water

learn it. live it.

an education resource
for primary and
secondary schools

Volume One: Water in the Natural Environment

A joint initiative of Yarra Valley Water City West Water South East Water

Acknowledgements

Water – learn it. live it.
Fourth Edition (2013)

Developed by Melbourne's government-owned water retailers:
City West Water
South East Water
Yarra Valley Water

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Subject Key Science English Environment Geography Maths

Introduction

Schools play an important role in delivering sustainable messages to our future generations.

Melbourne's government-owned metropolitan water businesses, City West Water, South East Water and Yarra Valley Water, have joined forces to bring you the new Water – learn it. live it. (Water-lili) Curriculum Resource, a collaboration between educators and water industry professionals.

This resource for primary and secondary teachers provides fun, interesting and interactive projects to assist students to learn about all aspects of the water story. From properties of water and catchments, to sewage treatment, recycling, health and hydration and responsible gardening, water is explored at a local, national and global level.

Bloom's Taxonomy underpins this collection of activities and asks more of the students than simple recall, instead requiring knowledge, comprehension, application, analysis, synthesis and evaluation. Great care has also been taken to cater for the varying interests and strengths of students, and offer activities based around Science, Mathematics, English and Communications, Art, Music and Geography, all with a focus on water.

The resource has been designed to be flexible in its use and allows educators the opportunity to pick and choose which activities will suit the needs of their students. There are three volumes in the series.

- *Volume One: Water in the Natural Environment*
- *Volume Two: Water in the Urban Environment*
- *Volume Three: Water in the Community*

Using the Resource

Volume One: Water in the Natural Environment investigates water in its natural state, and is broken into four sections: Properties of Water, Natural Water Cycle, Bodies of Water and Weather. Each section provides a collection of relevant activities for students from Years Prep to 10 and includes a main activity supported by three scaffolded options to explore the subject further.

The scaffolds are aimed at different levels of student ability, and are categorised as Engage (Prep-2), Connect (3-6) and Explore (7-10). These categories are a guide only, and you may find an activity that suits your students in any of the sections.

A selection of specific worksheets, thinking tools and graphic organisers are provided to assist students to clarify their processes and explore each subject completely. Specific worksheets are found directly following the relevant activity, and graphic organisers are kept together in the Templates section of the resource. An outline of the graphic organisers and their applications can be found at the beginning of the Templates section of this document.

Icons have been used in the Table of Contents to indicate the subject area to which the activity belongs. An Activity Matrix has also been included to allow you to easily identify the learning style and area each activity belongs.

 Hands on Activity

 ICT

 Pen and Paper

 Out and About

Suggestions, links and additional information are provided where deemed appropriate, however specific references have generally been avoided to insure against broken links or superseded information, and to allow for flexibility in using your favourite sites and programs. There are a variety of online sites for your students to create their works, including flipbooks, stop motion, animations, films and cartoons. Just use an online browser to find the information or program you require.

Activity Matrix

Activity Name	Pg	Activity Type			
		Main	Engage	Connect	Explore
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Melbourne's Water Businesses

City West Water

City West Water

City West Water provides drinking water, sewerage, trade waste and recycled water services to approximately 342,000 residential and 36,000 non-residential (industrial and commercial) customers in Melbourne's central business district and inner and western suburbs.

City West Water's boundaries contain the local government areas of Brimbank, Hobsons Bay, Maribyrnong, Melbourne (north of the Yarra River), Moonee Valley, Wyndham, Yarra and parts of Melton and Hume.

Relative to the other metropolitan Melbourne water retailers (South East Water and Yarra Valley Water), City West Water has a smaller customer base and geographic area, with a greater proportion of non-residential customers. These non-residential customers come from a range of sectors, including brewing, chemical manufacturing, oil refining, textile and automotive manufacturing.

South East Water

South East Water

South East Water provides water and sewerage services to over 1.6 million people in Melbourne's south east. Across a region spanning 3,640 square kilometres and fronting 300 kilometres of coastline, South East Water provides drinking water, sewerage, trade waste recycled water services.

South East Water is responsible for $3.2 billion of assets. This includes managing over 23,000 kilometres of water and sewer pipeline.

South East Water's vision is to provide healthy water for life. This includes educating our schools and community about the value of water.

Yarra Valley Water

Yarra Valley Water

Yarra Valley Water is Melbourne's largest water and sewerage business, providing services to over 1.7 million people and over 50,000 businesses in the northern and eastern suburbs of Melbourne.

Yarra Valley Water safeguard the community's health by effectively removing wastewater and running operations in a way that protects the environment. Its district covers around 4,000 square kilometres, from as far north as Wallan and extending to Warburton in the east and Malvern in the south.

Yarra Valley Water helps customers to enjoy a healthy, environmentally friendly and low-cost community lifestyle through the Choose Tap initiative. The program supports community sport, local festivals, education, parks and gardens, the business sector, and cafes and restaurants.

Melbourne Water

Melbourne Water

Melbourne Water plays a major role in the total water cycle.

Owned by the Victorian Government, Melbourne Water manages Melbourne's water supply catchments, removes and treats most of Melbourne's sewage and manages rivers, creeks and major drainage systems throughout the Port Phillip and Westernport regions.

These assets service 3.4 million people in an area spanning 12,000 square kilometres.

Melbourne's water resources are managed by Melbourne Water to ensure that future generations enjoy one of the best urban environments in the world.

water
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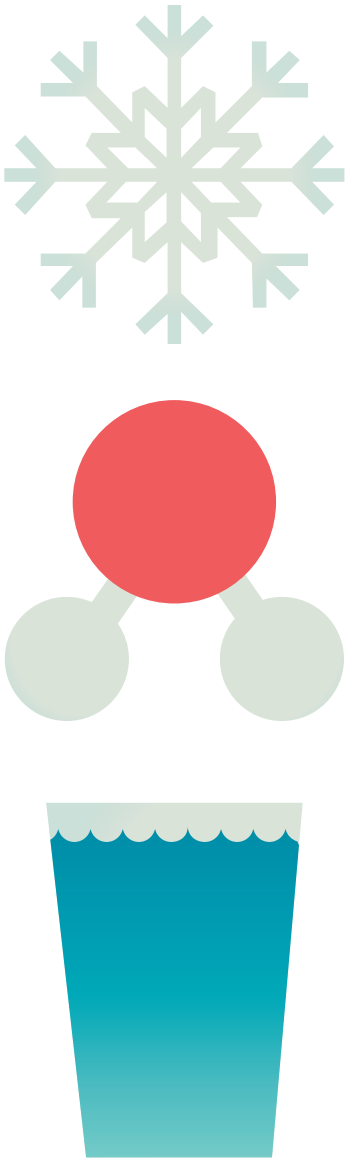
1

Properties of Water



Properties of Water

Pure water is colourless, tasteless and odourless, which may sound very boring, but the hidden qualities of water make it a particularly interesting and unique substance.

Water, also known as H_2O, is a molecule made up of two atoms of hydrogen attached to one side of an oxygen atom (Figure 1). Oxygen has a negative charge while hydrogen atoms have a positive charge, meaning the water molecules attract each other (because opposite electrical charges attract). This is called hydrogen bonding.

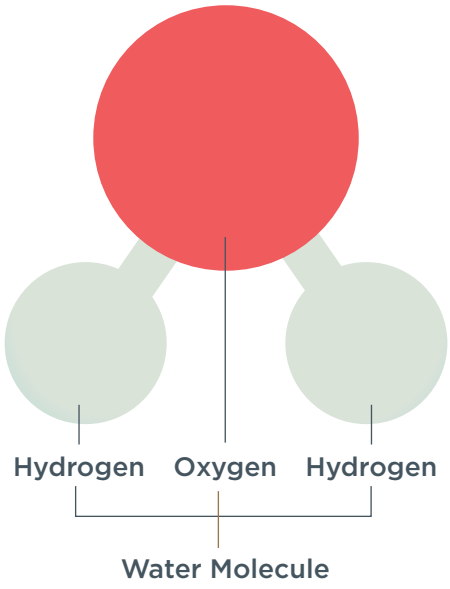


Figure 1: Water Molecule

States of Matter

Water molecules are constantly moving. Temperature determines at what speed they move and if they will form a solid, liquid or gas (Figure 2).

Solid

A solid is anything that holds a fixed shape. The only way a solid can change its shape is by applying force or heat.

Hydrogen bonding holds water molecules apart in an open net pattern, making the water expand. Water is the only substance that expands in its frozen state.

Liquid

A liquid is anything that has volume but does not have a fixed shape. Liquid forms the shape of the container it occupies. In liquid state, water molecules move more freely than the molecules in a solid.

Gas

As gas, water molecules move around really fast and collide with each other. They don't hold a fixed shape or volume but instead take on the shape and the volume of the container they are in.

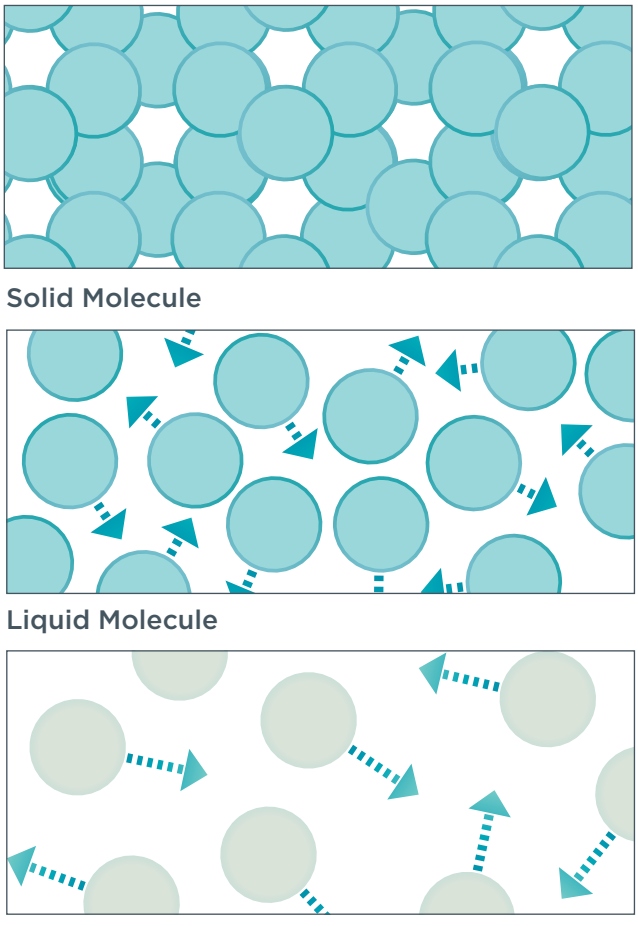


Figure 2: States of Matter

Water is found naturally on Earth in all three states: as water vapour in the atmosphere and our breath; as liquid in the ocean, rivers, streams and rain; and in solid form as snow, ice and hail. Water can change from one state to another with the application or removal of heat (Figure 3).

The Universal Solvent

Water is often called the universal solvent as it dissolves more substances than any other liquid. This is due to its polarity (uneven positive/negative charge distribution). It attracts atoms from other substances, pulling them apart and merging them into a solution.

However, there are many compounds water can't dissolve at all or won't dissolve well, such as fats and waxes.

Substances that easily dissolve in water are known as hydrophilic (water loving), while substances that do not dissolve in water are known as hydrophobic (water fearing).

Other Properties of Water

Cohesion
Water sticks to itself easily.

Adhesion
Water sticks to other things easily.

Surface tension
The surface of water has a 'film' that is more difficult to penetrate due to the strength of the molecule bond.

Climbing Water

Capillary action explains how water and nutrients can climb up the roots of plants despite the pull of gravity. Cohesion and surface tension of water (the forces binding a liquid together), combined with adhesion (the attribute that attracts this bound liquid to another surface), create a greater force than that of gravity. Among other things, capillary action helps trees get the water they need, allows human tear ducts to function, and enables towels to dry us after we wash!

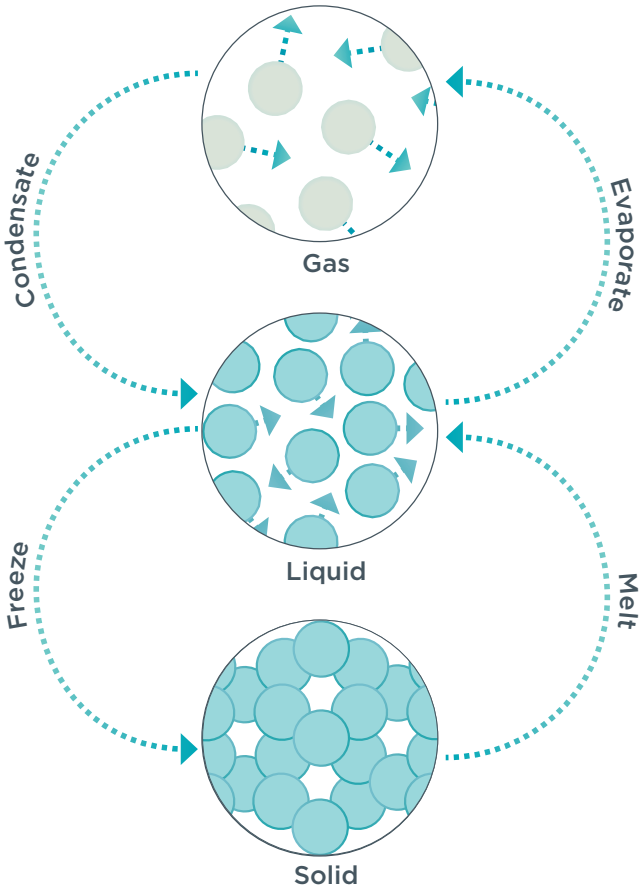


Figure 3: Changing States of Matter

What's your Measure?

Water is measured in different units, depending on what state it is in.

