


Image rights: John Doebley. Creative commons 2.5 license

Reference: https://www.sciencelearn.org.nz/resources/1204-ancient-biotechnology

Your task:

1. Reproduce the table below in your exercise book or online document.
2. Think critically about the benefits for humans (pros) and the challenges we might face (cons) of modifying our food sources or animals through selective breeding.

**Hint* Don't forget to include reference to animal and plant adaptations in your answers.*

Pros	Cons

3. Do a little research and find one other plant or animal that exists now as a result of selective breeding. What trait were humans wanting to manipulate? What adaptation(s) might have been lost during the process?
4. Draw a diagram of this plant or animal and label its unique adaptation features.

Day 4 activity 2: Red fleshed apples?

Notes for teachers and whānau

This task is designed to follow on from the previous tasks by looking at how humans selectively use genetics to create new varieties of apples. This topic could be used as a platform for whānau and families to discuss wider issues, such as whether or not we should interfere with natural selection or the implications for our own health and wellbeing by doing so.

I am learning to: think critically about the implications of selective breeding through genetic modification.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Instructions:

Read the text below then complete the tasks that follow.

The discovery that genes are made up of DNA that can be isolated, copied and manipulated has led to a new era of modern biotechnology.

Red-fleshed apples – unique and healthy

Most apple varieties have white flesh, but scientists at Plant & Food Research (PFR) are developing a new apple with red skin and red flesh. Apart from novelty value, these apples may also have health benefits – the red colour is caused by anthocyanins, which are antioxidants and can help protect against disease.

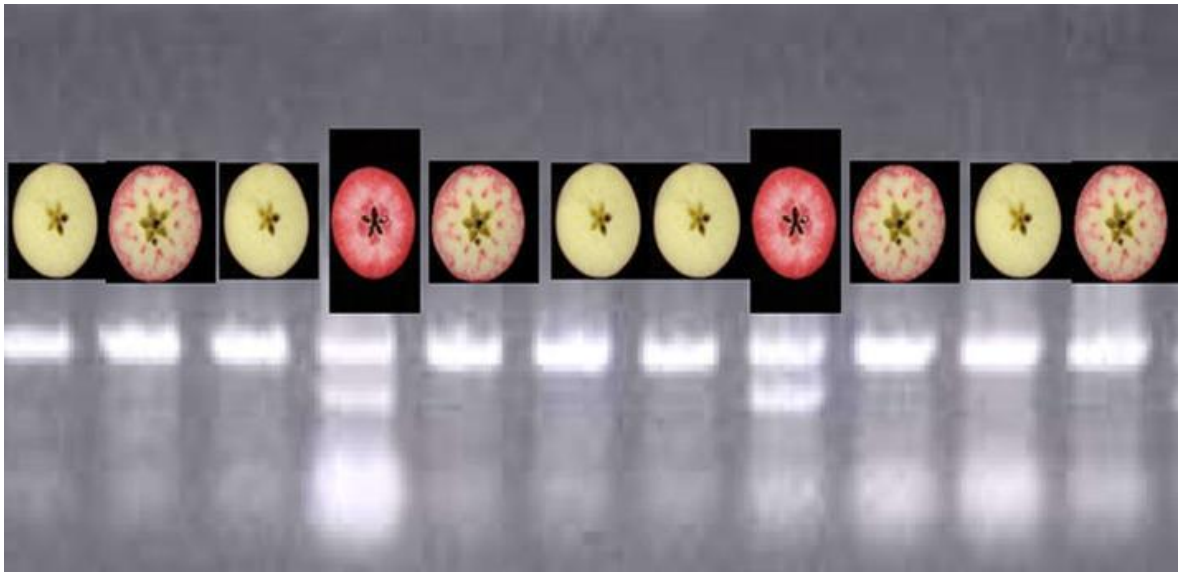
The idea of breeding a red-fleshed apple came from the wild apple forests of Kazakhstan, where the apple originated. The wild apples had striking red flesh, but the fruit was small, tasted bitter and lacked the quality attributes that today's consumers expect.

To improve the apples' taste, scientists at PFR crossed the original, red-fleshed apple with commercial, white-fleshed varieties. Now they're improving other characteristics important for consumer acceptability and commercial success, such as long storage life.

Genetic information streamlines breeding

New apple varieties in New Zealand are developed through selective breeding – the same technique used by humans for thousands of years. However, breeders can now use *genetic information* to make the breeding process faster and more efficient.

By analysing DNA from apple seedlings, they can predict many apple characteristics (including red flesh) long before the seedlings produce fruit, so they can decide which seedlings are worth growing and which can be discarded.



The scientific advancements of genetically modified organism (GMO) technology have the potential to increase food production, limit environmental damage and reduce disease and genetic abnormalities. There is, however, much public controversy, and there are many different views about how acceptable GMO technology is. For example, big business controlling the production of GMO crops could potentially control world food supply. And what about 'designer babies'?

Reference: https://www.sciencelearn.org.nz/resources/839-breeding-red-fleshed-apples-introduction

Your task:

Modern technology has enabled humans to breed more selectively than earlier technologies allowed. In this article, the issue of Genetically Modified Organisms is raised as being an area of public controversy.

- **Research** what the phrase public controversy means
- **Reflect** for a moment on where you stand on the issue of GMO, then
- **Create** a table listing the pros and cons of GMO. Finally
- **Write** a short opinion piece (approx 300 words) stating where you stand on the topic of GMO. You can use examples from the text or from other online sources to help illustrate your point of view.

Day 4 activity 3: Kiwi genetics

Notes for teachers and whānau

This task gives students a look at how certain features can be passed on or skipped in different generations of Kiwi. Learners will draw on the science concept of genetics to engage in statistical problem solving.

I am learning to: predict the chance of white Kiwi being born.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Instructions:

Read the text**:** (adapted from: Kiwi Genetics https://nzmaths.co.nz/investigations)

How rare is a white kiwi?

Investigation brief

The staff at Pūkaha Mount Bruce were amazed in 2011 when a white kiwi chick hatched. This was not an albino kiwi (a condition of no pigmentation) but a North Island Brown Kiwi with white feathers.

Since then, two more white kiwi have also hatched. Pūkaha Mount Bruce runs a kiwi conservation programme. White kiwi have also been reported in that population but they are extremely rare.

How probable is it that further white kiwi will be hatched at Pūkaha Mount Bruce?

The genes of its parents determine the colour of a kiwi's feathers. The gene for brown feathers is dominant and the gene for white feathers is recessive. In order for a kiwi to have white feathers both its parents must carry the 'rare' gene. Even then there is only a chance that a chick will have white feathers. Find out how this genetic trait is passed from one generation to the next and create a diagram that shows the chance of a white kiwi hatching.

Each kiwi has genetic information from both its father and its mother. This information can be presented as a trait, such as brown feathers or white feathers. Some traits are dominant and some are recessive. A dominant gene will overpower the recessive gene and thus for a recessive trait to occur, both parents must have the gene and then there is still only a 25% chance it will occur in the offspring.

For any kiwi we can describe whether they have the dominant gene from both parents (BB), the recessive gene from both parents (ww), or the dominant gene from one and the recessive gene from the other (Bw). Because each parent is equally likely to pass on either of their genes to their offspring, we can then easily construct tables to determine the possibilities for the chick. Let's take a closer look.

Your task:

Look at the genetic punnet squares and complete the tasks below:

Genetic Punnet square #1: Possible outcomes for chick if both parents have the recessive gene for white feathers (both parents [Bw])

	Father B	Father w
Mother B	BB (brown feathers)	Bw (brown feathers)
Mother w	Bw (brown feathers)	**ww (white feathers)**

For #1. What is the probability (chance) of a chick having white feathers?

- Write it as a sentence
- Write it as a percentage (%)
- Write it as a fraction

Genetic Punnet square #2: Possible outcomes for chick if one parent has the recessive gene for white feathers

	Father B	Father B
Mother B	BB (brown feathers)	BB (brown feathers)
Mother w	Bw (brown feathers)	Bw (brown feathers)

For #2. What is the probability (chance) of a chick having white feathers?

- Write it as a sentence
- Write it as a percentage (%)
- Write it as a fraction

Genetic Punnet square #3: Possible outcomes for chick if both parents have white feathers

	Father w	Father w
Mother w	**ww (white feathers)**	**ww (white feathers)**
Mother w	**ww (white feathers)**	**ww (white feathers)**

For #3. What is the probability (chance) of a chick having white feathers?

- Write it as a sentence
- Write it as a percentage (%)
- Write it as a fraction

Let's try to show the concept of 'rare' by diagramming a population such as that of the kiwi at Pūkaha Mount Bruce. E.g If there are 30 kiwi at Pūkaha–Mount Bruce and there are 2 males and 2 females who carry the recessive gene.