Solid

Weight

Kilogram (kg)
Gram (g)
Milligram (mg)

Gas

Volume

Cubic metre (m^3)
Cubic centimetre (cm^3)

Liquid

Volume

Litre (L)
Millilitre (mL)
Kilolitre (kL)
Megalitre (ML)
Gigalitre (GL)

You can also measure the attributes of a natural water body, such as temperature, pH levels, turbidity and dissolved oxygen. Special equipment is required to take these measurements, which can vary significantly in different locations. More information on water quality can be found in *Volume Two: Water in the Urban Environment*.

States of Matter

Water might seem a bit plain and boring, but it's actually pretty interesting stuff. The existence of water is essential for all life on Earth. It is a versatile substance that is used in lots of different ways by lots of different organisms.

Every water molecule is made up of two atoms of hydrogen and one oxygen atom (H_2O). These molecules interact with each other in different ways, depending on temperature, to become water as a solid (ice), liquid (water) or gas (vapour).

Water molecules are so small that there are millions and millions of molecules in a single drop of water. As a solid, the water molecules are packed close together so it does not change shape. When water is in its liquid form, the molecules 'loosen up' a little and become fluid. Finally, when water molecules are in a gaseous state, they move really fast and do not want to be near each other.

Main Activity (teacher demo)

Materials

- 3–4 ice cubes
- 2 plates
- 1–2 cups of water
- kettle or Bunsen burner
- clear glass bowl or cup

Method

1. Place 3–4 ice cubes on a plate in the sun and record your observations.
2. Place 1–2 cups of water in a kettle and boil.
3. As the kettle starts to boil, hold a large plate over the spout on an angle with the glass bowl below the plate. CAUTION: keep your hand clear of the spout.
4. Draw a diagram and label it; include notes on what you observed during the previous steps.
5. Once you have seen each state in action, find an online video that further explains how water molecules function.

EXPLORE TIP: Use your online search engine to help locate the ACMI storyboard generator or an animation generator to help you create your story. You can also find all sorts of video clips online to help you understand 'states of matter'; just type it in your search engine and start exploring!

Engage

Pretend you are a single water drop. Get together with your fellow drops and talk about how water molecules interact differently as a solid, liquid or gas. Practise acting like each state of matter. Once you understand these concepts, you can perform a water molecule dance.

In groups of four, mingle and dance together as single water drops while some music plays. When the music stops, your teacher will call out 'solid', 'liquid' or 'gas'. Quickly get together with your three other teammates to create the state of matter called out. Just like musical chairs, the last group to form the state of matter will be OUT!

Connect

Make your own water (H_2O) molecules using a chemistry molecule set (if available) or playdough and toothpicks. Join multiple molecules to show how they would appear as a solid, liquid or gas.

Create a set of drawings and label them to show how liquid, solid and gas might appear under a very strong microscope.

Explore

Investigate the molecular structure of water and how it behaves in different temperatures. Create a video or animation to show how water changes state from a solid to a liquid and then to gas. Use the **Storyboard template** provided to help plan your video or animation.

Disappearing Act

Have you ever stirred something into a glass of water? What happened? When a substance is dissolved in another, the atoms or molecules of each substance are mixed together evenly.

Water is known as the 'universal solvent' due to its ability to dissolve many substances. In fact, pure water is rarely found in nature because of its ability to dissolve both natural and man-made elements.

Main Activity

Materials

- 6 clear cups or beakers
- 600 mL water
- 1 teaspoon
- 1 teaspoon each of: oil, ground coffee (not instant), food colouring, plain flour, salt and sugar

Method

1. Read through the steps of this experiment then complete the 'Predict' part of the **Predict Observe Explain (POE) template** provided.
2. Measure 100 mL of water into each of the 6 clear cups/beakers.
3. Using one solution at a time, predict what will happen when you add the first substance (oil) to the cup of water.
4. Add the oil to the water with the teaspoon and stir it. Write down your observations. Is it the same as your prediction?
5. Be sure to rinse and dry your teaspoon after each substance so that the next experiment is not contaminated.
6. Repeat Steps 2 and 3 for each of the remaining substances, completing your **POE template** as you go.

FACT: Did you know that sound travels around four times faster in water than it does in air? Water is more dense than gas (in this case, air), meaning the molecules are held closer together. This allows the soundwaves to bounce off each water molecule more frequently and speed along their journey more easily.

Engage

Conduct the Main Activity and complete the **POE template** provided. As a class, discuss any other substances you think can or cannot dissolve in water, and why.

Connect

Conduct the Main Activity and complete the **POE template** provided. Discuss your explanations with a partner or small group, and then identify which explanation is most accurate; you may need to do some research. Share this information by creating a PowerPoint presentation, interactive poster or infographic. Use your online search engine to find an appropriate site to find inspiration, then create your own version.

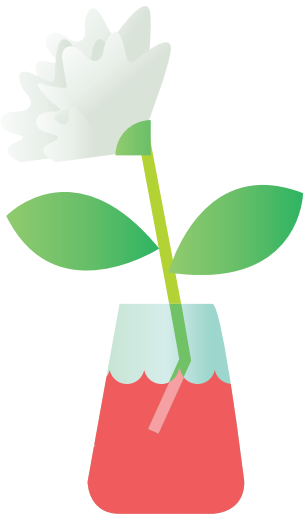
Explore

In pairs, undertake the **Disappearing Act Main Activity**. Now, design and conduct (if possible) an experiment to try to reverse the dissolving process and separate each substance from the water. Write up both experiments, using the **Scientific Lab Report template** provided. Include an additional paragraph outlining how the processes of dissolving and separating could be applied or required in real life.

Climbing Water

Capillary action refers to the ability of water to 'climb' upwards despite the downward pull of gravity. This action is caused by adhesion and cohesion—two water behaviours that work to attract and repel water molecules.

Plants use capillary action to draw moisture up from the soil, through their roots and into their leaves.



Main Activity

Materials

- water
- clear glass or cup
- 1 stirring spoon
- 1 knife
- measuring cup
- blue or red food colouring
- 3 white carnations

Method

1. Measure ½ cup of water and pour it into the clear glass or cup.
2. Add several drops of food colouring to the water and stir with a spoon until it has dissolved.
3. Cut the ends of the carnation stems at 45° angles, being careful not to crush them.
4. Place the carnations stem first into the container with the coloured water.
5. Put your experiment somewhere you can leave it safely to view over several days.

FACT: Cotton can absorb up to 27 times its own weight in water, which is why bath towels are often made of cotton. The small spaces between the cotton fibres allow space for water to be 'absorbed' via capillary action.

Engage

How do plants get their water? In small groups, perform this experiment to show how capillary action works. Check on your experiment at 2, 4, 24, 48 and 72 hours. Use the **Graphic Timeline template** to show what happened at each stage. Include hand drawn pictures or photographs.

Connect

Spill a small amount of water on a table. Does it spread out or cling together in a drop? Use some paper towel to clean it up. Can you see how the water adheres to the paper by filling in the spaces between each fibre? This is another example of how capillary action works. Use the **Detailed Lab Report template** to write up the carnation experiment; include a labelled diagram.

Explore

Perform the carnation experiment as instructed, but use 2 different beakers and 4 carnations. In 1 of the beakers, add 3 teaspoons of salt to the coloured water and use 2 carnations. In the other, add two of the carnations, but don't add anything additional to the coloured water. Complete all other steps of the experiment as written.

Write a report on your experiment. Your report should include a summary of results, an explanation of how capillary action works and discussion about the impact of adding salt to one of your containers. Complete the **Graphic Timeline template**, using photos or illustrations, and an explanation for each stage.

Teaching States of Matter

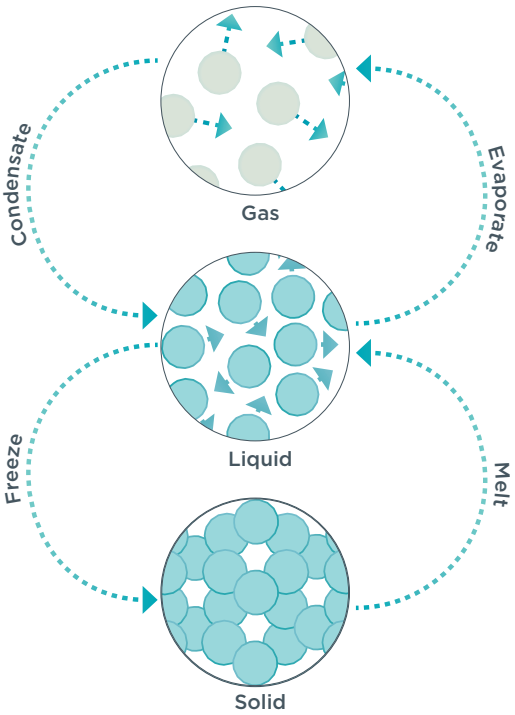
There are three main states of matter: solid, liquid and gas. Each state looks, feels and behaves differently, depending on the level of energy in the atoms that make up the water molecules.

Main Activity

Use your search engine to find some clips to explain the three states of matter. The BBC *KS3 Bitesize* presentations are a good example and offer exercises on the *Particle Model* and *Behaviour of Matter*. They even offer a Third Degree quiz at the end of each presentation!

Research further to find any additional information on the three states of matter: solid, liquid and gas. Find out the characteristics of each state and write your findings in a table.

FACT: Did you know that when water freezes it expands by around 9%? The water molecules in ice form a honeycomb-like structure, creating space in between the molecules. In contrast, as a liquid, water molecules have little space between them and sit close together. Therefore, water takes up less space than ice.



Engage

Split your class into three groups. Each group will focus on a different 'state of matter': liquid, gas or solid. In your group, find magazine pictures, take photos and draw images of water in the 'state' you are assigned. Collate them with some descriptive words and make a collage to share with your class.

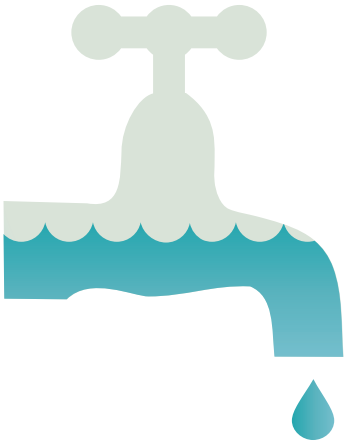
Connect

Write and illustrate a story about a water molecule and their adventures. Name your molecule, then send them through the three states of matter during your story. You might like to include friends, enemies, and different settings for them to travel through. Take turns in reading your stories to the rest of the class. Use the **Storyboard template** provided to help you plan your water molecule's journey.

Explore

Create an annotated poster (online or by hand) that could be used by a science teacher to explain the different states of matter. Be creative but ensure you are factual. You might like to search online for existing infographics to inspire you.

Weird and Wonderful Water



Pure water is colourless, odourless and tasteless which makes it seem quite dull. This is not the case at all! Water has some amazing properties which makes it invaluable in everyday life.

Main Activity

Conduct five short experiments to observe the different properties of water. Each experiment is outlined in detail on the following pages.

Activity 1 – Sticky Water

Use water, a coin and detergent to examine surface tension.

Activity 2 – Water Weight

Compare the difference in the density of hot and cold water.

Activity 3 – Scared of a Little Water?

Help oil overcome its fear of water in this colourful experiment.

Activity 4 – Ice Action

Explore the density of ice and water in this simple but effective activity.

Activity 5 – Solid, Liquid, Gas...Oobleck?

Think you know all the properties of solids and liquids? What happens when a substance behaves like both?

FACT: Did you know that hot water can freeze more quickly than cold water? This is called the Mpemba effect. While this phenomenon has been verified, there is yet to be a clear explanation as to how and why it happens.

Engage

Conduct or observe the experiments in the Main Activity, then record your observations in the **Engage & Connect - Weird and Wonderful Water worksheet** provided.

Connect

Conduct or observe the experiments in the Main Activity then record your observations in the worksheet provided. Select one experiment to investigate further and present your results in a creative way such as a poster or informative video.

Explore

The experiments outlined under the Main Activity explore density, surface tension and polarity of water, but water has a range of other amazing properties. Conduct the experiments, then investigate two other properties of water and design an experiment or create a video to explain these properties of water to a younger audience.

Activity 1

Sticky Water

Use water, a coin and detergent to examine surface tension.

Materials

- 10 or 20 cent coin
- eye dropper
- water
- detergent
- paper towel

Method

1. Wash your coin using tap water and then dry it thoroughly.
2. Using the eye dropper, slowly drop water onto the coin, counting each drop as you go. How many drops did you fit on the coin before it overflowed?
3. Dry the coin then smear a small amount of detergent over the surface with your finger.
4. Repeat Step 2.

Activity 2

Water Weight

Compare the difference in the density of hot and cold water.

Materials

- 2 glass cups that are the same size
- hot tap water (not boiling)
- cold tap water
- red food colouring
- blue food colouring
- a thin plastic card (a flat square cut from an ice cream container works well). It must be larger than the diameter of your glass.
- large tray

Method

1. Sit the 2 glasses in the tray—this will minimise the mess if you accidentally spill your experiment.
2. Add 2–3 drops of blue food colouring to one glass then fill right to the top with cold water.
3. Add 2–3 drops of red food colouring to the other glass and fill right to the top with hot water.
4. Place the plastic card on top of the hot cup. Then, holding the card in place, tip the glass upside down; if you have filled the glass right to the top there should be enough pressure to hold the card in place. Slowly remove the hand holding the card against the glass.
5. Carefully place the upside down glass of hot water over the cold glass of water.
6. Before you remove the plastic card, predict what you think will happen. Ask your partner to record the prediction in your worksheet.
7. Slowly and carefully, remove the card by sliding it out. What do you notice? Record your observations in your worksheet.
8. What do you think would have happened if the cold water glass was on top? Record your prediction in your worksheet.
9. Place one hand around the cold glass of water and one hand around the hot glass of water. Hold the glasses together and turn them so the cold cup is on top. Be sure you do this over your tray in case you spill your experiment.

Activity 3

Scared of a Little Water?

Help oil overcome its fear of water with this colourful experiment.

Materials

- clear jar or bottle with a tight fitting lid
- detergent
- cooking oil
- water
- food colouring

Method

1. Add 3 drops of food colouring to the jar.
2. Add equal amounts of oil and water to the jar, each about 1/3 of the jar's volume.
3. Screw the lid on tightly then shake the jar.
4. Let the liquids settle and observe them. Record your observations in the worksheet provided.
5. Add a few drops of detergent to the jar then shake it again.
6. Observe the results.

Activity 4

Ice Action

Explore the density of ice and water in this simple but effective activity.

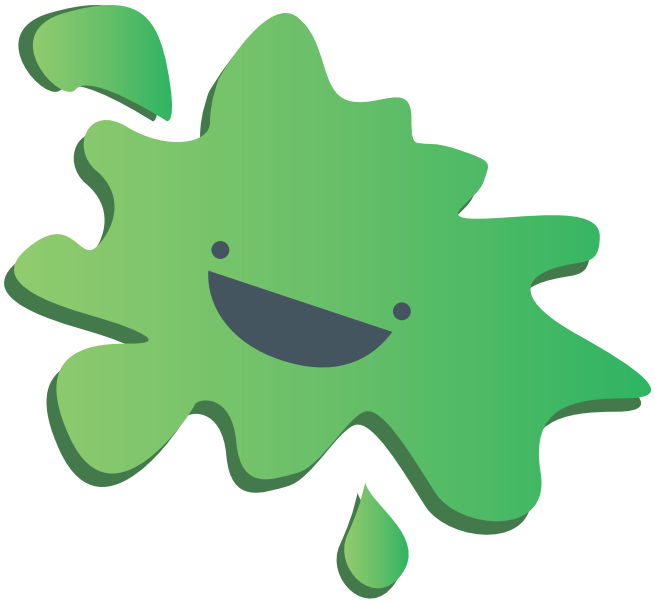
Materials

- glass cup
- water
- oil
- tongs
- ice cube coloured with food colouring

Method

1. Half fill a clear glass with water.
2. Carefully top up the glass with oil by slightly tilting the glass of water and letting the oil run down the inside of the glass.
3. Carefully place your coloured ice cube in the oil using tongs. Be sure to place it carefully in the glass—don't let it drop in!

Ensure you dispose of the oil correctly (not straight down the sink!).



Activity 5

Solid, Liquid, Gas... Oobleck?

Think you know all the properties of solids and liquids? What happens when a substance behaves like both?

Quicksand, many pastes and glues, gelatine and shampoo are all non-Newtonian fluids. They get their name from the fact that they do not fit Newton's laws of how true liquids behave (specifically, in how they react to sharing forces). Cornflour slime, also known as oobleck (from the Dr. Seuss book *Bartholomew and the Oobleck*), is a non-Newtonian fluid, a fluid that can change its viscosity (thickness).

Materials

- large mixing bowl
- large spoon
- 2 cups of cornflour
- 2 cups of water
- food colouring

Method

1. Add 2 cups of water and a few drops of food colouring to the mixing bowl.
2. Gradually add the cornflour until you achieve a smooth consistency. It should flow smoothly when you stir very slowly but should be difficult to stir quickly.
3. Roll up your sleeves and try the following activities:
   a. *Drop your hands quickly into the Oobleck, then slowly lower your hands into it.*
   b. *Hold a handful in your open palm—what happens?*
   c. *Try squeezing it in your fist or rolling it between your hands—how does it behave differently?*
   d. *Move your fingers through the mixture slowly then try moving them fast.*
   e. *Pour the mixture from one container to another. Try pulling at the slime mid-stream.*
   f. *What else can you do to test the mixture's properties?*

Engage & Connect – Weird and Wonderful Water

Experiment	PREDICT *Before you start each experiment, think about what might happen. Complete the following sentences:*
Sticky Water	I predict that the clean coin will hold _____ number of drops of water before it overflows. I predict that the coin covered in detergent will hold _____ number of drops of water before it overflows.
Weighty Water	I predict that when the hot cup is on top... . . . . I predict that when the cold cup is on top... . . . .
Scared of a Little Water?	I predict that when I combine oil and water I will see... . . . . I predict that when I combine oil, water and detergent I will see... . . . .
Ice Action	When I add a coloured ice cube to a glass of water and oil, I think I will see... . . . .
Solid, Liquid, Gas... Oobleck	When I mix cornflour (solid) with water (liquid), I think my new substance will behave like... . . . .

Experiment	OBSERVE *During your experiment, use your senses to observe what is happening. Record your observations below and include a diagram.*	EXPLAIN *After you have finished your experiment, try to explain what happened. You may need to do some research.*
Sticky Water		My prediction was/was not very close to what actually happened. The person in my class whose guess was closest was . . . . . . The . . . . . coin was able to fit more drops on it. I think this is because . . . .
Weighty Water		When the hot water was on top the colour of the water was . . . . . . I think this is because . . . . . . When the cold water was on top the colour of the water was . . . . . . I think this is because . . . .
Scared of a Little Water?		When I mixed oil and water, I noticed that . . . . . . I think this is because . . . . . . When I added detergent to the oil and water mixture I noticed that . . . . . . I think this is because . . . .
Ice Action		When I put the ice block into the oil, I noticed that . . . . . . I think this is because . . . .
Solid, Liquid, Gas...Oobleck		I think my new substance, oobleck, was more like a solid/liquid/solid and liquid. This is because . . . .

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2

Natural Water Cycle

Natural Water Cycle

Water is constantly on the move. Whether it is on the surface of the earth, underground or in the atmosphere, water's continuous movement is called the water cycle (or the hydrological cycle).

During this natural process, water can change between three different states of matter: solid, liquid and gas, depending on the temperature. This sequence serves to naturally remove some of the impurities in the water. An example of this is when water from the ocean evaporates. The salt, minerals and metals are left behind in the ocean, and only 'freshwater' returns to the atmosphere to form clouds.

There is no real start or end to the water cycle, but when explaining the stages it is often easiest to start with evaporation.

Evaporation

The sun heats water bodies across Earth, causing the liquid water to transform into water vapour. The vapour (or gas) is light enough to rise into the atmosphere.

Condensation

Water vapour rises into the air where the temperature becomes colder, and condenses the water vapour into small droplets which form clouds.

The shape, size and texture of clouds can be quite revealing and indicate a variety of weather patterns. Clouds are categorised according to their shape, their size, how high they sit in the sky, and how fast and in which direction they're moving. The layer of atmosphere where all clouds exist is called the troposphere.

Precipitation

When so much water has condensed in the clouds that the air cannot support its weight, water falls from the clouds as rain, hail, sleet or snow. Much of this water flows across the land and collects in rivers, lakes and eventually the ocean. However, some of the water is absorbed into the ground and gathers in the cracks and pores of rocks, forming groundwater. These areas of water-filled crevices are called aquifers.

In addition to supplying water for natural ecosystems, groundwater provides an alternative drinking water supply for humans and animals when surface water is limited or of poor quality. It can also be used for irrigation, agriculture and industry.

Transpiration

Water is absorbed by a plant's roots as a liquid, then travels up to its leaves before it is released as water vapour through the plant's stomata into the atmosphere.


Precipitation
Condensation
Evaporation
Transpiration
Groundwater

Water Cycle in a Jar

The water cycle is the continuous movement of water on Earth. As water moves through the cycle, it changes states and can be found naturally as a solid, liquid or gas. The stages of the water cycle include:

- **Evaporation:** water is heated by the sun and transformed into water vapour (or gas).
- **Condensation:** the cool air in the atmosphere changes the water vapour into tiny droplets that form clouds.
- **Precipitation:** water falls from the clouds when so much water has condensed that the air around the cloud cannot support it. This water falls to the ground as rain, snow, sleet or hail (precipitation), and seeps into the earth (infiltration).
- **Transpiration:** water absorbed by a plant's roots travels up through to the leaves before being released through the stomata into the atmosphere as water vapour.

Recreate the water cycle by making your own terrarium in this simple experiment.

WARNING: There are some risks associated with the use of bagged compost and potting mix. To reduce these risks, please:

- **read the warning on the bagged compost/ potting mix before use**
- **always wear gloves when handling soil, potting mix or compost**
- **avoid inhaling the mix by wearing a face mask**
- **carefully dampen the mix to reduce airborne particles**
- **wash hands thoroughly after using potting mix or compost, even if you've been wearing gloves.**

Main Activity

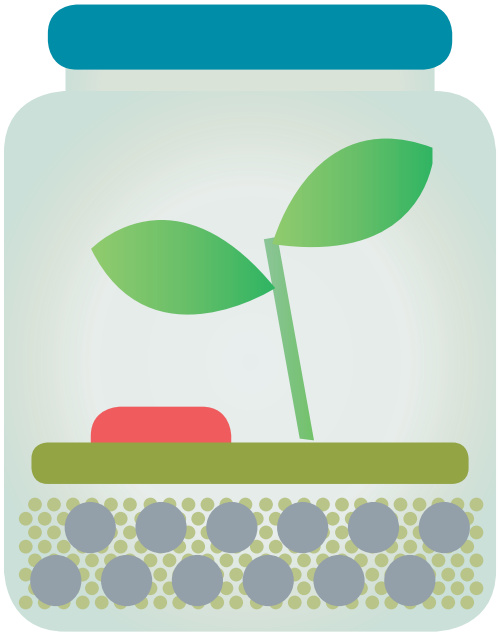
Materials

- rocks
- soil
- small plant
- soft drink bottle cap
- plastic glove
- sand
- jar with lid (you could also use an old soft drink bottle cut in half and covered with plastic wrap)

Method

1. Place a layer of rocks over the bottom of the jar, approximately 0.5-1 cm deep.
2. Sprinkle a thin layer of sand over the rocks, approximately 0.5 cm deep.
3. Cover the sand with a thick layer of soil (3-4 cm). The rocks, sand and soil create a similar soil structure to that found on Earth.
4. Wearing a glove, use your finger to make a small hole in the soil for your plant.
5. Keep your glove on and put the plant in the hole. Pat the soil firmly around the plant's roots.
6. Fill the soft drink bottle cap with water and carefully place the cap on the soil.
7. Screw the lid on the jar (or use plastic wrap to seal the container) and place it in a sunny position.
8. Observe your experiment over the next seven days. Once you have finished your experiment, you may like to transfer the plant to your garden.

Note: If you are making your terrarium in groups or pairs, take turns for each of the steps.



Engage

Draw and label your experiment on days 1, 2 and 7. Comment on the experiment on each of these days; write down what you notice happening. Present this information in a poster.

Connect

Draw and label your experiment on days 1, 2 and 7. Explain how your terrarium acts like the water cycle. Use the **Detailed Lab Report template** to write a report on this experiment.

Explore

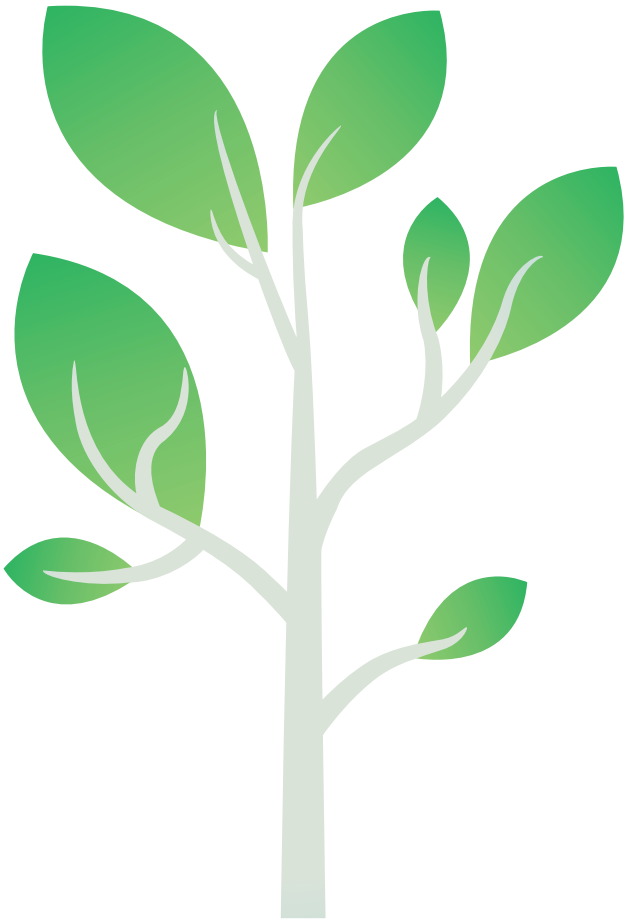
Examine your terrarium over several days and compare the jar to a real ecosystem. Does the plant have everything it requires to continue to survive? Expand on this question by writing a short essay with your findings. You may like to record your responses over several days on a blog or wiki comment thread.

Where Else is Water?

Water is a finite resource; there is the same amount of water on Earth today as there was when the Earth first formed. You may have even heard that you are drinking the same water that the dinosaurs drank, but how is that possible?

After water leaves our body, via sweat, tears or urine, it continues its journey through the water cycle. The water cycle naturally removes some of the impurities that water picks up along its continuous journey. A similar process occurs when water leaves trees.

The following activities explore the process of transpiration in trees, and the way condensation occurs in our environment. Complete the Engage, Connect or Explore activity on the next page.