Use a table or tree diagram to represent your findings about how genetic traits are passed on.

Show how do you express this diagram in numbers (percentages, fractions etc)?

Consider: How will the introduction of more white kiwi to the population in Pūkaha Mount Bruce change the probability of hatching white kiwi?

- Are there equal chances that any kiwi may mate with another, or are kiwi likely to mate for life? How does behaviour influence the probability of a recessive trait occurring?
- What does ‘rare’ mean in numbers?
- What could staff at Pūkaha–Mount Bruce do to improve the chances of more white kiwi hatching?

Did you know? White kiwi genetics

- The North Island brown kiwi species has a dominant brown gene.
- Both the male and female must carry the recessive white gene to produce a white chick.
- There is a one in four chance of such a pair producing a white chick.
- If two white birds breed, they will only produce white chicks.
- To grow a population of kiwi requires a survival rate of greater than 25% among chicks. The Pūkaha breeding programme ensures a survival rate far exceeding this (better than in the wild) by hatching and rearing chicks in captivity, for subsequent re-release in the wild forest as nearly adult birds.

Day 4 activity 4: “Water hating” adaptations.

Notes for teachers and whānau

This activity takes a look at a how humans have adopted or mimicked plant adaptations. Humans will attempt to mimic some plant adaptations in order to be innovative when in it comes to the problem of things getting wet.

I am learning to: make connections between natural adaptations and human innovations.

What do I need?

- 30 minutes
- *The Lotus Effect* article
- *Hydrophobic Coating Technology Inspired by Butterfly Wings* by Richard Hammond https://www.youtube.com/watch?v=Htr-J5ojRDc
- Materials for recording your responses (exercise book or an online document)

Instructions:

Watch “Hydrophobic Coating Technology Inspired by Butterfly Wings” by Richard Hammond or read *The Lotus Effect* article below to explore the water repelling adaptations of some plants. Then complete the tasks that follow.

The Lotus Effect

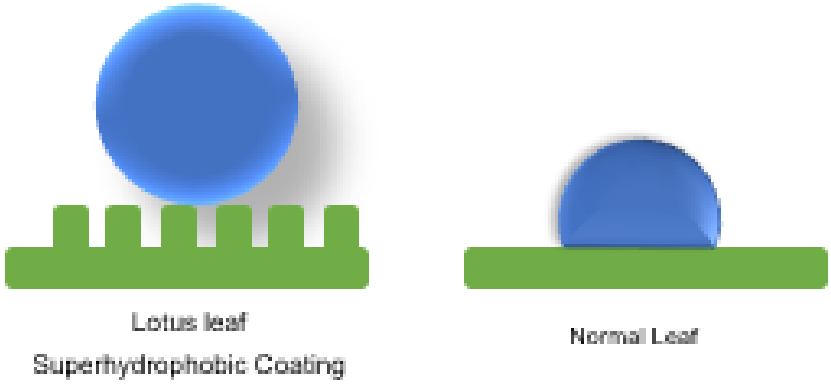
Written by Lynette Hay – used with permission

Have you ever seen some leaves that just never seem to get wet or dirty? Or when you’re watering the garden and water just seems to roll off it as if it was never there? The you are observing what is called the “lotus effect”.

The lotus effect is basically considered the ability of a surface to clean itself of dirt. In the 1970s, German botanist Professor Dr Willheim Barthlott observed that lotus leaves never seem to get dirty despite the fact they grew in muddy waters. He called it the lotus effect after the plants where the phenomenon occurred. However, the more scientific term is *hydrophobic*, literally meaning “water hating” or water repelling.

But how does it do this?

The lotus leaf’s surface may look smooth, but if you look at it under the microscope you will find that it is covered in a thick waxy coating and has lots of small bumps called papillae. This structural adaptation causes the water to bead rather than sticking to the leaf surface.



Lotus plants are not the only ones with hydrophobic properties. The taro leaf also displays the same ‘water hating’ properties.

Humans have long been trying to copy the water repelling properties demonstrated by these plants, in order to improve the ability for things to continue working in areas that are prone to dirt and water. Scientists have come up with ways to spray hydrophobic coatings on just about everything needing or wanting protection.

Your task:

1. What normal everyday items do you think could benefit from being hydrophobic? List two and give your reasons.
2. Water repelling and water resistance sound similar but are actually quite different. Do a little bit of research and explain the difference between the two. You can use diagrams or images to help you explain.

Remember to do your end of day reflection and wellbeing activities (see p. 7&9).

Day 5 activity 1–2: Create or innovate

Notes for teachers and whānau

Today the learner will demonstrate their understanding of the concepts covered this week. They will choose an aspect of the week they would like to highlight and create a presentation.

Note that today our Inquiry focus is "present – share learning about the theme" which includes thinking about who the audience is and considering different ways of communicating learning. E.g. presentation, video, poster, etc.

I am learning to: make links between what I have learned and apply it to different scenarios.

What do I need?

- 60 minutes
- Colouring items – such as pencils, pens, felts or crayons

Remember to start your day right (see p. 7).

Instructions:

Read all the scenarios below then choose one to base your design on.

Your task:

Design a new organism

Using this week's learning; your task is to design a new organism. This can be an animal or a plant, but it will need to be something original in response to your chosen scenario. You may choose to do a little extra research to help you out with your design.

Sketch your organism and **label** all the adaptations you have added and how these help the organism survive. Two or three adaptations is plenty. Make sure the adaptations work together and are not simply random selections.

Scenario 1 – your organism lives in a very dark and cold environment. It rains a lot during the year, and it is hard to find somewhere dry to build a home.

Scenario 2 – your organism naturally lives in the water, even though the environment it's in has only shallow pools that are usually muddy and filled with water weed. It is quite a small organism and often has to defend itself from becoming the next meal.

Scenario 3 – your organism is a warm-blooded predatory species that lives in an environment that is often wet, humid, and full of plant life. Because of its large size it needs to be able to be undetectable when stalking its prey.

Scenario 4 – your organism lives in an urban environment that is constantly developing and changing – more buildings, lights, and manmade structures. This organism relies on staying hidden in plain sight to survive.

Scenario 5 – your organism is unable to move about and does not have claws or teeth to protect itself. It lives in a very dry environment and relies on other organisms to provide it with water. One major feature it has is that it produces food that attracts other animals and has wide leaves that provide shelter.

Day 5 activity 3: Improving human lives

Notes for teachers and whānau

In this task, learners will be required to think of ways adaptations have been used to improve the lives of humans and enable them to exist or survive in environments that are difficult for us to inhabit without extra help. They will need to make links to what they have already learned and justify their choices.

I am learning to: apply learning about adaptations to solve a human problem.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Instructions:

Complete the table below using learning you have developed over the week.

Your task:

1. Recreate the table below
2. Reflect on the three adaptation types below and come up with an example of how humans have utilised or copied nature to help them survive.

Adaptation	Example of how an organism uses it in nature	Example of how humans have adapted or copied this adaptation to suit them
Behavioural		
Physiological		
Structural/physical		

Day 5 activity 4: Share your learning

Notes for teachers and whānau

*For the final activity of the day, learners will have the opportunity to create an artefact (physical or digital) to represent what they have learned or what they understand about **change**.*

I am learning to: relate this week's learning back to the concept of change and communicate my understanding.

What do I need?

- 30 minutes
- A digital device for creating a multimedia presentation – OR –
- Any other materials that could be used to create a physical piece of work (artefact) such as drawing and colouring materials, natural objects like leaves, twigs, shells etc.

Instructions:

Think about how this week's learning has helped you to understand the concept of **change**, then complete the task below.

Your task:

Be creative!

Design either a digital or physical artefact (object) that describes your understanding of the concept of **change**. Think about the different learning you have engaged in over the week and incorporate some of these ideas or concepts into your work.

*You may want to share your work with your teacher, friends or family. Be prepared to explain your thinking to them.

Remember to do your end of day reflection and wellbeing activities (see p. 7&9).

Context 2: Innovation – can I make a better ...?

The next five days investigate the theme of change by looking at innovation, and looking at how to make improvements to something.

Innovation

Can I make a better ...?

Change | Panoni

Day 6 activity 1: Inquiry getting started

Notes for teachers and whānau

Today's activities are designed to introduce the learner to the concept of innovation and provide a foundation from which tasks for the rest of the week will be based on. As with the week prior, learners may come across a number of new and unfamiliar words, so it is encouraged that they maintain a working glossary to support their understanding of the content and tasks.

*Note that our Inquiry focus for today is – **"getting started"** which includes generating questions, activating prior knowledge, and introducing the theme.*

I am learning to: think critically about the difference between invention and innovation.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Remember to start your day right (See p. 8)

Instructions:

Reflect on the two quotes below, then complete the tasks that follow.