Activity 1

Perspiring Trees

Materials

- 3 black plastic bags
- masking tape or string
- measuring cylinder
- 3 sticky labels with your name written on them

Method

1. Walk around your school grounds and select three different trees for this experiment. Consider the colour, size and shape of the leaves. You may like to photograph the tree or pick a leaf to include in your final report.
2. Place a plastic bag over a large bunch of leaves on Tree 1. Seal the end of the bag with masking tape or tightly tied string.
3. Repeat Step 2 for Tree 2 and Tree 3.
4. Leave overnight. You may want to make a sign or label your bag to make sure you don't get your experiment confused with another group's.
5. Collect the 3 bags in the morning and observe the contents.
6. Pour the contents of the bag collected from Tree 1 into a measuring cylinder and record your results. Repeat for Tree 2 and Tree 3.
7. Record your observations in the **Where Else is Water worksheet.**

Activity 2

Solar Stills

Materials

- large clear plastic container
- clear glass or beaker
- 2 tablespoons salt
- plastic wrap
- 250 mL water
- blu-Tack
- sticky tape
- a small weight or rock

Method

1. Take the empty glass and place it into the clear container. The top of the glass should be shorter than the container. Use tape or blu-Tack to hold your glass in place.
2. Make a 'seawater' solution with the salt and water, and pour the mixture into the large bowl so that it comes halfway up the sides of the glass; be sure not to get any of this solution in the glass.*
3. Cover the container with plastic wrap, taping the edges to ensure the seal is tight.
4. Place a weight in the centre of the plastic wrap, suspended over the empty glass. This will assist the water to collect in the glass.
5. Carefully place your construction, called a solar still, in a protected sunny area.
6. Check at 1 hour intervals for the first day, then check at the same time each day for 5 days. Record your results in a table.
7. Taste the water collected in the small glass. What do you notice?

*TIP: If you have access to seawater you can use it to get more 'realistic' results, but DO NOT drink the collected water as it would require further filtration before being safe to drink.

Engage

Complete the **Where Else is Water? worksheet** provided. As a group, prepare a poster to display your results.

Connect

Complete the **Where Else is Water? worksheet** provided. In groups, investigate the different factors that may influence the amount of water collected, e.g. temperature, UV, time of day, length of time, colour of bag, type of tree. Create a mini-documentary to share your findings. You may like to use the **Storyboard template** to help plot the scenes of your film.

Explore

Record your results using the **Where Else is Water? worksheet** provided. In groups, design an experiment that investigates the variables that might influence the amount of water collected in this experiment. Present your findings using the **Scientific Lab Report template** or create a poster. Complete the **Ranking Ladder template** for each of the variables to complement your findings.

Where Else is Water?

We can see water in lakes, rivers, oceans and even puddles, but where else is water? Conduct the experiments on page 28 and 29 and use the following tables to record your results.

These experiments will help you to find water that you can't see. Can you describe how this happens?

Date: . . . . . Day of the Week: . . . . . .

Time of the Day: . . . . . .

Activity 1
Perspiring Trees

Tree No.	Description of Tree (incl. height, leaf size, colour, shape, type, etc.)	Drawing/Leaf Sample	mL collected	Notes (weather, temperature, UV level)

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Activity 2

Solar Stills

	Prediction	Measurement	Observations		
			Look	Taste*	Other
Day 1					
Day 2					
Day 3					
Day 4					
Day 5					

*DO NOT taste if seawater was used; this is not suitable for drinking.

Being the Water Cycle

Water reacts to changes in temperature and pressure, changing state as it passes through the natural water cycle processes of precipitation, infiltration/groundwater flow, transpiration, evaporation and condensation.

Main Activity

In this activity, you will get creative and explore each of the stages of the natural water cycle using colour, sound and movement.

Contact your local water retailer for a copy of the Water-lili Natural Water Cycle poster. Use the poster to examine each of the stages of the water cycle.

Discuss ways to remember the name of each stage and the features of each phase and create a mnemonic (see the tip box below).

TIP: There is so much to learn—how can we remember everything? Here is a fun little device that might help you; it's called a mnemonic. Mnemonics rely on associations between easy to remember constructs and can be created to help you spell a word or recall an ordered sequence.

Sequence: create your own sentence by matching the initial letters of a phrase to the initial letters of the corresponding word beginning with the same letter that will help order the contents, e.g. the order of taxonomy in biology (Kingdom, Phylum, Class, Order, Family, Genus, Species): Kids Prefer Cheese Over Fried Green Spinach.

Spelling: make a fun sentence where each word starts with the letter of the word you wish to spell, e.g. Rhythm: Rhythm Has Your Two Hands Moving.

Your sentence can be relevant to the subject you're trying to remember, but it's not essential—as long as it makes sense to you.

Engage

Take turns to draw the **Water Cycle Cards** your teacher has copied for you (worksheet provided) out of a hat. Which part of the water cycle will you be? Gather with other members of your part of the water cycle and come up with some suitable actions and sounds for your team. When everyone is ready, show your classmates what you've come up with for your section of the water cycle. Get together with all of the other groups to create a full class performance.

Connect

In groups, create a short play about the water cycle and perform it in front of the class. Use the **Story Map template** to assist you with plotting out your story. Consider how the different 'characters' in the play interact with each other. You may like to include a song or dance element, or make it a drama.

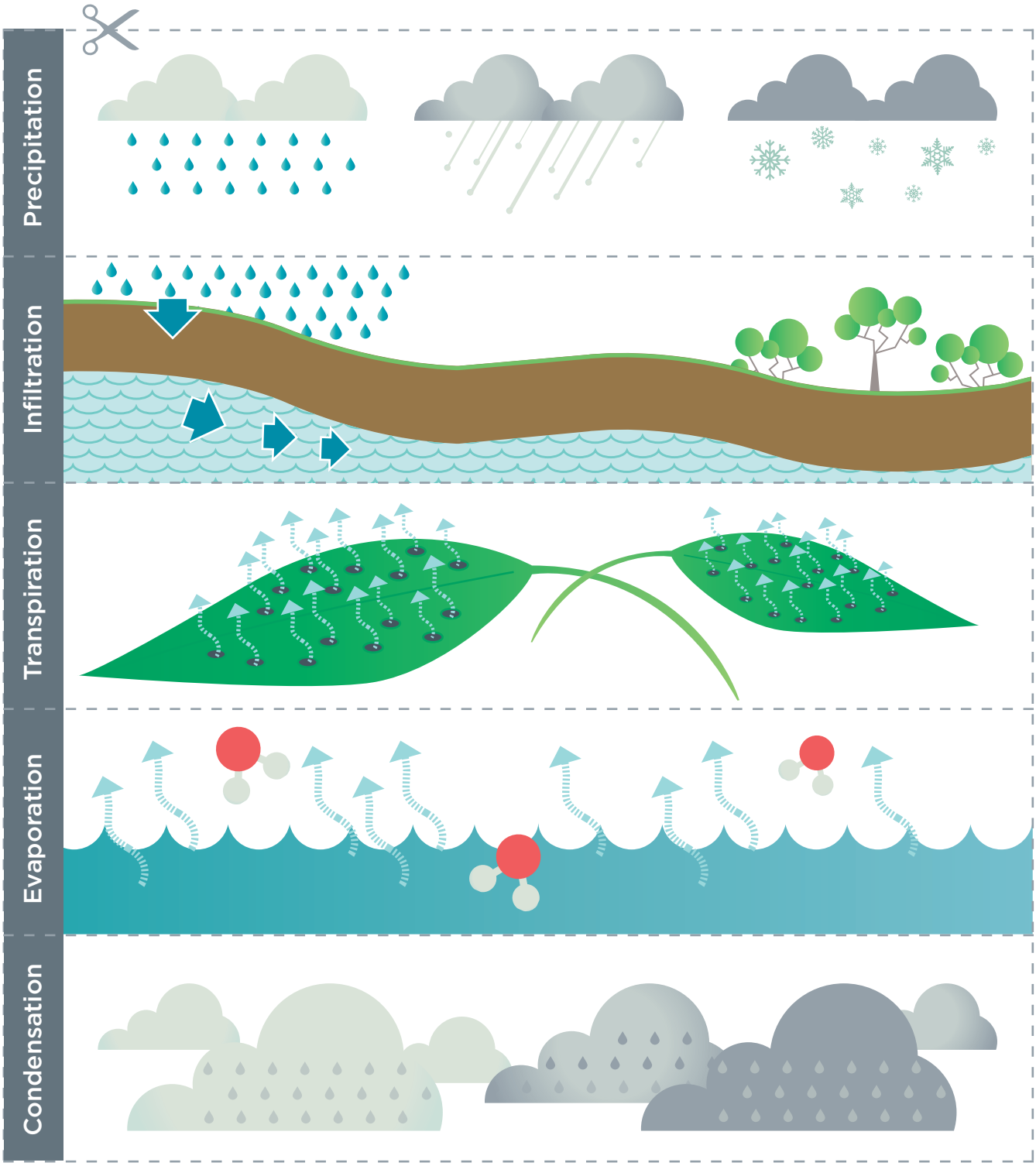
Explore

Create a short film about the water cycle. You may like to act out a script, annotate photos or incorporate a voice-over into your masterpiece. Try to be creative, but ensure you're still factual.

Use the **Storyboard template** provided to plan your film and use movie making software to collate all your fantastic ideas into your final product. Run a film festival to inform and entertain students, friends and/or family.

Being the Water Cycle

Take turns to pick out one of the cards without peeking. Form groups for each part of the water cycle and complete the Engage activity.



Discovering Groundwater

When it precipitates, some of the rain (or other precipitation: snow, hail, sleet) flows into the soil. It moves through the spaces between the soil particles and eventually reaches an impermeable layer of rock or hard clay.

The level at which the earth becomes saturated is called the water table. The water found within the water table, where water fills the pore spaces of the soil, is called groundwater.

Main Activity

Use the **Predict Observe Explain template** to assist you to conduct one or all of the following experiments that demonstrate the features of groundwater.

Activity 1

Demonstrating Groundwater

During the course of this activity, the bottom of the cup/container acts like the bedrock of clay that is found beneath the earth's softer soil layers. The water, therefore, operates like rain soaking into the soil.

Materials

- 2 clear cups
- sand
- gravel
- measuring cylinder

Method

1. Fill one cup with gravel and the other with sand.
2. Fill a 100 mL measuring cylinder with water.
3. Pour water slowly into the cup containing gravel until it just covers the gravel.
4. Measure how much water it took to reach the top of the gravel (100 mL minus the remaining volume of water still in the cylinder).
5. Empty the cylinder and repeat Steps 2-4 for the cup containing sand. Don't forget to record your results!
6. Discuss how the water fills, or saturates, the soil/sand once it reaches an impermeable layer. Note any similarities or differences.

Activity 2

Groundwater Reaching the Surface

Lakes and ponds receive their water from many sources: direct rainfall, water run-off and groundwater. Groundwater travels through the small pores in rocks (gravel, in this instance) to eventually reach the surface (generally a water body such as a lake). The areas that are thoroughly saturated around the surface water are called the water table.

Materials

- small clean gravel
- large, clear container with flat bottom
- blue food colouring
- jug of water

Method

1. Pour a layer of gravel in the clear container approximately 1-2 cm deep.
2. Make a hole in the gravel with your finger.
3. Add some blue food colouring to the jug of water. Gently pour the coloured water into the container at one edge until it soaks 5 cm of the gravel throughout the bowl.
4. Note what happens to the 'soil' and where the water gathers.
5. Keep the experiment set up so it can be used in Activity 3.

Activity 3

Groundwater Pollution

Water that is drawn from the ground has to come from somewhere. During times of drought, you may have seen signs that said 'bore water in use'. Bore water is a type of groundwater, which is used as an alternative water supply to water bodies above ground. Now you know that they're all connected!

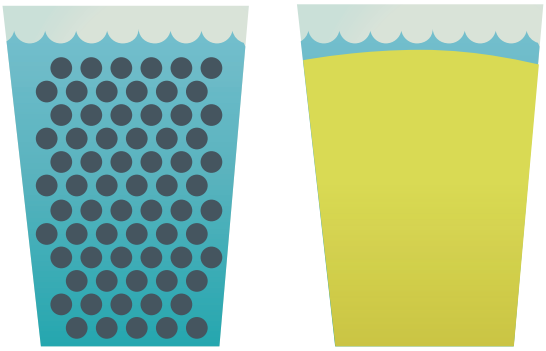
When pollution occurs in one area, it has the ability to affect a far greater area. This, in turn, can impact on the water supply for humans, plants and animals in a much larger region than you might think!

Materials

- use the container from the previous experiment (don't clean it out!)
- an eye dropper
- red food colouring
- paper or plastic cups
- a wooden skewer

Method

1. Use an eye dropper to withdraw water from one corner of the container of gravel (away from the pond). What do you notice about the pond level?
2. Squirt the water back into the corner to ensure the pond is full.
3. Create a rain cup by poking holes in the bottom of your paper/plastic cup with the skewer.
4. Place a teaspoon of undiluted red food colouring at the side of your bowl (away from the pond and from where you drew water previously).
5. Holding your rain cup over your pond bowl, fill the cup with water to make it 'rain'. Be sure to 'rain' over the entire surface of your 'land'. Do you notice anything?
6. Use the eye dropper to remove water from the pond. Is your pond polluted?



Engage

Decorate and colour in the **Groundwater Maze worksheet** provided so that a classmate can find their way through.

Connect

Research and identify towns in Australia that rely mainly on groundwater. You might like to go further and find out which towns across the world use groundwater.