Your task:

Plato, a famous historical philosopher during the 5th Century BC, is known to have written: ***"our need will be the real creator"***.

Over time however, Plato's quote became moulded into the old English proverb: ***"Necessity is the mother of invention"***, which is now more widely known than his original statement.

Critical thinking and writing:

1. In your exercise book or online document, explain in approx. 300 words what you think Plato meant by his initial statement. Use real life examples to help your reader understand what you mean.
2. Consider how Plato's original statement changed over time. How would you rephrase this proverb to reflect more of today's way of speaking? Record your answer in your exercise book or online document.

Day 6 activity 2: Invention? Innovation? What's the difference?

Notes for teachers and whānau

For this activity, learners will engage in tasks that help them to better understand both concepts by comparing and contrasting definitions. As with any other task, learners should be encouraged to add any new or unfamiliar to their glossary.

I am learning to: understand the difference between invention and innovation.

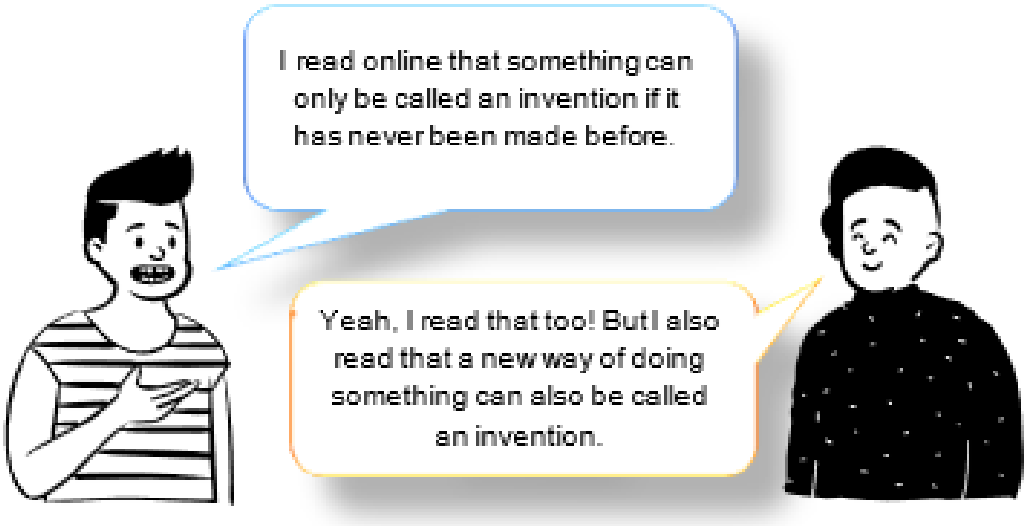
What do I need?

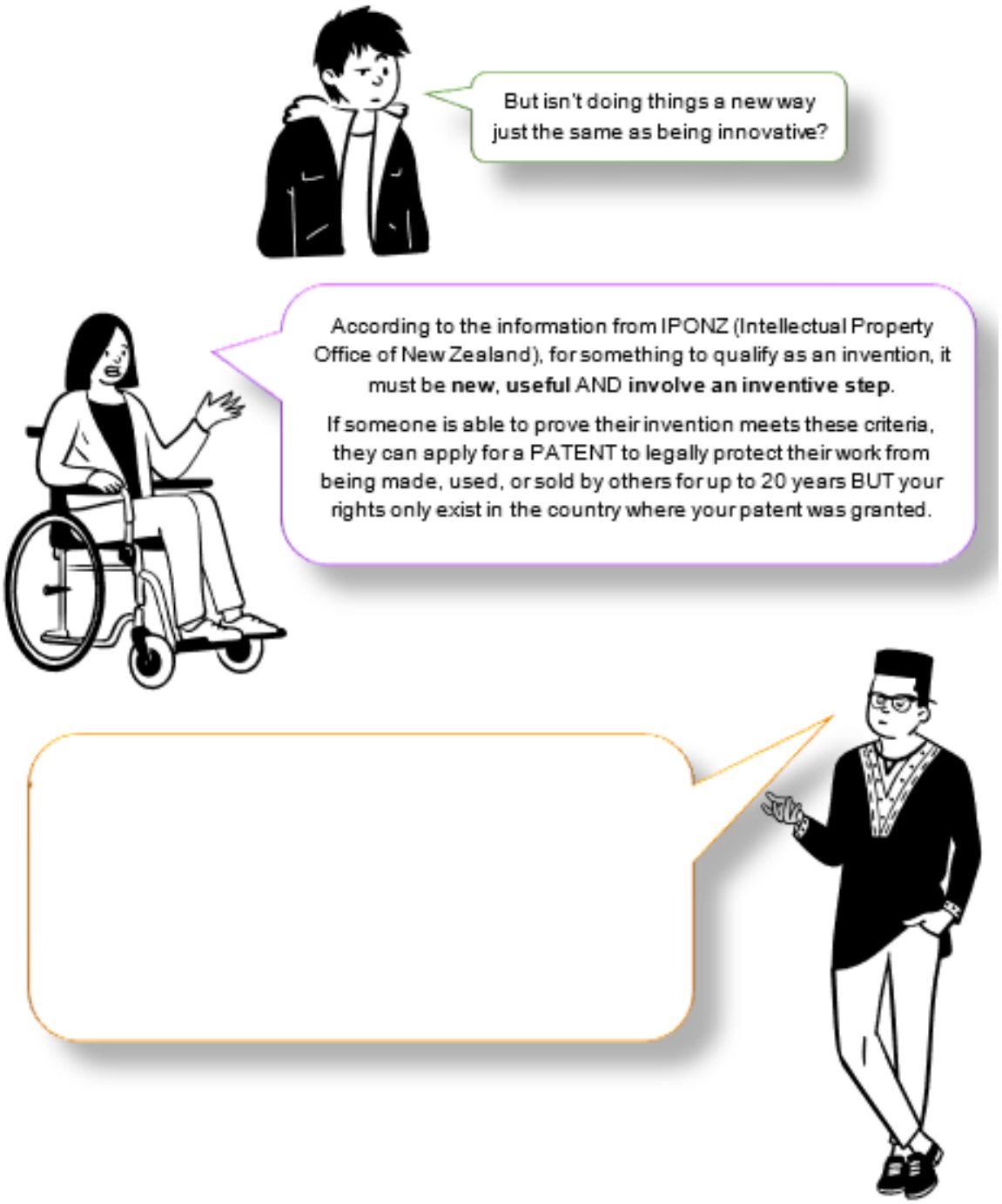
- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- A copy of the transcript *About Innovation* presented by Meremaihi, Sol and Holly – OR –
- *About Innovation* by the Science Learning Hub https://www.sciencelearn.org.nz/videos/1018-about-innovation

Instructions:

Read the text below then complete the tasks that follow.

Your task:





Summarise and Define

Watch the video called *About innovation* or read the transcript below, then fill in the speech bubble above with a summary definition of what innovation means. Try and keep it short and to the point.

Compare the two definitions (invention vs innovation) and identify the main difference between the two.

About Innovation transcript

Innovation. It's a word that we hear a lot today. What's it all about?
Innovation can be hard to explain as it's used by a lot of people to describe a lot of different things. Is innovation only about big changes – or could it be about small steps? Is it just about new ideas – or can it be about improved ideas? Is it about different ways of doing things – or is it only about new products? So do different innovations have anything in common?

All innovation involves change. It's about creating value for people by solving a problem or meeting a need. Through coming up with new ideas or new ways of doing things. Or by making improvements to something that already exists. Innovation is an activity that begins with an idea. It might result in a product that you sell or in a new way of doing something. However, all innovation needs to create value for people. Otherwise, it's not innovation, it's just an idea.

All innovation involves a process. Most innovation involves these steps.

- Coming up with ideas.
- Choosing and developing the idea.
- Researching, developing, and testing.
- Convincing others.
- Seeing your idea being used or adopted by others

This makes it sound easy, but sometimes some steps take longer than you planned, or you need to repeat them or even start again. There are lots of different kinds of innovation. Different types of people are innovators too.

Each innovation process involves a unique range of people – people with different personalities like leaders, followers, risk-takers, doers, planners. Also people with different knowledge and skills, like scientists, engineers, technologists, manufacturers, marketing experts and lawyers. All these people might not even be in the same place at the same time.
So why do we need innovation? To make the most of opportunities to develop new ways of doing things in a changing world. To solve the problems we face now and in the future to keep New Zealand moving forward. Innovation can benefit all New Zealanders.

Best of all, the skills, attitudes, and values needed for an innovative society can be fostered from a young age through formal and informal learning opportunities.
Creating an innovative society starts in the classroom.
Creating innovators can start here!