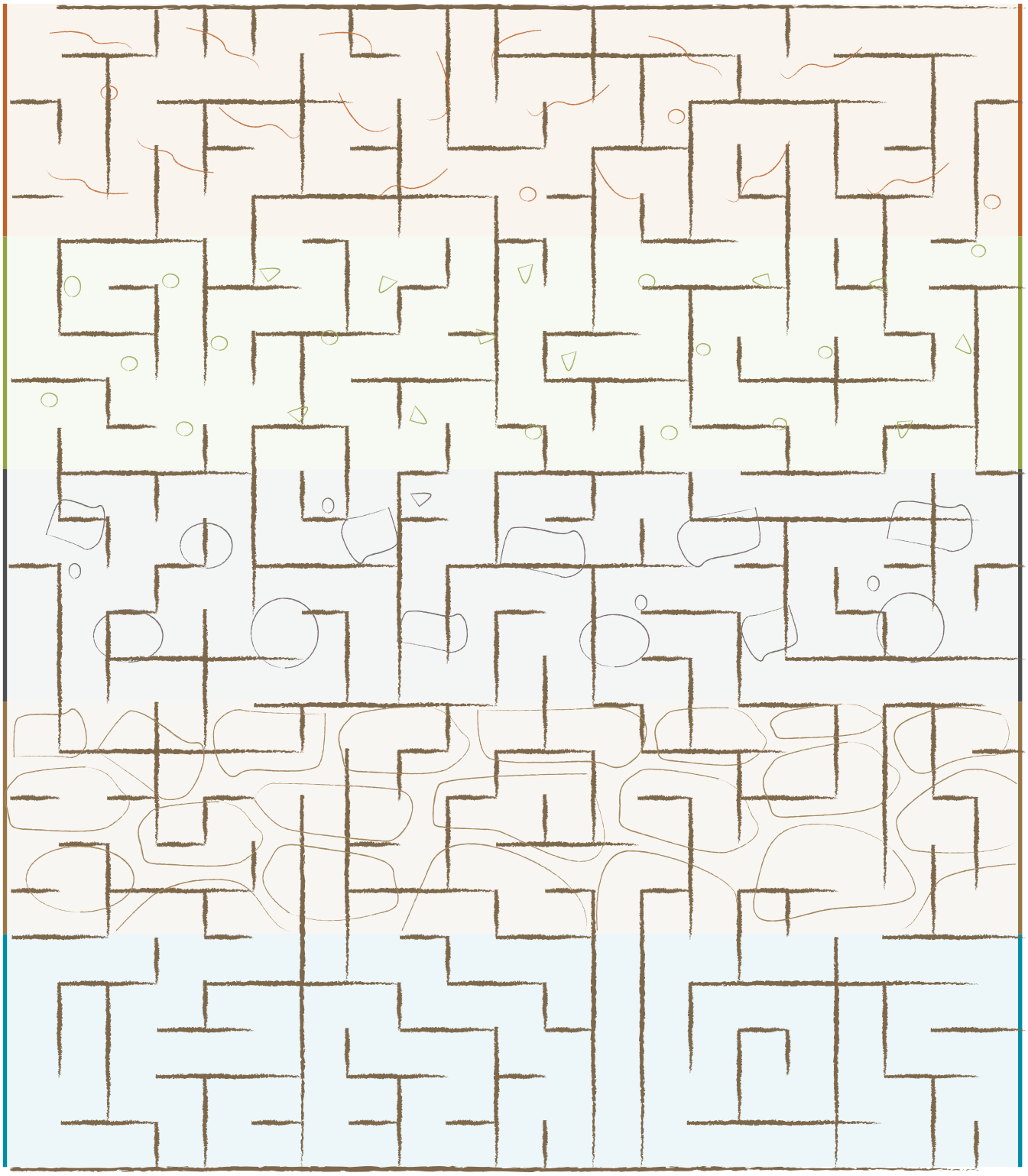
Explore

Investigate the impacts of salinity on groundwater in Victoria. Select an area within the state and create a TV documentary or written report based on your findings. Identify any impacts that have occurred and whether there have been any attempts to reverse these.

Groundwater Maze

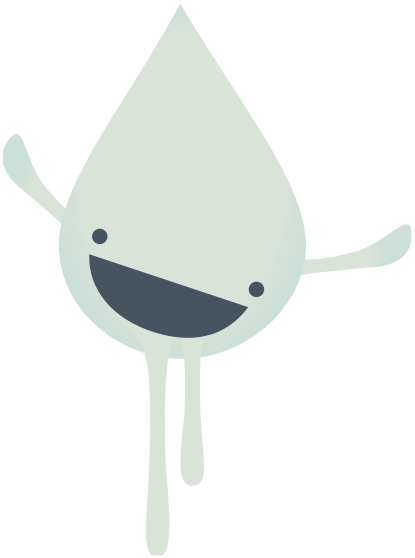
Carefully colour in the maze below, using a different colour for each layer of soil.
Make sure you don't colour in the spaces between the soil particles – just the particles themselves.
Give your maze to a friend to try to complete.

START



FINISH

The Amazing Water Journey



The water cycle goes on a pretty amazing journey if you think about it. Water is transformed into different states of matter, travels from the atmosphere down to Earth, into the ground and through plants, is consumed by humans and animals, then returns back up to the atmosphere to do it all over again!

Main Activity

Read the *Yarra Valley Water Big Book About Water* (available online). Consider how the information has been delivered in an interesting and fun way. Think of some other examples of where serious issues have been dealt with in a fun but informative way through storytelling, and discuss these examples with your classmates.

You can access this big book about water on the water-lili website, *waterlili.com.au.*

FACT: In a 100-year period, a water molecule spends approximately 98 years in the ocean, 20 months as ice, around 2 weeks in lakes and rivers, and less than a week in the 'atmosphere'.

Engage

Use a series of illustrations provided by your teacher, or the *Storybird* website, to inspire you to write a creative story about the water cycle. You might like to use the **Story Map template** to help you plan the plot and content of your story.

Connect

Create a comic strip to show how water travels through the natural water cycle. Use your search engine to find an online comic strip creator, or create your own comic strip on paper.

Explore

Use the **Storyboard template** to plot out the amazing journey of water through the natural water cycle. Use your ideas to create a stop motion movie or flip book. If creating a flip book, remember to keep the images fairly simple or it'll take you forever! Planning for your story can be done using ACMI storyboard generator or another online site you find.

Which Cloud is That?

A cloud is made up of tiny droplets of water or ice crystals. As gas rises into the atmosphere through evaporation, it slowly cools and the water condenses to become tiny droplets. These droplets group together to make a cloud. As long as the cloud, and the air it holds, is warmer than the air around it, the cloud will float, otherwise it will fall as precipitation.

Main Activity

Lie down on the ground outside and observe the clouds in the sky. Note the different heights, shapes, textures and colours. Then, complete the Engage, Connect or Explore activity.

Engage

Create a collage of photos and drawings to represent the different clouds you saw. Write some words and sentences to describe your feelings about your favourite cloud. Present this information as a poster and display it in your classroom.

Connect

Create a table outlining the different clouds you noted in the sky. Add to your list any other clouds that exist (you may need to do some research). Include a picture of each cloud, a description, the name of the type of cloud, and any other relevant information you find.

FACT: The largest clouds are the cumulonimbus, climbing up to 9.7 km high and holding up to half a million tons of water.

Explore: Create a Cloud

Materials

- a small (450–600 mL) clear plastic bottle with a screw on cap
- long matches*
- warm water

By combining water vapour (gas), smoke to help condense your gas, and pressure generated by squeezing your capped bottle, you can create a cloud.

Method

1. Fill your plastic bottle with warm water. Shake the bottle and then pour out *most* of the water, leaving only a teaspoon or so in the bottle.
2. With the lid on, squeeze the bottle in and release it to demonstrate high and low pressure. Does anything change?
3. Unscrew the lid of your bottle.
4. Light your match and let it burn for a few seconds. Then, drop the match into the bottle and quickly screw the lid on the bottle to capture the smoke.
5. Shake the bottle vigorously.
6. Now, squeeze the bottle and release it quickly. Does anything change this time?

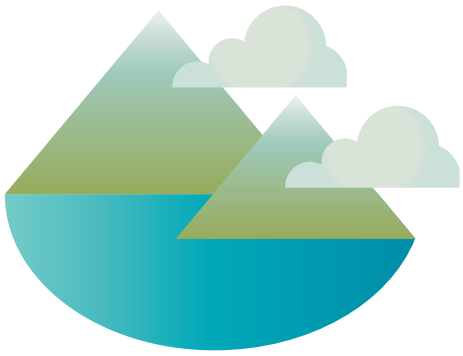
** Please note that matches can be dangerous and should only be used under strict supervision.*

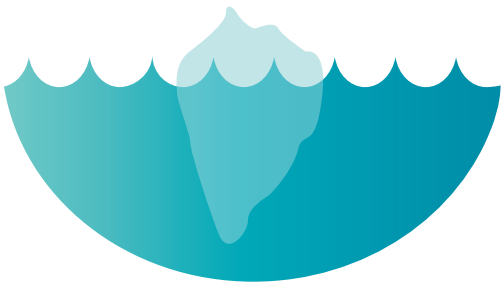
Investigate further and create a spreadsheet of data about all existing clouds: what they look like, their specific features and at what altitude they generally sit. Mark any clouds you recognise from those you saw outside.

water
learn it. live it.

3

Bodies of Water





Bodies of Water

With 70% of the Earth's surface covered in water, it is no wonder it is often called the 'Blue Planet'. But with so much water, why do we need to preserve this resource?

Of this 70%, only 2.5% is freshwater. Now, let's take that measly 2.5%—how much is available to drink? Half? Perhaps less than half? Keep guessing! Only 0.3% of freshwater is available for us to drink (or about 0.007% of all water on Earth)! See Figure 4 for a visual outline.

It is important to remember that this volume of water is finite, meaning there will never be any more water created. We have the same volume of water on the Earth today as we did when the Earth first formed. This means we are drinking the same water the dinosaurs drank!

Almost all living organisms on land require freshwater for survival, making water a particularly precious resource. Freshwater can be sourced through various bodies of water.

A body of water refers to any place where water is naturally collected, including standing water in lakes and ponds, slow-moving water in oceans and seas, and fast-moving water in rivers and streams. A body of water may also be man-made, such as a reservoir, harbour or canal.

Catchments

A catchment is an area of land that has natural features like hills or mountains, and all water run-off flows to a single low point, such as a dam, river or lake.

Catchment areas vary in size and form, and may be open, public land or private property. Catchments usually contain a range of features, including land, water, vegetation, crops, wildlife, people, homes, industry, dams, farms and national parks, to name just a few.

Most of Melbourne's drinking water comes from closed water catchments. These large areas of land are closed to the public and allow the native forests to filter the rainwater as it flows into creeks, rivers and eventually into our reservoir storages. This natural process produces high quality water which means the water requires very little treatment before reaching homes and businesses. Less resources are required to make the water suitable for drinking if the water is already very clean.

Many other cities source their water from open catchments—areas of land that often contain farms and houses—as well as harvesting water. This water must be treated and filtered to ensure it meets the same standards as the treated water from closed catchments.

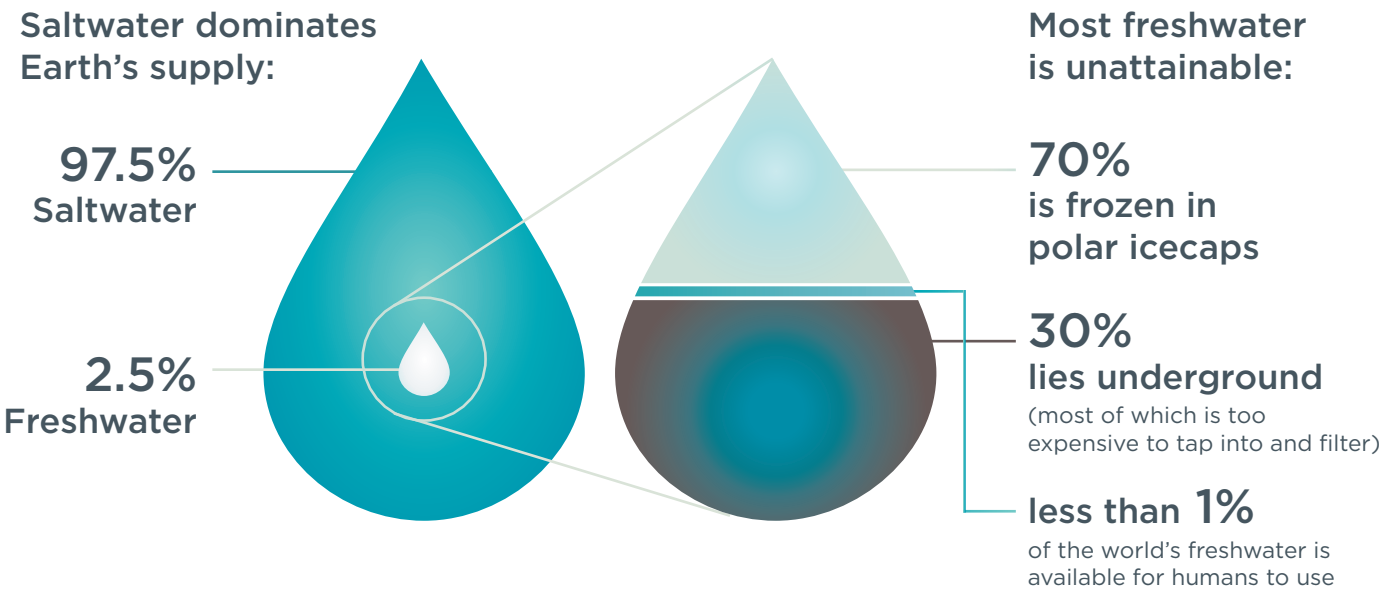


Figure 4: Breakdown of Water on Earth. Statistics from unwater.org

Where in the World is Water?

Water can be found in a variety of places, both above and below ground. The amount of water on Earth is finite. That means that there will never be any more water available than is already in the Earth's atmosphere.

Main Activity

Using a globe or an atlas, locate all of the different water bodies on Earth (oceans, seas, glaciers, icecaps, lakes, rivers and underground stores). Consider whether each of these bodies make up a large or small portion of Earth's water.

Using the **Main - Where in the World is Water? worksheet** provided, think about which amount of water might represent each water body and write down your prediction. Discuss your responses with a classmate and give reasons for your estimates.

Find out the actual answers and compare them with your estimates. Are there any surprises?

FACT: Despite its name, the Caspian Sea is considered the largest lake in the world. This body of saltwater became landlocked around 5.5 million years ago due to a shift of tectonic plates (moving of parts of the Earth's 'crust').

Engage

As a class, play a game of *Toss the Globe*. One student stands at the front of the class and tosses an inflatable globe to another student. When the globe is caught, note whether the catcher's right thumb falls on land or water. Repeat until all students have had a chance to catch the globe and keep a running tally on the board. What do you notice? Complete the **Engage - Where in the World is Water? worksheet** provided. Do you notice any similarities between your worksheet activity and the Toss the Globe game?

Connect

Now that you know how the water on Earth is distributed, create a pie chart to reflect the percentage. Be sure to include a title and key. Complete the **Connect - Where in the World is Water? worksheet** provided.

Explore

Water, water everywhere and only a drop to drink. Elaborate on this sentence to discuss the availability of drinking water. You may like to write an essay or create an interactive poster that explores the quantity of drinking water available and how much is actually required for Earth's survival. Visit the internet for some inspiration and some fascinating facts to include in your work.

Main – Where in the World is Water?

Water on Earth can be grouped broadly into fresh drinking water, icecaps and glaciers, saltwater and groundwater. Look at the table below and think about the amount of water that might represent each type. Imagine all of the water in the world fits into a single bucket. Write down your predictions. Discuss your responses with a classmate and give reasons for your estimates.

Find out the actual answers and compare them with your estimates. Are there any surprises?

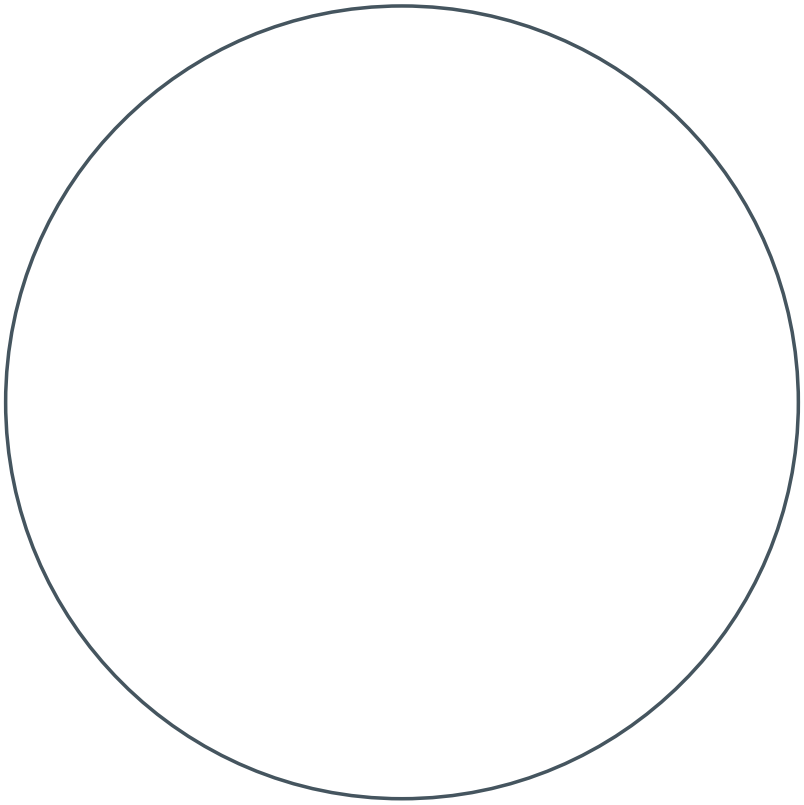
Amount of Water	Type of Water - Prediction	Type of Water - Actual
Bucket 	Predict: Reason:	Actual:
Glass 	Predict: Reason:	Actual:
Bottle Cap 	Predict: Reason:	Actual:
Drop 	Predict: Reason:	Actual:

Engage – Where in the World is Water?

On A3 paper, use a compass to draw a large circle. Try to take up as much of the page as possible. Enlarge the map below to A3 and carefully cut out all of the saltwater. Paste all of your water cut outs into your large circle, making sure to keep them close together. You should be left with a small amount of white space. Cut and paste the land into the remaining space. Can you estimate the percentage of your circle that is water? Compare this number with the percentage you found in the Main Activity, and discuss with your class.

Connect – Where in the World is Water?

Create a pie chart below, using the figures you discovered in the Main Activity. Remember to include a title, key and labels for each part of the pie chart.



Now, let's have a look at some of the water bodies on our blue planet by finding out the answers to the below questions:

1 Name a local waterway.

2 What is the longest river in Victoria? Make sure you check that the river actually belongs to Victoria and not another state!

3 Name a town the answer to Q2 goes through.

4 Which river borders Victoria, New South Wales and ends in South Australia?

5 What is the largest lake in Australia, and in which state is it found?

6 List all of the oceans on Earth (hint: there are 5).

7 Which of these oceans is the largest?

8 Which sea is bordered by Greece and Turkey?

9 What is the longest river on the planet?

10 Through which countries does the answer to Q9 flow?

Create a Catchment

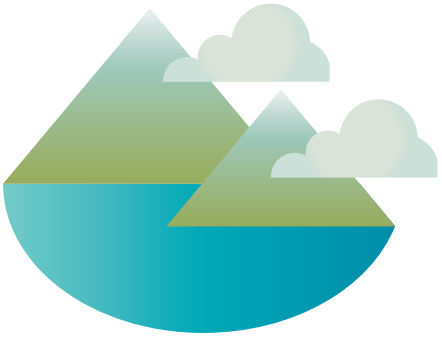
Catchments are an extremely important part of our ecosystem. Catchments divert water that falls on mountains and hills (run-off) to a single low point, such as a river, lake or reservoir.

Main Activity

Visit the Melbourne Water website and investigate the location of the catchments that service Melbourne. Find out what the difference is between an open and a closed catchment and complete the **Plus Minus Interesting (PMI) template** supplied.

In groups, make a list of the different features that catchments might have, and think about how each feature impacts the quality of water. Share your thoughts with the rest of the class and update your list with any new features mentioned by your classmates. Using the information gathered, create a Venn Diagram to compare your findings.

FACT: Did you know ombrophobia is the fear of rain? This word comes from the Greek, ombros, meaning 'rain,' and phobia, meaning 'morbid fear'.



Engage

Materials

- sandpit
- tarp or large plastic sheet
- rocks to use as anchors
- buckets
- water

Method

Create a sandpit catchment as a class: In your school sandpit, pile up some high areas to form hills and mountains and dig some trenches and holes to create rivers, ponds and lakes. Cover your landscape with a tarp or large plastic sheet, weighing down the edges with some heavy rocks. Now, your teacher will pour a bucket of water over the high areas. Notice where the water goes and what it does along the way. Share with your class the thing that you found most interesting.

Connect

In groups, use craft supplies to create a catchment. You may like to use the Water – learn it. live it. Melbourne Water Cycle poster to assist you. Annotate your model with sticky notes that include the most important features of your catchment. When you've finished, deliver a short presentation describing your catchment to the class.

Explore

In pairs, model one of Melbourne's catchments using craft supplies. Be sure to include and annotate the specific features of your catchment and explain why they're important. Rotate through the class to see what other students have created.

Then, research the impact/s of removing a single element from your catchment. Who would be impacted and how? Present your findings to the class with a short oral presentation. You may like to imagine you are either a local farmer or the catchment manager, and then have a debate about the impacts for both.

Discovering Waterways

Much of the water flowing into our catchment areas and feeding our reservoirs arrives via smaller waterways. These bodies of water carry our drinking water, and enrich the natural landscape, flora and fauna. Keeping these areas healthy is essential for all local animal and plant life, as well as to maintain the landscape.

Main Activity

Become more familiar with water in your area by visiting a local waterway or finding information about a local river online. Examine the waterway closely and complete the **Discovering Waterways worksheet** provided. Present your findings in an interesting way to inform others.

TIP: Visit Melbourne Water's website to find lots of information about your local waterways, including maps and images.

Engage

Discuss the visit to your local waterway as a class. What things did you notice when you were there? Sights, sounds, smells? Use the information you collected at the site to create a collage.

If an excursion is not possible, try using Google Maps to find water bodies in your local area. Then, draw an illustration of a local waterway and what it means to you.

Connect

Create a simplified map of the local waterway you visited; include a key and any important features. You may like to annotate the map with information/specimens/photos/sketches you collected on your visit and photographs you have taken.

Explore

Research the history of a waterway in your local area and create a timeline that outlines the changes that have happened before and since European settlement. Enlarge a copy of a map of your local area including your waterway, and populate it with images, notes and labels. Include details about what this waterway may have been used for in the past, and how it is currently being used.

Discovering Waterways

Name of the waterway: . . . . . .

Type of (waterway river/creek/estuary):. . . . . .

Site location (address or GPS location):. . . . . .

. . . . . .

Observations

Make notes draw, photograph or film your waterway to record the following information:

Land use (surrounding the site):. . . . . .

. . . . . .

Pipes and drains: . . . . . .

. . . . . .

Litter: . . . . . .

. . . . . .

Smell: . . . . . .

. . . . . .

Flora: . . . . . .

. . . . . .

Fauna:. . . . . .

. . . . . .

Back at school

Research the following:

Length of waterway:. . . . . .

The town where your waterway starts and ends: . . . . . .

Historical use:. . . . . .

. . . . . .

Current use (industry, recreation):. . . . . .

. . . . . .

Other interesting facts : . . . . . .

. . . . . .

. . . . . .

. . . . . .

Testing the Water

There are many different factors that affect water quality—some that are clearly visible and some that need further investigation. Small changes in pH levels or water temperature can have an enormous impact on the flora and fauna that live in and around a waterway. More visual problems around waterways might be pollution, introduced species or erosion.

Main Activity

Visit a local waterway to test the water quality and make observations about the area, including the look, sound, smell and feel. Use the **Testing the Water - Location worksheet** provided to ensure you record all relevant information. Collect photographs of key features, sketch the overall landscape and record video footage of your data collection, describing the process. You may like to combine this activity with **Discovering Waterways** (page 49).

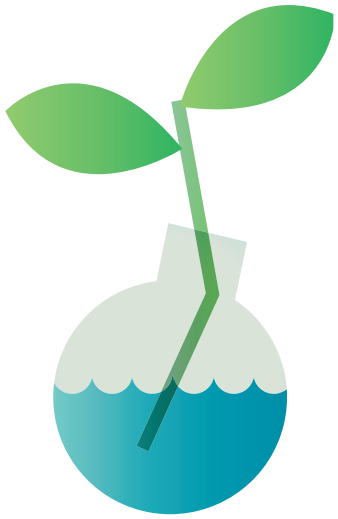
WARNING: Waterways are wonderful places to explore, but they can be hazardous. Ensure you dress appropriately, have the necessary equipment and are especially careful in the outdoors.

If an excursion is not possible your teacher may be able to collect some samples for you to test in class.

Writing a slogan:

A slogan is a memorable phrase or saying that is used to express an idea or message. Use the below information to help you come up with your own slogan:

- **What slogans do you remember? Why?**
- **Try to focus on just one message.**
- **Use creative language, but ensure it is clear.**
- **Short slogans are most memorable.**
- **Keep your art design simple.**
- **Try to link your artwork to your message.**



Engage

Use the **Ripple Effect template** to consider what would happen if your local waterway was not healthy. Write the question in the drop and write potential consequences in each ripple. See how many ripples you can add.

Connect

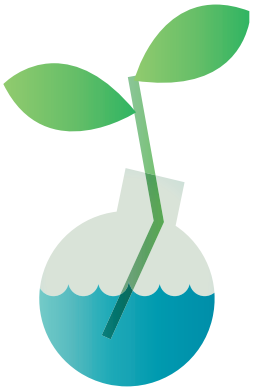
Consider any unnatural elements that surrounded the waterway you visited. Think about how these items ended up in the area. Make a sign with your own slogan to let people know how to keep their local waterways clean. Discuss how you might share this with the school and your local community, and plan your strategy!

Explore

Research the equipment you'll need to take water samples from your local water body. Using the **Testing the Water - Sampling worksheet** as a guide, test the water to gauge turbidity, pH, ammonia and phosphates. Back at school, interpret the data you collected and identify if these levels are appropriate for the waterway. Research what might cause these levels to occur. Speculate on this information and create an action plan to protect your local waterway. Visit the Victorian Waterwatch website for lots of information on comparisons for your water quality tests.

You may like to test at different points along the waterway to see if there are any noticeable differences, or test tap, bottled or another source of water to compare with your sample.

Testing the Water – Location



Date:. . . . . Time:. . . . . .

Location: . . . . . .

Today's weather: . . . . . .

Recent weather conditions:. . . . . .

Area

What is the surrounding land used for? . . . . . .

What is this body of water used for? . . . . . .

Water condition

Water odour:. . . . . .

Water colour: . . . . . .

Surface of the water:. . . . . .

Impacts

Are there any man-made structures nearby? . . . . . .

. . . . . .

Can you see any animals? . . . . . .

. . . . . .

What sort of vegetation is surrounding this body of water? . . . . . .

. . . . . .

Do you see any pollution/litter?. . . . . .

. . . . . .

Is there any erosion? What do you think has caused this? . . . . . .

. . . . . .

Try to capture as much information you can about the area you're visiting. You may like to sketch an image, take photographs, collect samples and undertake water testing.

Testing the Water – Sampling

Use this checklist to determine the health of a local water body.

Date:. . . . . Time:. . . . . .

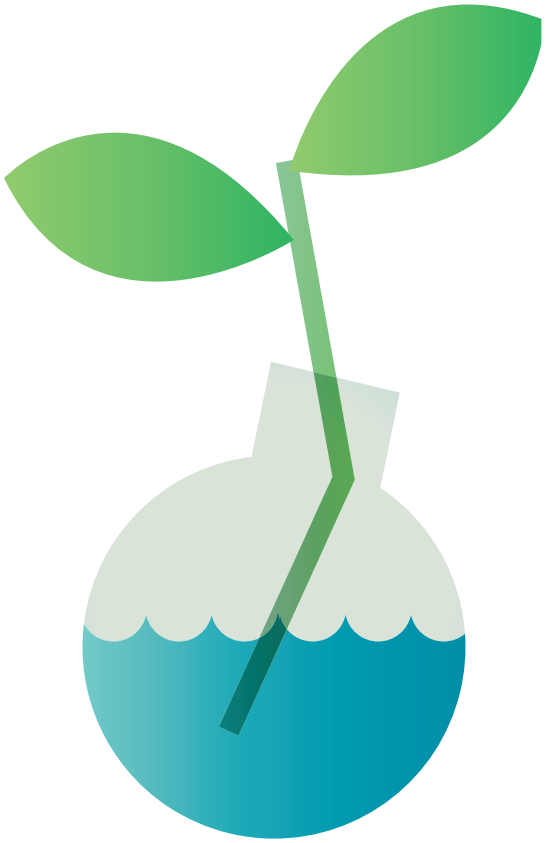
Location: . . . . . .