Something to note…

Sometimes people make claim to having been the first to DISCOVER something. A discovery is different from an invention because things that get discovered already exist and the claim is that someone has "found" these things, not created them.

Write: What is one issue that you think claiming to "discover" can cause?

Day 6 activity 3: Is it an invention or an innovation?

Notes for teachers and whānau

In this task the learner will use the information from the previous tasks to help them decide whether the object or process listed below is an invention or an innovation.

I am learning to: use my understanding of the meaning of inventions and innovations to correctly categorise items in a list.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Instructions:

Reflect back on the definitions of invention and innovation in the previous task then apply that knowledge to the task below.

Your task:

Tick the column you think the item or process belongs to:

Item/Process	Invention	Innovation
Shoelaces		
Texting		
Mobile phone		
Flush toilet		
Automatic doors		
Ballpoint pen		
AA Battery		
Compass		
Wheel		
Pasteurization of milk		
Dusting for prints		
Milk chocolate bars		

Select an invention from the list above and sketch and describe what you think the next step in its development could be **in your home learning book.**

Day 6 activity 4: Napier's Bones

Notes for teachers and whānau

This activity introduces the learner to mathematical process invented by a Scottish mathematician. This activity uses an interesting historical context to help students to understand place value ideas as they explore multiplication.

For question 2, the students will find that information about John Napier is readily available in reference books and on the Internet. He lived from 1550 to 1617.

Napier's invention made multiplication much easier for the people of his time. Patterns of numbers were carved on rods or sticks, but originally the facts were carved on bones and therefore became known as Napier's Bones. Napier has also been credited with the invention of the decimal point and tables of logarithms. Learners will need to work with a peer for this activity.

I am learning to: Use a range of multiplicative strategies when operating on whole numbers.

What do I need?

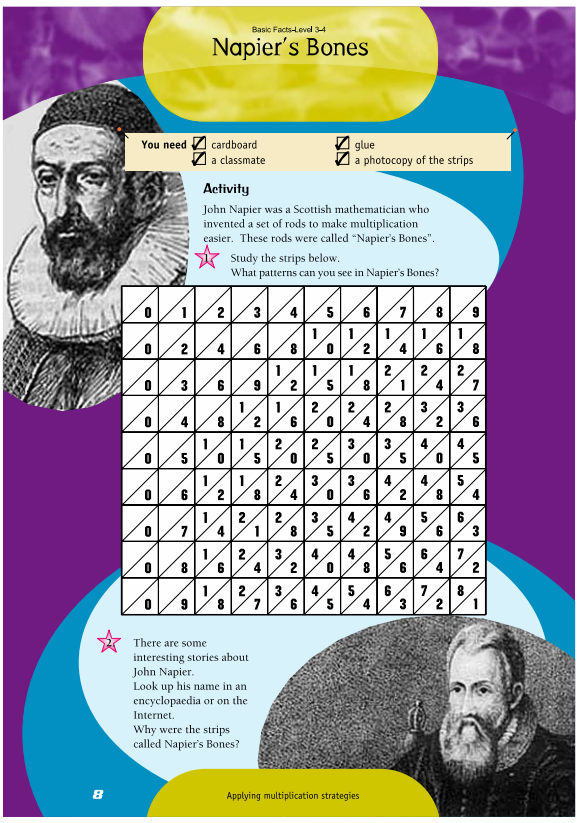
- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- Copy of https://nzmaths.co.nz/sites/default/files/NapiersBones.pdf
- Cardboard, glue, and scissors
- A copy of the strips
- Someone to work with

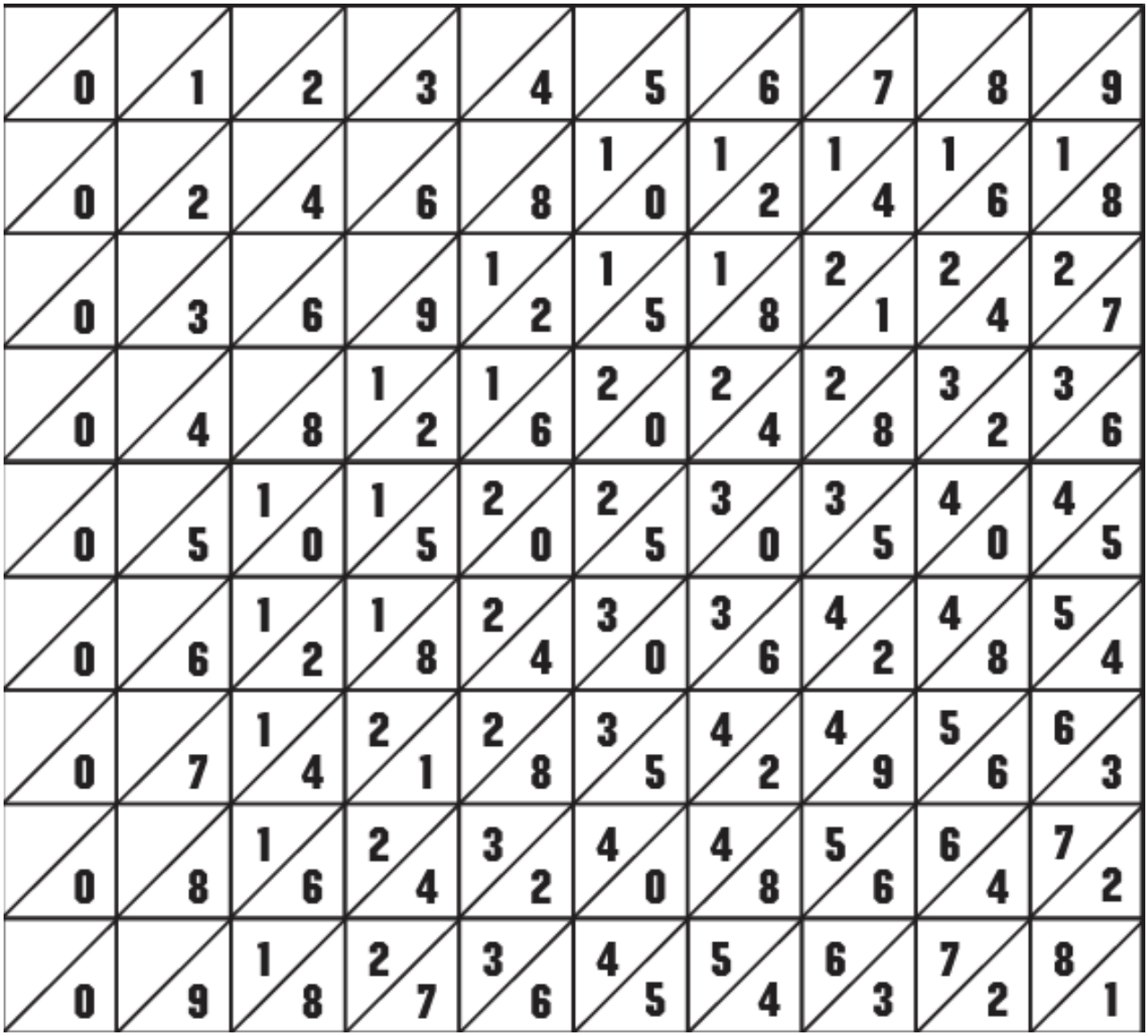
Instructions:

Read the instructions on Napier's Bones worksheet and complete the tasks that follow.

Your task:

Explore the Napier's Bones multiplication pattern.





Remember to do your end of day reflection and wellbeing activities (See p. 7&9).

Day 7 activity 1: Outside the square

Notes for teachers and whānau

Today's activities will explore different ways in which traditional practices responded to different needs through integrating innovative thinking and non-traditional materials.

Note our Inquiry focus for today is "explore, investigate, and discover" which includes choosing and evaluating information, and thinking critically.

I am learning to: outline how Māori used traditional innovative thinking and methods to preserve food.

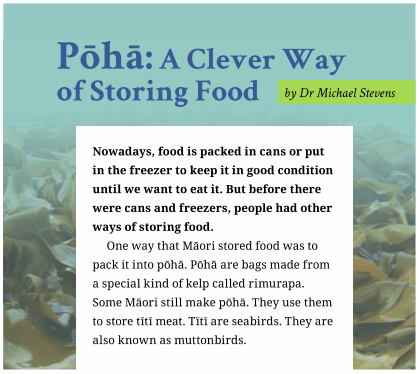
What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- Look in your pack for a copy of *Pōhā: A clever way of storing food* by Dr Michael https://instructionalseries.tki.org.nz/Instructional-Series/School-Journal/School-Journal-Level-2-September-2014/Poha-A-Clever-Way-of-Storing-Food
- Optional digital: "Preserving muttonbirds" by Cpt Bob Whaitiri (Ngāi Tahu) https://teara.govt.nz/en/speech/40253/preserving-muttonbirds

Remember to start your day right (See p. 8)

Instructions:

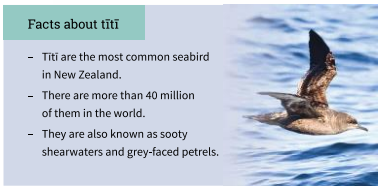
Read "Pōhā: A clever way of storing food" by Dr Michael Stevens, then complete the tasks that follow.