Today's weather: . . . . . Yesterday's weather: . . . . . .

Chemical Test	Sample #1	Sample #2	Sample #3	Average
pH (pH units) Aquatic animals and plants are adapted to specific pH ranges. The pH of water increases in warmer temperatures so pH levels can be affected by the time of day a sample is taken. Most natural freshwaters in Victoria have a pH range between 6.5 and 8.0.				
Water Temperature (°C) The temperature of a water body directly affects many physical, biological and chemical characteristics. Warmer waters can increase salinity, reduce the amount of dissolved oxygen and increase the chance of eutrophication.				
Total Phosphates (mg/L) Plant growth is limited by the availability of dissolved phosphates. A sudden increase in phosphates in a waterway can cause a rapid growth in algae and other aquatic plants. It is naturally derived from the weathering of rocks and the breakdown of organic material, but it can also enter water bodies in run-off or discharge.				
Turbidity (NTU = JTU) Turbidity measures the cloudiness of water. Plants may not receive the light required for growth in turbid waters and the water can warm due to the particles absorbing heat. Particles can get into gills of fish and other aquatic animals, making it harder for them to get oxygen. Acceptable readings will depend on your local area.				
Salinity (electrical conductivity EC)(µS/cm) Aquatic life is suited to a certain level of salt. Salinity above or below the usual range for an organism can cause stress or even death. Salinity also affects the availability of plant roots to absorb nutrients. The EC level for a freshwater river should be between 0-800 µS/cm.				
Total Dissolved Solids (TDS)(mg/L) TDS is a measure of the combined content of all inorganic and organic substances such as minerals, salts and metals contained in a liquid. The TDS level for a freshwater river should be between 100-1,000 g/L.				

If available. You can cross-check many of your results against those collected by Melbourne Water at: www.melbournewater.com.au/content/rivers_and_creeks/river_health/water_quality_monitoring.asp

NOTE: Use your internet search engine to find a Macroinvertebrate chart to identify any creepy crawlies you may find in your local body of water. The presence of these creatures can give an indication of the quality of the water, and may provide a good indication of river health.



Safety considerations:

- Check the weather before you set out to ensure conditions are appropriate for you to undertake your testing safely.
- Do not work alone.
- Be careful near the edges of waterways and be aware of slippery rocks and banks.
- Keep a first aid kit available.
- Remember to wear appropriate clothing for outdoors, including covered in shoes. Wear waterproof clothing if the weather is wet, as well as a hat and sunblock.
- Take some clean water with you for washing down any spills on your skin or clothes.
- Place all used gloves, paper towels, empty packaging and any other rubbish from testing into a plastic garbage bag and take it with you when you leave.
- A water bottle attached to a post or long stick can be a good and safe way to collect a water sample.

Additional Notes

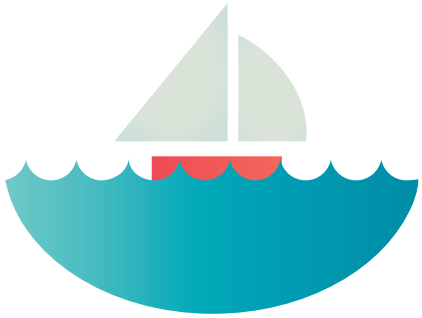
Bodies of Water

Liquid water takes two definite forms on Earth: saltwater and freshwater. However, it can also be found as brackish, which occurs when water contains more salt than freshwater but less salt than seawater. Water on Earth can be found as groundwater in aquifers beneath the earth, or on the surface of the earth in bodies of water.

Main Activity

Create a thorough list of bodies of water through either brainstorming as a class or researching online. Group your lists as saltwater, freshwater or brackish.

TIP: Use a search engine to find appropriate water body images to use for the Engage and Connect activities, including: river, lake, ocean, dam, channel, puddle, billabong, estuary, wetland and spring.



Engage

As a class, discuss how you can identify the different bodies of water, then hold a line race in your classroom. In heats, line up at a starting point. You will be shown an image of a body of water by your teacher. The first student to put their hand up and correctly name the type of body of water should take a step forward. Repeat until a winner reaches the finish line. Have the heat winners play off in a Grand Final.

Connect

Use the provided **Match Up Puzzle worksheet** to create a set of match cards that could be used by younger students to teach them about different bodies of water. Each card set should include an image (either drawn or sourced from magazines or online) and a set of features for that body of water.

Explore

Research a local example of each body of water you came up with in your brainstorming session. Write a descriptive piece about the physical features of the water body and where it might be found. Compare and contrast two selected bodies of water using a Venn diagram.

Match Up Puzzle

Photocopy this template onto paper that is heavy enough to make puzzle pieces. You may like to enlarge it to A3 size for a jumbo puzzle.

Imagine a line is drawn down the middle of the puzzle; fill one side (two puzzle pieces) of each row with an image of a specific type of water body (i.e. lake, river, puddle, ocean) and on the other side, in two columns, write a dot point list of features that correspond with the water body images. You may like to have all of the images in the left or right-hand columns, or alternate between them.

When you are finished, cut out the pieces of the puzzle and give them to another student to match up and put together.

Describing Water

It will come as no surprise to you that water is often used as a source of inspiration for authors and poets throughout the world. After all, all living things need water to survive, including us!

Water can be used in literature, both literally and figuratively. Used literally, you can describe the way water looks, feels, smells and moves. Figuratively, water can represent feelings and emotions or foreshadow change in a story.

Main Activity

Use the **Lotus Diagram template** provided to create a list of inspiring words relating to water. Think about how water looks, feels, or what emotions water evokes in you.

CONNECT TIP: 'Haiku' is a traditional form of Japanese poetry. Haiku poems consist of three lines. The first and last lines of a Haiku have five syllables and the middle line has seven syllables. The lines rarely rhyme.

Here's a Haiku to help you remember:

My / first / line / has / five

Then / se/ven / in / the / mid/dle

Five / a/gain / to / end

Engage

Use the words and imagery from Dorothea Mackeller's *My Country,* Verse 2, to inspire a piece of artwork.

Connect

Find an image of water that inspires you. Try writing your own poem, song or Haiku, to reflect your chosen image. Collate all of the class work and present it as an anthology. Ensure you comply with any copyright restrictions for any images if you wish to publish this anthology for use outside your classroom.

Explore

Use some water images you have found to inspire your own story or poem, using descriptive language. Research how other authors and poets have used water as a symbol in their writing to help you integrate it into your work.

water
learn it. live it.

4

Australian Weather

and Impacts on Water Supply

Australian Weather and Impacts on Water Supply

Weather refers to the state of the atmosphere at a given time and place. We often comment on the weather—it might be hot, cloudy, dry, sunny, windy or rainy. Climate refers to the average weather patterns for a particular area over an extended period of time. Climate zones are categorised by vegetation distribution, temperature, humidity and precipitation patterns.

Climate Change

Climate is never static. Although weather changes from day to day, climate changes over a much longer period of time. 'Climate change' is commonly used to describe erratic and extreme weather caused by increased carbon dioxide ($C0_2$) in the atmosphere and 'global warming'. 'Global warming' is the name given to the relatively fast increase in the Earth's climatic temperature, mostly due to human activities and an increased level of $C0_2$ in the atmosphere. Climate change is certainly not a new concept, as weather patterns have always changed over time. However, scientists believe changes are now happening at a rapid rate. They believe we are likely to see more natural disasters, more droughts and more floods, in the future.

Natural Disasters

Hydrological disasters, as indicated by the name, are disasters involving water. Floods and tsunamis make up only part of the suite of natural disasters—water is also involved in geological disasters (e.g. earthquakes), meteorological disasters (e.g. heatwaves) and health disasters, either through its excess, shortage or simply by its presence. If people don't have access to clean water during natural disasters or can't get rid of their waste, disease can spread quickly.

Natural disasters usually have obvious primary impacts (such as physical damage to property and loss of life), but can also have much greater secondary impacts, and can cause financial, environmental and long-term health problems.

Drought

A drought is a prolonged period of acute water shortage caused by lack of rain. Impacts of drought include loss of crops, stock and vegetation, soil erosion, reduced water quality and an increased risk of bushfire. These impacts can affect human health. Drought is a normal part of Australia's variable climate; Melbourne's water storages are designed to store water during wet periods to be used in dry periods. However, climate change means we are likely to see more extremes in our weather—more droughts and more floods.

Floods

Flooding occurs when water within a body of water overflows or breaks its banks, escapes its usual boundaries and submerges land not normally covered by water. This may be caused by a surge of seawater, tidal flooding, river run-off or urban drainage problems, but is usually the consequence of heavy rain.

We could eliminate flood damage by moving away from rivers and other bodies of water. However, people throughout history have lived and worked by the water as it is a good source for drinking, finding or growing food, and capitalising on convenient travel and trade. People continue to inhabit these areas today and we must assume that the perceived value of living near the water outweighs the risk of periodic flooding.

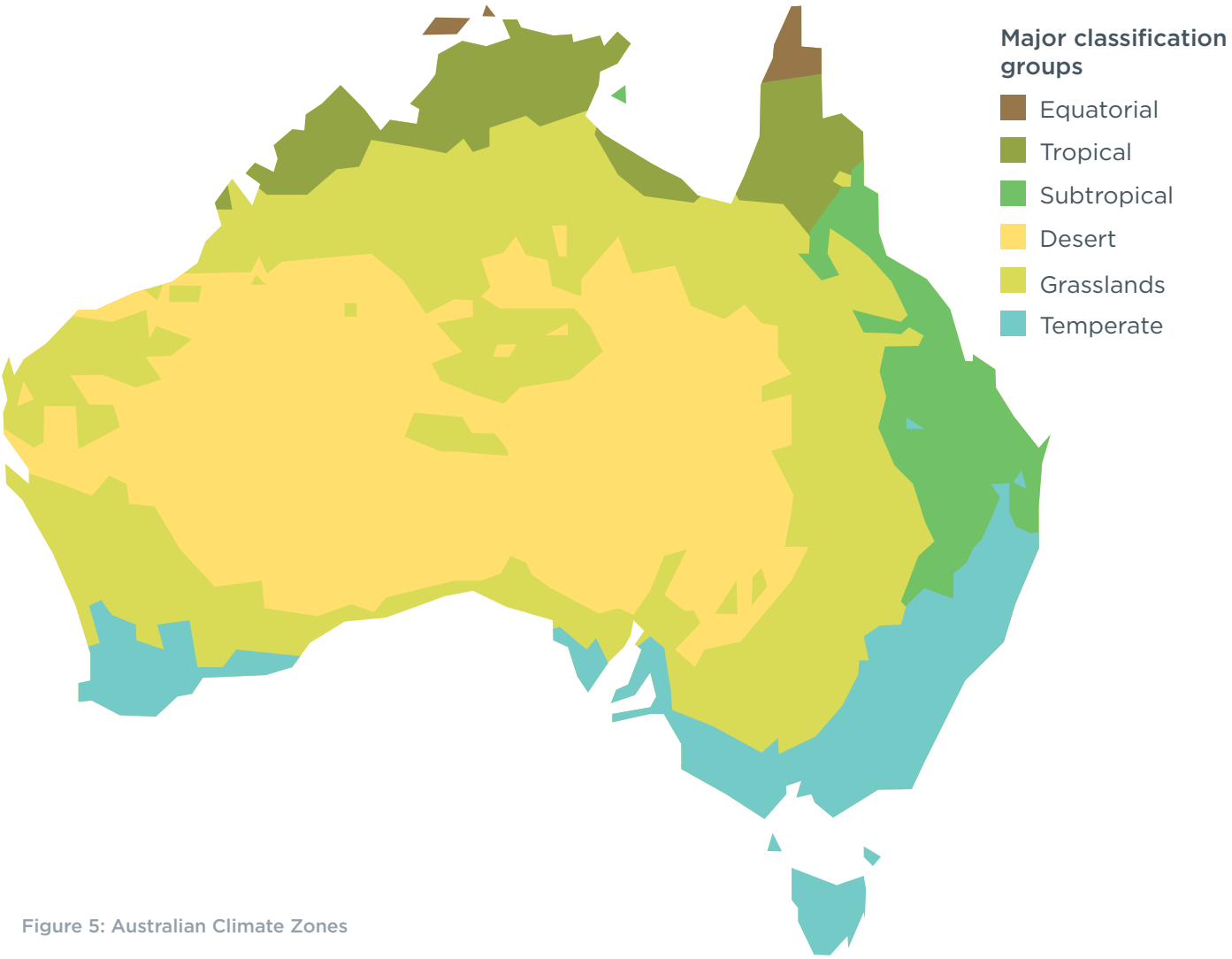


Figure 5: Australian Climate Zones

Rainfall

Australia has one of the most variable rainfall climates in the world, due to:

- its location across tropical, subtropical and temperate climate zones
- its small landmass in relation to the vastness of its surrounding ocean
- the enormous variety in the sea surface temperatures of the Indian and Pacific Oceans
- the meteorological system called Southern Oscillation, which is a result of the combined sea surface temperature and atmospheric pressure of the Pacific Ocean.

El Niño (Spanish for 'the boy') refers to the warming of the ocean's surface temperature. In El Niño years, we will often see lower than average rainfall over eastern Australia. La Niña (Spanish for 'the girl') refers to the cooling of the ocean's surface temperature and in La Niña years we will often see higher than average rainfall over much of Australia. Both can significantly impact water supplies, and can return at irregular intervals every three to eight years, lasting for one or two years each time.