Pōhā: A Clever Way of Storing Food

by Dr Michael Stevens

Nowadays, food is packed in cans or put in the freezer to keep it in good condition until we want to eat it. But before there were cans and freezers, people had other ways of storing food.

One way that Māori stored food was to pack it into pōhā. Pōhā are bags made from a special kind of kelp called rimurapa. Some Māori still make pōhā. They use them to store titi meat. Titi are seabirds. They are also known as muttonbirds.


Facts about tītī

- Titi are the most common seabird in New Zealand.
- There are more than 40 million of them in the world.
- They are also known as sooty shearwaters and grey-faced petrels.

Your task:

Food is one of the five basic physiological needs that humans need to survive. There have long been many threats to food supply that affect our ability to maintain a continuous supply of food such as natural disasters and pests. Before the invention of the refrigerator, being able to preserve and store food for leaner times was a continual concern for our ancestors. However, through innovative thinking and ingenious use of natural materials, our forefathers were able to solve these issues and keep the food supply chain going for generations.

The story is about one innovation in particular – the preservation of tītī, more commonly known as mutton-birds, using seaweed!

Find out more by reading the story 'Pōhā: a clever way of storing food' by Dr Michael Stevens and if you have access to a device, have a listen to Cpt Bob Whaitiri (Ngāi Tahu) recall his experiences of preserving muttonbird.

Respond to the following questions in your exercise book or online document.

1. What is one major difference between the olden days and now, in the way the tītī are prepared before they are packed into pōhā?
2. Rimurapa is described as having three different properties that make it suitable for being made into bags to store tītī. What are those three properties and what are they comparable to?
3. On average, how many tītī can a pōhā hold and how long can the bird meat be stored for?
4. What are other uses for rimurapa are listed in the text?
5. What other te reo kupu were used in the text? Create a glossary of te reo Māori and include these.

Let's get creative!

1. Thinking about the properties of rimurapa, what other ways do you think this natural substance could be used to meet a need or add value to our lives?
2. Sketch out your design and label its parts, then briefly describe how your creation integrates the rimurapa.

Did you know…?

Bull kelp is an **annual seaweed** – meaning it grows from a spore to maturity within a single year! This seaweed can grow up to 10 metres in length and can live for 10 years. Talk about sustainable packaging!

Day 7 activity 2: New materials, old ways

Notes for teachers and whānau

This activity looks at how Pacific People are able to sustain cultural practices by being innovative in their use of non-traditional materials.

I am learning to: think critically about the ways in which materials can be used for functions outside of what they have been designed for.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- Optional digital: *Makataone Pilokolu – Master Weaver* https://youtu.be/vfKX6-4Ys-E

Instructions:

Watch the video *Makataone Pilokolu – Master Weaver* or read the text below then complete the tasks that follow.

Your task:

New materials, old ways

Many islands in the Pacific are known for their weaving skills and traditions. However, the ability to continue to practice these arts can be extremely challenging here in Aotearoa. Traditional materials used for centuries by Pacific women are either very difficult or impossible to come by. The art of weaving is passed on from generation to generation, however it is not only the skill of weaving itself that is important, but also the way materials are chosen, prepared, and treated.

In efforts to sustain the cultural heritage of weaving in their new home, Pacific communities of weavers have had to become innovative in their thinking and use products in some very different ways then what they were created for.

*Jasmine Underhill and Vaine Ngaro, members of the Porirua Cook Island Community Group, show off hats made for a 1993 exhibition celebrating the centenary of women gaining the vote in New Zealand. The hats were woven with raffia, coconut palm fronds or **plastic bread bags**.*

Alexander Turnbull Library, Dominion Post Collection (PAColl-7327) Reference: EP/1993/2491; photograph by Ray Pigney

Handy strap to a handy bag

One particular material that has found a permanent place within weaving circles is polypropylene strap also known as packing strap or plastic strapping. You may have come across these if you've ever opened up a box with a new fridge or tv inside. Or you may even have had to have your luggage strapped at the airport before flying overseas.

Photo courtesy of Lynette Hay 2022

Pacific women's weaving groups have found beautiful and creative ways to reuse these materials that many consider to be waste products, by turning them into strong and long-lasting baskets or handbags. This innovation also helps keep the plastic straps from ending up in rubbish dumps. Now that's some sustainable and innovative thinking!

Critical thinking

1. Why do you think Pacific women persevered with finding and using alternative materials for their weaving instead of just abandoning it due to lack of traditional materials?

> "Plastics are so ubiquitous in our lives and the issues posed by them are now so large that a single innovation, or even a single type of innovation, will not solve the challenge"
>
> Office of the Prime Minister's Chief Science Advisor, Kaitohutohu Mātanga Pūtaiao Matua ki te Pirimia

This example from Pacific weavers has shown us one way in which the challenge of plastic waste can be addressed in a creative way. However, as the quote above states, this innovation alone is not enough to deal with the growing issue of plastic waste.

- **Select** a plastic product that would usually be a single use item, such as a plastic milk bottle for example. Think about an innovative way that this product could be repurposed so that it becomes a small step in reducing the problem with plastic pollution.
- **Describe** your idea in detail and provide diagrams or sketches to emphasise and "sell" your idea. Don't worry, you won't be required to actually create a prototype unless you really want to. BUT your idea must be realistic and based on processes or technology that is actually available.

Day 7 activity 3: Fantastic firestarters

Notes for teachers and whānau

In this activity we continue to explore different innovations from around the world. This set of tasks is focused on the precursor to modern day matches and lighters.

I am learning to: identify different innovations ancient civilisations used to make fire more portable and easier to create.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- Optional digital: *Carrying Fire the Pikunii Way* https://www.youtube.com/watch?v=VdLfdjX6smU

Instructions:

Read the story below about different innovations that ancient and indigenous peoples used to make fire more portable and easier to create, then complete the tasks that follow. If you have the opportunity, watch the video *Carrying Fire the Pikunii Way* – an amazing video on the ingenuity of the Blackfeet tribe.

Your task:

Fire

Fire is one of the four classical elements in Greek philosophy and science alongside Earth, Water and Air. More than that though, fire was an essential factor in the survival of many ancient civilisations. With it, people were able to keep themselves warm, ward off wild animals, cook food, send signals over long distances, and provide light for areas that were too dark to see well.

Before the advent of the modern-day matchstick, fire was most commonly created by rubbing two wooden sticks together or by striking two hard pieces of stone together or iron on a piece of flint. These processes however were quite time consuming and labour intensive. According to historical accounts, the first self-igniting friction matchsticks that we use today were created in 1827 by English chemist John Walker. However, there are many accounts of people having created more basic versions of the matchstick, with the earliest being made by a young maid in the 6th Century during the Cheng Dynasty. Stories have it that during a long siege by a neighbouring state, the palace in which she worked ran out of kindling for starting the fires needed for heating the palace and cooking food. The young girl came up with the idea to dip small pieces of pine in sulphur. When the sulphur dried the sticks could then be rubbed together making it easier for the sticks ignite.

Another ancient way of making fire was by collecting embers or hot ashes from a forest or grass fire, or saving embers from the main fire that had previously been lit.

This method however, meant that ancient civilisations had to come up with ways of storing and transporting the embers, so that they remained “alive” – or being able to start another fire when they were needed.

The Fire Carrier

The Pikunii people (also known as Blackfeet) used an innovative way to carry fire from one camp to another, by storing embers along with wood and other fuel to keep the fire going, in buffalo horns. These fire carriers were designed in such a way that they could alert the one holding the fire carrier to when the fuel inside the horn had almost run out and it was time to change the fire over to another horn.

Photos by Mark Pieper, USDA Forest Service. Fire Carrier Model constructed by Blackfeet Elder Marvin Weatherwax. Used with permission.

Thinking critically

Modern day matches are definitely a fantastic and potentially lifesaving tool. However, they also have their weak points.

List two issues that your everyday box of matches face and come up with a solution for each issue. *Hint: you can use the internet to help you research some solutions.*

The disposable lighter is definitely a step up from your everyday box of matches. Its construction is quite simple but very effective in creating instant flame.

Imagine you have just travelled back in time, where you find yourself in an era where people are still using flint and iron to light fires and matches and lighters haven't been invented yet. You just happen to have a lighter in your pocket and you take it out to use it, startling those around you who start calling it sorcery and mistaking you as a supernatural being. You suddenly find yourself in the position of having to explain what the lighter is, or face being imprisoned.

Research the disposable lighter, either online or in person. Consider how the mechanisms within the lighter work together to make a flame.

Present your research in diagrammatic form either in your book or online document.

If you could make an improvement to the disposable lighter, what would it be and why?

Make sure you are always safe around fire and flame.

Day 7 activity 4: Matches–matics

Notes for teachers and whānau

The following activity is designed to develop some basic concepts in algebra.

I am learning to: describe a linear relationship between two variables in words and as an equation.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- Any item that could be used to represent matchsticks and create patterns.

Instructions:

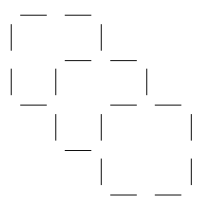
Read over the task then answer the questions in your book or online document.

Your task:

Overlapping Squares

Matchsticks are used to make a pattern of overlapping squares as in the diagram.

How many matchsticks are required for 8 squares?
How many squares could be made with 38 matchsticks?
How many matchsticks are required for 81 squares?
How many squares could be made with 134 matchsticks?



1. Use matches to represent 1 square, 2 squares, etc up to 5 squares.
2. Make a table showing the number of matches versus the number of squares.
3. Graph the number of matches versus number of squares for up to 10 squares.
4. Use your graph to find how many matches are used for 7 squares. Use your graph to find how many squares could be made with 56.
5. Can you use your graph to find how many matches are used for 33 squares?
7. What is the relationship between the number of matches and the number of squares?
8. Write your rule as an equation.
9. Julie has written m = 6s + 2 and Denise has written m = 8s – 2(s – 1). Who is correct?
10. Use your equation to find how many:
    - matchsticks are required for 8 squares, 81 squares.
    - squares could be made with 38 matchsticks, 134 matchsticks.

Challenge: repeat the activity above making triangles or hexagons.

Remember to do your end of day reflection and wellbeing activities (See p. 7&9).

Day 8 activity 1: Riding on sunshine

Notes for teachers and whānau

Today's activities focus on different innovations that are helping humans reduce their impact on the environment around them, by searching for alternative fuel sources and reducing our footprint.

Note our Inquiry focus for today is "making meaning" which includes analysing data, organising, and sorting information, summarising, synthesising, making connections/ conclusions, building deeper understandings, and thinking critically.

I am learning to: think critically about my impact on the environment and what I can do to preserve our planet for future generations.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- https://instructionalseries.tki.org.nz/content/download/42867/479629/file/SJ-L4-May-Reducing%20our%20Footprint.pdf
- A calculator (optional)

Remember to start your day right (See p. 8)

Instructions:

Read *Reducing our footprint* then complete the tasks that follow.

Your task:

You do the math!

1. Cleve mentions one of his clients' goals was to sell a car every minute. If this was realised, how many cars would have been sold by this company in one working week?
2. Cleve also mentioned that it took 2 hours to travel 5 km. How many km per hour does that work out to be?
3. A fit, healthy adult will generally travel at an average speed of 1.5 m/s. Based on your calculations from question 2, how far would a fit adult walk in the time it took Cleve to drive across town?

Critical thinking

1. What major climate issue are Cleve and his business partners trying to address by getting people out of cars and onto bikes?
2. What does Cleve say is preventing more people from switching to e-bikes and what is his solution for this?
3. What other issues, apart from that identified in question 2, are possible factors preventing more people from switching to e-bikes. List 2 and give your reasons.
4. Dr Helen Caldicott is quoted as saying:

> "We did not inherit the earth from our ancestors; we borrowed it from our descendants."

Explain what you think she meant and use examples to illustrate your point.

Day 8 activity 2: Off the grid

Notes for teachers and whānau

The following activity focuses on technological developments designed to harness the sun's energy to provide clean and renewable to power our homes.

I am learning to: identify developments in solar technology and how we can lessen our dependence on electricity produced using fossil fuels.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- https://www.sciencelearn.org.nz/resources/1745-photovoltaic-roofs

Instructions:

Read the text below then complete tasks that follow.

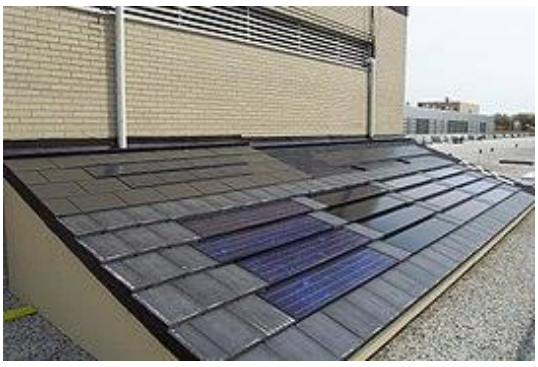
Your task:

Photovoltaic roofs

Wouldn't it be great if you could produce all your own energy needs – at no cost? Imagine having your own personal electricity supply to run your house and your cars.

Associate Professor Ashton Partridge from Massey University is working on just that. His work in photovoltaics aims to produce a roof that (together with solar energy) will supply us with all the electricity we need. Ashton is not talking about having a few photovoltaic panels on your roof, but the roof itself is photovoltaic.

NIWA (National Institute of Water and Atmospheric Research) has calculated that every square metre of light shining on a roof is the equivalent to a 650–watt light bulb being shone onto it. Ashton says, "We want to harness that energy. We want to spread the photovoltaic effect over the whole roof."



Public domain, via Wikimedia Commons

On the left is an example of current photovoltaic panels installed on a rooftop. New technology means an entire house roof can be photovoltaic. Photovoltaic cells are embedded within the roof and are not visible such as in the right-hand image. The roof looks like any ordinary roof.

Having the whole roof photovoltaic means the average house will have 4 times more electricity than the average household needs. This is enough electricity for a whole house plus 2 vehicles with some left over that could be fed back into the national grid. Ashton says, if you put a photovoltaic roof on every house in New Zealand, you could generate the total amount of energy required for the country including what is used by businesses. He says, "We won't need more hydro dams or windmills. There will be an abundance of electricity including for the running of vehicles."

So, what exactly does the term '**photovoltaic**' mean and how does it work?

Photovoltaic (PV) basically means energy from the sun. The term itself is made up of the words "photo" which is Greek for light and "voltaic" meaning voltage (or electricity). The term photovoltaic describes a process known as the "photovoltaic effect" the process by which a material such as silicon converts sunlight into electricity.

In photovoltaic cells, sunlight shines through a thin sandwich of two different types of silicon. The Sun's energy causes some electrons to cross from one side of the sandwich to the other. In this way, the solar cell 'pumps' electricity (the movement of electrons) through itself and around the circuit. The solar cell will keep producing electricity as long as the Sun is shining on it.

Adapted from Photovoltaic roofs – Science Learning Hub|Pokapū Akoranga Pūtaiao https://www.sciencelearn.org.nz/resources/1745-photovoltaic-roofs and "What does Photovoltaic mean?" – ESOLAR.co.nz https://www.esolar.co.nz/what-does-pv-or-photo-voltaic-mean/

Think critically

1. Apart from the PV panels on the roof, what other devices would you need to ensure you can capture and store the energy from the sun?
2. Compare this photovoltaic roofing with photovoltaic panels that are attached to roofs. What is new with this technology?
3. What are the benefits to the environment of having all roofs in NZ covered with PV?
4. What do you think feeding electricity back into the national grid means? What benefit could that have to the homeowner or bill payer?

Let's get creative!

The technological ability to harness free and clean energy from the sun has come along. As you would have found in the article above, innovative ideas have made it possible to capture even more energy by integrating PV cells directly into the structure of the roof rather than adding it on later.

What other uses do you think PV technology can be added to, to make our lives better, easier, or more mobile? Consider an object or device that you could integrate PV into.

Draw a diagram of your idea, label and explain how it incorporates the concept of capturing and storing energy from the sun. You will also need to indicate what need is being met by your design.

Hint – you may want to do a little bit of research around photovoltaic if you still need a further insight into what it can do before you start your design.

Day 8 activity 3: Saving power

Notes for teachers and whānau

This activity continues on with the theme of power saving innovations. Learners will engage in adult scenarios that involve power bills, loans, and savings. To get to the mathematics, the learner will have to read and interpret the scenario and the questions.

I am learning to: practice inductive reasoning and calculate percentages and rates for savings and loans.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- A calculator
- Look in your pack for a copy of https://nzmaths.co.nz/sites/default/files/SavingPower.pdf

Instructions:

Read the instructions on the worksheets below and complete the tasks within them. You will practise inductive reasoning, calculate percentages and rates for savings and loans, and you will likely discover that small changes over time can lead to big savings.

Your task:

Remember:

- getting stuck is part of every problem-solving experience (if you don't get stuck, the "problem" is not a problem!).
- state in your own words exactly what it is you are being asked to solve
- recognise and discuss the assumptions that you have had to make when answering questions

Energy: Mathematics in science contexts, Levels 3+–4+

Saving Power

You need ★ a calculator (optional)

Activity One

Jimmy's mum has just bought a thermal eco-wrap for their hot-water cylinder. The wrap cost her $70, which the salesperson said she'd save in power in the first year. Jimmy read on the Internet that only 25 percent of houses in New Zealand have insulated hot-water cylinders.

1. If there are 1.58 million homes in New Zealand, how many have uninsulated cylinders?
2. If all these homes put thermal eco-wraps around their cylinders and the wrap saved each household $70 in power per year, what would be their total saving in the second year?

So next year I'll be paying $70 less!

Activity Two

Jimmy's Uncle Jack has a solar panel on his roof that helps heat his water. He and Jimmy's mum are discussing their power bills.

Our power bills used to be very similar, but mine has gone down quite a bit since I had the solar panel installed.

Solar panels do help the environment, but they cost about $2,000 to buy and install. That'd use up our holiday savings!

1. a. Which is Jimmy's mum's power company?
   b. i. If the difference in the monthly bills above is due to Uncle Jack's solar panel, about how much might Jimmy's mum save *each year* if she had a solar panel installed?
   ii. At this rate, how many years would it take for the solar panel to pay for itself?

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Day 8 activity 4: Green thinking & eco living

Notes for teachers and whānau

The final activity for the day looks at the different innovations that help us live more sustainably, produce less waste and be kinder to the environment and people's wallets.

I am learning to: understand the impact of our lifestyles (consumerism) on the environment and ourselves.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- Optional digital: *Solving Plastic Pollution*
  https://www.youtube.com/watch?v=aTcMPy6L88E&t=61s
  https://environment.govt.nz/assets/Publications/Files/Government-response-to-the-Rethinking-Plastics-report.pdf

Instructions:

Read the text below then complete the tasks that follow.

Your task:

Rethinking plastics

We all know that New Zealand – and the world – has a plastic pollution problem. It's estimated that 8 million metric tonnes of plastic end up in the ocean every year – that's one rubbish truck worth of plastic being tipped into the ocean every minute! Some science commentators are predicting that, by 2050, there will be more plastic in our oceans than fish. Fancy going for a swim in a sea of plastic or fishing up a fish meal full of plastic?

The problem

Plastics are useful materials that have many positive aspects. Unfortunately, they also have some significant impacts on the environment in which we live. They do not biodegrade. Plastic can take up to 400 years to break down in a landfill – and even then it will not completely break down. Rather, it forms very tiny fragments called microplastics.

Microplastics are now found in our water, in our soils, in many foods that we eat and in the air that we breathe. Microplastic research is looking at the possible health effects of this on animals and humans. Many plastics are made from fossil fuels and by processes and machinery powered by fossil fuels. The burning of fossil fuels is a significant driver of climate change through the release of greenhouse gases into the atmosphere.

Our modern society seems to be driven by the impulse for instant gratification. Another way to put it is many of us want everything and we want it now. As a society, we have become used to many of our goods being 'disposable' – use once, then throw away. Things like single use plastic bags, plastic food packaging, disposable

cups and cutlery, plastic straws and more, are continuing to find their way into our landfills, waterways and even our food source!

So how do we solve a wicked problem like plastic pollution?

Part of the solution to solving the problem of plastic pollution is changing our own thinking around consumption. We must eliminate the plastics we don't need and innovate so all the plastic we do need is designed to be safely reused, recycled, or composted. We also need to start changing our thinking around "single use" and "disposable" objects and try to find alternative ways to meet these needs without costing us the earth – literally.

Adapted from Rethinking plastics in Aotearoa New Zealand – the report. *https://environment.govt.nz/assets/Publications/Files/Government-response-to-the-Rethinking-Plastics-report.pdf*

1. Make a list of at least 5 single use or disposable items that have had innovative thinking or practical solutions applied to the problem they pose.

Single use/disposable item	**Innovative solution**

Not all plastics are bad. In fact, if we didn't have plastics, we would find ourselves with some bigger issues. Here are two examples where plastic can contribute positively to the environment:

- *Reduced food wastage* – Between one–quarter and one–third of all food produced is wasted through spoilage. But without plastic packaging, it would be considerably worse and have a larger carbon footprint.
- *Lightweight transport* – The use of plastics in transportation (cars, trains, and planes) reduces fuel consumption.

Critical thinking

Used correctly, plastics can actually enhance our lives and help us take better care of the environment.

2. Think of two other benefits innovations with plastic can have on our society. Think widely and consider areas that may not currently be well known. Record your answers in your book or online document in the same format as the examples above.

Remember to do your end of day reflection and wellbeing activities (See p. 7&9).

Day 9 activity 1: Emotional robots

Notes for teachers and whānau

Going further/ deeper

Today's set of activities will be looking at advancements in digital technologies, how they have become a part of our lives and the impact they have on us personally and as a society.

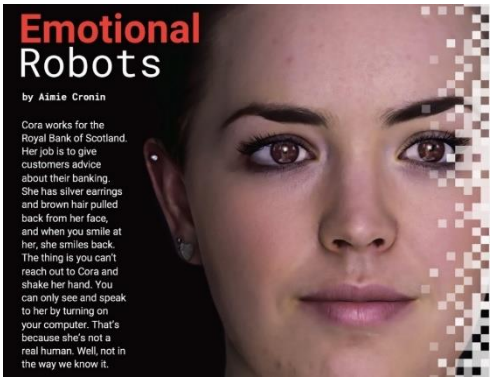
Note that today our Inquiry focus is "going further, deeper". This may include promoting opportunities to engage further and dive deeper through discussions, provocations, exploring further contexts, taking action, or thinking critically and drawing conclusions.

I am learning to: understand how technological development expands human possibilities.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- *Emotional Robots* (Google slides print p. 1–2) https://instructionalseries.tki.org.nz/Instructional-Series/Connected/Connected-2018-Level-4-Digital-Space/Emotional-Robots

Remember to start your day right (See p. 8)



Instructions:

Read the text *Emotional Robots* (included in your pack) then complete the tasks that follow.

Your task:

Before you start:

Consider the following question and make notes for yourself, then continue to read the rest of the text.

- What does it mean to be "human"?

Critical thinking:

In the text above Greg Cross, the chief business officer of Soul Machines, states:

> "Human beings are wired to engage on a face-to-face basis. The human face plays a very important role in the way we communicate."

1. What are your first impressions regarding his statement? How true does this statement sound to you?
2. How important is it to you to be able to see the face of someone you are trying to communicate with you?
3. What non-verbal cues can someone's face communicate to you that voice alone can't?
4. List one advantage and one disadvantage of applying a human face to a non-human entity (i.e., a robot or artificial intelligence).

Day 9 activity 2: Artificial Intelligence (AI)

Notes for teachers and whānau

The following activity continues along the same theme as the previous activity, this time looking at defining the concept of Artificial Intelligence and the ethical considerations that come with such technologies.

I am learning to: critically reflect on the impact AI can have on the development of a society and vice versa.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- Emotional Robots (Google slides print p. 3) https://instructionalseries.tki.org.nz/Instructional-Series/Connected/Connected-2018-Level-4-Digital-Space/Emotional-Robots
- *The Turing test: Can a computer pass for a human?* https://www.youtube.com/watch?v=3wLqsRLvV-c

Instructions:

Read the text *Artificial Intelligence* (included in your pack) and complete the tasks.

Your task:

1. What does the writer say makes up a large proportion of human thought?
2. Define emotional intelligence.

According to the text, Greg Cross believes that a computer is able to ***understand the way we feel*** and can mimic human emotions.

3. What does the term **mimic** mean?
4. Based on the definition of the word mimic, how accurate do you think Greg Cross's statement above is? Justify your answer.

It's almost certain that each one of us would have come across and used some form of AI in our daily lives. Chatbots are almost everywhere online. They're a useful tool for business because they save time and effort by automating particular jobs previously covered by humans in customer support roles. Automated assistants like Siri, Alexa, and Google Assistant are also examples of AI. However these examples are referred to as Conversational AI as their programming enables them to hold more of a natural conversation with a user, than the static answers given by Chatbots.

5. Compare and contrast chatbots against automated assistants. Consider their function, user experience, application and how much you can interact with them. Use a Venn diagram to record your answers.
6. What sort of tasks are most suitable to AI? Why?
7. What are some tasks that we may not wish to give up?
8. When do you think artificial intelligence could surpass human intelligence? What consequences could there be to this?

Day 9 activity 3: Saving the world one swipe at a time

Notes for teachers and whānau

This activity looks at different ways digital technology is being used to find solutions to social and medical problems.

I am learning to: justify whether an intended outcome meets a stated need or opportunity.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- *Saving the world one swipe at a time* (Google slides print p. 2–3) https://instructionalseries.tki.org.nz/Instructional-Series/Connected/Connected-2018-Level-4-Digital-Space/Saving-the-World-One-Swipe-at-a-Time

Instructions:

Read the text *Thoughtful technology* (included in your pack) and complete the tasks that follow.

Your task:

Answer:

1. What was the main problem that the developers of the Thought-Wired wanted to address?
2. What does the word **prototype** mean? How do developers know to make changes to their designs? Where do they get their data from, to help make their improvements?
3. How is this device different from other products on the market that are looking to answer the same problem?
4. According to Dmitry, both the user and the computer programme had to be trained to perform certain functions that would work together to communicate. What were they?
5. How would society as a whole benefit from this kind of innovation? Justify your thinking.

Let's get creative!

What could be a digital technology that could enhance life at your school? What about at home or in your neighbourhood? Think of an idea and plan out how you could integrate a digital technology to solve an issue, address a problem or provide an opportunity.

Day 9 activity 4: Inventive Thinkers

Notes for teachers and whānau

The last activity for the day is a maths task that looks at some famous inventions that were created by New Zealanders.

I am learning to: use timelines and interpret time-based information.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- Copy of https://nzmaths.co.nz/resource/inventive-thinkers
- A ruler
- Someone to work with

Instructions:

Read the worksheets and complete the tasks.

Your task:

You will be making timelines. Timelines are a useful way to display information. They are often used in social science contexts. They show the order in which events occurred and the periods of time between them.

Timelines need to follow conventions used in other data displays: in particular they must have a uniform scale and clear labels.

Remember to do your end of day reflection and wellbeing activities (See p. 7&9).

Inventive Thinkers

You need ★ a ruler ★ classmates

TECHNOLOGY New Zealanders have invented very clever solutions for problems and ways to make everyday life easier. Some famous New Zealand inventions relate to outdoor adventure activities.

Activity One

Ingrid made a list of some New Zealand inventions that were created before she was born.

All-terrain baby buggy 1992

Amphibious sports car 2003

Bungee jumping (as a tourist activity) 1987

Ski plane (with retractable ski) 1955

Electric fence (early version) 1937

Sonic spectacles 1965

Childproof medicine cap 1976

Jetboat (no propeller) 1954

Tranquilliser dart 1959

1. a. Show Ingrid's list of inventions on a timeline.
   b. Why is a timeline a good way to present this information?

2. Ingrid discovered that, before Europeans settled in New Zealand, Māori invented a drill. The date of this invention isn't known. She decided to make a timeline from the drill to the amphibious sports car. If she showed each year as 1 centimetre and chose 1750 for the date of the drill, how long would her timeline be?

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Day 10 activity 1: Back to the Future

Notes for teachers and whānau

The learner will demonstrate their understanding by choosing an aspect of the week they would like to highlight through creating a design brief and prototype.

Note our Inquiry focus is "present – share learning about the theme" which includes thinking about who the audience is and considering different ways of communicating learning for example, presentation, video, poster, etc.

I am learning to: make links between what I have learned and apply it to different scenarios.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)
- Optional digital: *Top 10 Movie Predictions That Came True* https://youtu.be/uotsI6Kuv-g

Remember to start your day right (See p. 8)

Instructions:

Follow the sequence below.

Your task:

Sci-Fi movies over the years have fuelled our fantasies about what the future might bring us. Some have been quite "out there" depicting alien invasion and the total annihilation of the human race, while others have managed to come to life in our modern day. Here are some examples:

Predicted technology/innovation	Movie title and year released
Self-driving cars	Total Recall (1990)
Digital Billboards	Blade Runner (1982)
Holograms	Star Wars (1977)
Tablet computers, AI and more	2001: A Space Odyssey (1968)

1. What are some other technologies or innovations that you know of that were predicted in movies as the way of the future? Do some research and create your own list. Recreate the table above in your exercise book or online document.
2. What are some of your predictions for the future? Describe in 200–300 words what you think the world will be like in 10 years' time? Think about:
    a. what schools or learning might look like
    b. how we might interact or communicate with each other
    c. how we might travel across land or in the sky
    d. the types of foods we might be eating and how they are made
3. Choose an object or process and draft up a sketch or description of what you think it will look like in 10 years' time. Label and add detail to help your audience understand your thinking.

Day 10 activity 2: Future thinking

Notes for teachers and whānau

Keeping with the theme of predicting the future, the following task encourages learners to think critically about what changes may occur within food production, creating alternative fuel sources and medical care.

In this activity I am learning to: think critically and widely about the future of food, fuels, or medicine.

What do I need?

- 30 minutes
- Materials for recording your responses (exercise book or an online document)

Instructions:

You will use your critical thinking skills to consider the future of food, fuel or medicine.

Your task:

Choose ONE of the following topics below to analyse. Fill in the table that relates to that topic.

THINKING ABOUT FUTURE FOODS: Identify changes in eating habits over time and explore what might happen in the future.				
	Individual	Local	National	Global
Existing situation: What types of foods are eaten and why?				
Trends: What differences are there between the food eaten now and the food our parents ate when they were young?				
Drivers: What has caused the changes in the types of foods people eat?				
Possible futures: What foods might be available in the future? Why?				
Wild cards: E.g. What would happen if we could not grow our own food?				
Preferable futures: What foods do you think should be available in the future?				

THINKING ABOUT FUTURE FUELS: Identify changes in energy supply over time and explore what might happen in the future.				
	Individual	Local	National	Global
Existing situation: What is electricity used for? What natural resources are used to generate this electricity?				
Trends: How has the use of electricity changed over time? What changes have occurred in availability of electricity and how it is generated?				
Drivers: What has caused the changes in electricity use and generation?				
Possible futures: How important will electricity be in the future? What will be used to generate the electricity?				
Wild cards: E.g. What could happen that would drastically change how electricity is used/generated?				
Preferable futures: What do you want your future to look like in terms of electricity availability and use?				

THINKING ABOUT FUTURE MEDICAL CARE: Identify changes in medical care over time and explore what might happen in the future.				
	Individual	Local	National	Global
Existing situation: What medical care do you have access to, should you need it?				
Trends: What changes have occurred in medical care over time?				
Drivers: What has been behind the changes in medical care?				
Possible futures: What medical care might be available in the future? Who will have access to it?				
Wild cards: E.g. What could happen that would drastically change what medical care is available, and who has access to it?				
Preferable futures: What medical care do you think should be available in the future?				

Day 10 activity 3 & 4: What's the big idea?

Notes for teachers and whānau

For the final activity of the day, learners will have the opportunity to create an artefact or prototype (physical or digital) to represent what they have learned or what they understand about ***innovation****.*

In this activity I am learning to: relate this week's learning back to the concept of innovation and communicate my understanding.

What do I need?

- 30 minutes
- A digital device for creating a multimedia presentation – OR –
- Materials to create a physical piece of work (artefact) such as drawing and colouring materials, carboard, glue, sellotape, straws, string, rubber bands etc.

Instructions:

You will need to prepare a design brief and a prototype of your idea. Use the notes, prompts and ideas below to help you with the process.

Your task:

A design process typically follows the following steps:

1. Identify a need
2. Research information
3. Plan a design
4. Create a product
5. Present
6. Evaluate

Create a design brief for an idea for an invention/innovation sparked by your learning.

Set the scene

- what is the problem you have identified?
- how will your design benefit individuals, your community, or the environment?
- what else do you need to find out before you can start planning?

Survey

- If your idea is designed to benefit people, then it is a good idea to survey others and find out what their ideas might be about your innovation.
- If you do not have prototype available to start with, then you should prepare a list of questions that will help guide data collection.

Your construction materials

- Make a list (or create a table) of materials and how you intend to use them

Your design

- Create a design plan including specific details and labels.
- Check your design before building to ensure it is practical and achievable.

Build your design

- construct a prototype of your design.
- test your prototype for functionality and consider how it looks and feels.
- if you must make any changes to your design, make sure that you record the changes that you have made and state why you have done so.

Share your process and prototype with someone to gain feedback.

Congratulations on two weeks of learning about change.

So, what do you think? Is change a good thing?

Write a reflective response to this question in your home learning book.

Ka pai! Ngā manaakitanga.

Remember to do your end of day reflection and wellbeing activities (See p. 7&9).