Weather the Musical

Weather refers to the state of the atmosphere in relation to wind, temperature, moisture and air pressure. The natural water cycle contributes to the weather through its processes of precipitation, transpiration, evaporation and condensation.

Main Activity

Use an internet search engine to find and view footage and sound clips of performances that mimic 'weather'; try typing in phrases like 'people making rain sounds' or 'weather performance'. In addition, you may like to find footage of actual rain or thunderstorms to inspire you.

Use these sounds and images to inspire you to create your own version of 'Weather, the Musical' by completing the Engage, Connect or Explore activity.

FACT: Native South Americans are credited with the invention of the rain stick; a long, hollow tube partially filled with small pebbles or beans and used to encourage rainstorms. When the rain stick is turned on its end, it makes a sound similar to rain falling. You might like to include rain sticks in your musical performance.

Engage

As a class, brainstorm a list of instruments or other things that might replicate rain, thunder, snow falling, evaporation, etc. Use the **Weather the Musical worksheet** provided to help you keep your list. Gather the instruments to plan and create a soundscape of the natural water cycle as a class.

Connect

In groups, select a range of instruments or make your own instruments, and create a musical piece to sound like a storm or replicate the water cycle. Use Movie Maker (or an equivalent) to create a film clip to accompany your recorded piece of music.

Explore

Use a range of pre-recorded sounds, or your own recordings, of water (e.g. rain, ocean, thunder) to create a piece of music in the style of your choice (pop, hip-hop, classical, etc.). You might like to use the online program *garageband* to produce your soundtrack—uploading the finished work onto *soundcloud* or *youtube* when it's complete.

Weather the Musical

Think about the types of sounds and movements that different weather patterns make. Make a list of weather sounds you want to replicate in the cloud, then use your list to label the buckets with ideas for how you might mimic these sounds.

Climate Changing

Weather has many aspects: hot and cold, wet and dry, calm and stormy, clear and cloudy. Weather always changes; you can see a weather forecast on the news each and every day. Climate refers to weather conditions over a sustained period of time, and is broken into the four seasons: summer, autumn, winter and spring. Climate also varies depending on the part of the world you live in, and your proximity to the sun. Because climate changes more slowly than weather, you may not have noticed many changes over your lifetime. However, you may have older friends or family who have noticed a slow change in the local climate.

Main Activity

Books and the internet provide us with many places to find facts and figures, but you don't even have to go that far for good quality information. You may find that the people around you have lots of interesting stories to share. Carefully constructed questions and an inquisitive attitude will help draw this information out of your subjects.

Create a set of interview questions to ask older friends or relatives, then conduct your interview/s using these tips:

- Use open-ended questions; questions that can't be answered with a simple yes or no.
- Write down your outline questions, but don't be afraid to ask for more information if the opportunity arises.
- Listen really carefully to answers, take notes and record the interview if your subject doesn't mind.
- Recap at the end of the interview. Check to see all of your questions have been answered and ask your subject if they'd like to add anything else.

If you have family or friends who live overseas, you may like to put together an email questionnaire to find out about the climate where they live.

FACT: The hottest day recorded in Melbourne was on 7 February 2009, the day of 'Black Saturday', at a scorching 46.4°C. The coldest day on record for Melbourne is a chilly -2.8°C on 4 July 1901.

Engage

Write a sentence about the most interesting thing your subject told you in the interview, and draw a picture to reflect this. Show the class your picture and read the sentence you wrote aloud.

Connect

Present the information you collected from your interview/s as a six to eight slide PowerPoint presentation. You may like to include photographs provided by your subject, take your own pictures, or source photos online.

Explore

Use the information you have gathered from your interview/s, in addition to your own research, and write a one page article profiling the way weather has changed over the past century. Be sure to include a couple of quotes, and try to source an appropriate image.

The Power of Water

Natural disasters are the result of the Earth's natural hazards, which include floods, drought, earthquakes, tornados, volcanic eruptions and landslides. These hazards become natural disasters when they impact the local population, either through human, financial and/or environmental loss.

Main Activity

Use your online search engine to find a program or video clip about natural disasters; abc.net.au is a good place to start.

Choose and watch an appropriate program in small groups or as a class, then discuss the issues together.

Engage

Discuss the features of droughts and floods as a class. Next, focus on what happens to the local population when there is too much water and when there is not enough water in an area. Draw a line down the middle of a sheet of paper and draw two images: what happens when there's too much water and what happens when there isn't enough water. Write a descriptive sentence at the bottom of each drawing.

Connect

Break into small groups to research floods, droughts, cyclones or tsunamis. Your research should include an example of a recent event, how water was involved, and what the impacts were on humans and their environment. Give a group oral presentation to the class about what you discovered. Include photographs or clips of the event if possible.

Explore

Research and create a thorough list of the different types of natural hazards that involve water. Select a natural hazard from your list and research it further to explain why such a thing might occur and how its impact could be minimised. Find a relevant example of your hazard to support your findings. Present your results as an oral presentation with images or a filmed documentary.

Rainfall Records

When a part of the atmosphere becomes saturated with water vapour (gas), the cool surrounding air temperature forces the gas to condense into liquid water. This water is too heavy to be supported by the air around it, so falls to Earth as precipitation, in the form of rain, hail, sleet or snow.

Main Activity

(or Teacher Demonstration)

Materials

- glass jar with a metal lid
- hammer and a nail
- boiling water
- a few cubes of ice
- a pinch of salt
- a dark coloured non-permanent texta
- sticky tape

Method

1. Using the hammer and nail, carefully make five indentations in the top of the jar lid, being careful not to punch through the lid.
2. Colour in the underside of the lid with your non-permanent texta. A nice rich colour will give you the best result.
3. Fill your jar almost to the top with boiling water.
4. Place the lid upside down on top of the jar. Ensure the lid covers the entire opening of the jar, creating a seal so that none of the gas escapes. Use sticky tape if necessary to seal the edges of the jar.
5. Wait, observe and explain what happens using the appropriate terms.

FACT: Mawsynram in India is noted as being the wettest place on Earth, with over 11 metres of rain falling in a single year. That compares to well under a metre per year in Melbourne.

Engage

Use a rain gauge to measure the rainfall at your school for 1-2 weeks. Have your teacher record this information in a large graph displayed in your classroom. Over the same period, collect measurements from three other capital cities in Australia, using your local news weather report. Add these details to your graph. Copy the graph into your workbook.

Connect

Using the instructions provided, make your own rain gauge to measure the rainfall over your school or home.

Materials

- glass jar with vertical sides
- ruler
- permanent marker
- sticky tape
- cardboard
- scissors

Method

1. Measure a 2 cm x 10 cm rectangle on a piece of cardboard.
2. Carefully cut out the rectangle.
3. Using your ruler, mark every 5 mm along the long edge of your rectangle. Ensure the bottom end starts at exactly 0 cm.
4. Line up your newly made cardboard ruler next to the jar, ensuring the bottom of the ruler is at the very base of the jar.
5. Tape your ruler to the jar. Ensure you cover the whole paper ruler in sticky tape so that it is waterproof.
6. Place your rain gauge outside, away from trees and buildings. You may wish to place it inside an open topped box so that it is not accidentally knocked over.
7. Take your measurements at the same time each day over a period of 1–2 weeks. Remember to empty the gauge each day after you've recorded the measurements.

Collect the rainfall details from other capital cities in Australia for the same period. Create a graph showing your figures. Remember to label your X and Y axis and include a descriptive title.

Explore

Think about how much rain there has been over the last two years or so. Do you think it rains the same amount at the same time each year? During which months do we get the most rain?

Using the Bureau of Meteorology website, find information for your suburb including:

- the mean rainfall for each month over a 12 month period. Which month has the highest/lowest average rainfall?
- the year that had the highest/lowest annual rainfall in the last 10 years.

Find the same data for a regional city in Victoria and a capital city from another state. Use the data collected to identify significant weather events from your three cities. Search online to find relevant media clips/articles relating to the weather event. Display your data in a PowerPoint presentation or as an interactive poster.

Flood Warning

Floods occur when water submerges land that is not usually covered by water. Floods are generally caused by a normally contained water body (such as a river or lake) breaking its banks, or a high level of rain that builds up in an area that is unable to be drained sufficiently. Floods are most catastrophic when they breach areas of human population, and lives, buildings and possessions are destroyed.

Main Activity

Visit Melbourne Water's website and play the animated Floods Explorer game. This activity will give you lots of information about the impact of rainfall on different parts of your community and should help you determine how to cope in flood situations.

TIP: Teacher's notes are available in PDF from Melbourne Water for the Floods Explorer activity (melbournewater.com.au).

FACT: Floods aren't always a bad thing. Seasonal flooding can provide an important source of nutrients to wetlands, swamps and waterways, encouraging flora and fauna to flourish. It can also recharge the water supplies in dams and aquifers.

Engage

Your town is flooding and you need to leave immediately! Write a list of the things you would take with you. You will only be able to take one bag! Present your list to the class, giving reasons why each item is important.

Connect

Floods are forecast in the coming days. How might you protect your home and possessions? Research online and prepare a list of items to include in a flood prevention/disaster kit. Present this in an informative poster.

Explore

Floods are forecast in the coming days. Your news team has a responsibility to let people know how to cope with the situation. In pairs, Anchor and Weatherperson, research the appropriate details and write a script to assist people in preparing their homes for a flood and to help plan their safe escape. Present your news report to the class.

You may also want to prepare a follow up report on the impact of the flood on the ecosystem.

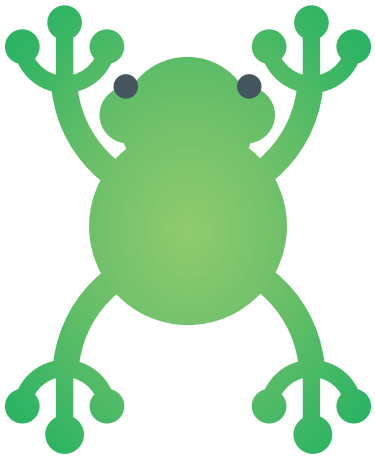
Dreaming of Water

Australia's Indigenous people have lived in Australia for tens of thousands of years, with many different tribes speaking different languages and no such thing as storybooks to read. Australia's Indigenous people, along with many other cultures, often used verbal stories to explain and share their knowledge, spirituality and wisdom about how things came to be. This oral tradition of storytelling makes up part of what is known as The Dreaming.

Main Activity

Tiddalik the frog awoke one morning with an insatiable thirst, drinking and drinking until there was no water left in any of the lakes or rivers across the land. This caused a terrible drought, and the animals and plants started to suffer and die. The dying animals conspired to make Tiddalik laugh so that he'd release the water and quench the ground, but it wasn't an easy task...

Find and read a version of *Tiddalik the Frog* then complete the Engage, Connect or Explore activity. You may find there are quite a few variations, which isn't surprising since the story has been around for approximately 12,000 years! Consider the themes in the story and why your version might be different to another.



Engage

As a class, discuss the themes in the story about Tiddalik. Create a four to six frame comic strip reflecting what happened in the story. You may like to turn this into a short play to present to the class.

Connect

Discuss the story as a class, and then consider what might really cause floods across our lands. Create three images showing the different stages of the story (flood, drought and an ideal scenario), with captions for each. Alternatively, use the **Story Map template** to help you write a modern retelling of the story. Your story can be fantasy or reality based, but should tackle the concept of drought and/or flood and the impacts on the Earth.

Explore

Aboriginal people have an inherent knowledge and connection with the land which has led them to develop weather lore to help them predict the weather. You can find some of these on the Bureau of Meteorology website (bom.gov.au). Around the world, there are many other folklores about weather, such as 'Red sky at night, shepherd's delight; red sky in the morning, shepherd's warning'.

Research five weather lores, explain where each of them has come from and what they mean, and determine if there is any truth to your chosen folklores by investigating the science behind them.

Wet and Dry Australia

People often confuse weather and climate, but they are actually quite different. Weather is what happens each day, including rainfall, temperature and wind. Climate refers to an average weather pattern that occurs over a sustained period of time.

By understanding climate, we can choose an appropriate holiday destination, plant the right crops, and ensure our homes are designed for long-term comfort and durability.

Australia is made up of six climate zones: Equatorial, Tropical, Subtropical, Desert, Grassland and Temperate. Each zone varies in its rainfall and temperature.

Main Activity

Consider the different climates you are aware of on Earth. They don't need to be official zones, but rather general climates, such as hot and humid or freezing cold. How might these climates change the way a person lives? Choose a climate, and use the **Main - Wet and Dry Australia worksheet** to think about what sorts of considerations you would have to make if you lived in such an area. Think about clothing, housing, activities and hobbies, food and travel.

Engage

Using the internet, magazines or travel brochures, collect images of the wet and dry areas in Australia. On a piece of A3 paper, make a collage, grouping the images you have collected into two sections—WET and DRY. You may like to do this as an individual project or make a giant collage with all of your classmates.

Connect

Using the **Connect - Wet and Dry Australia worksheet** provided, investigate Australia's six climate zones and collect pictures that represent each zone. Paste the images onto the relevant areas of a giant map of Australia and mark capital cities and any geographic highlights on the map. Don't forget your BOLTSS—Border, Orientation, Legend, Title, Scale and Source.

Explore

On the **Explore - Wet and Dry Australia worksheet** provided you'll find a map outlining Australia's six climate zones. Research where each zone belongs and use coloured pencils to create a key. Shade each zone as appropriate and mark in the capital cities. Complete the poster by creating breakout boxes that summarise the main features of each zone.

Main – Wet and Dry Australia

Consider how the climate conditions might alter the way you live. It might be fun to select a location with extreme conditions, such as the coldest, hottest, wettest or driest. List what things would need to be considered if you were to live in this area, including benefits and risks. Consider the type of house you might live in, whether you would/could have a garden, transport you could/couldn't use, food and water availability, specific clothing needed, and anything else that would be affected by the regional climate conditions.

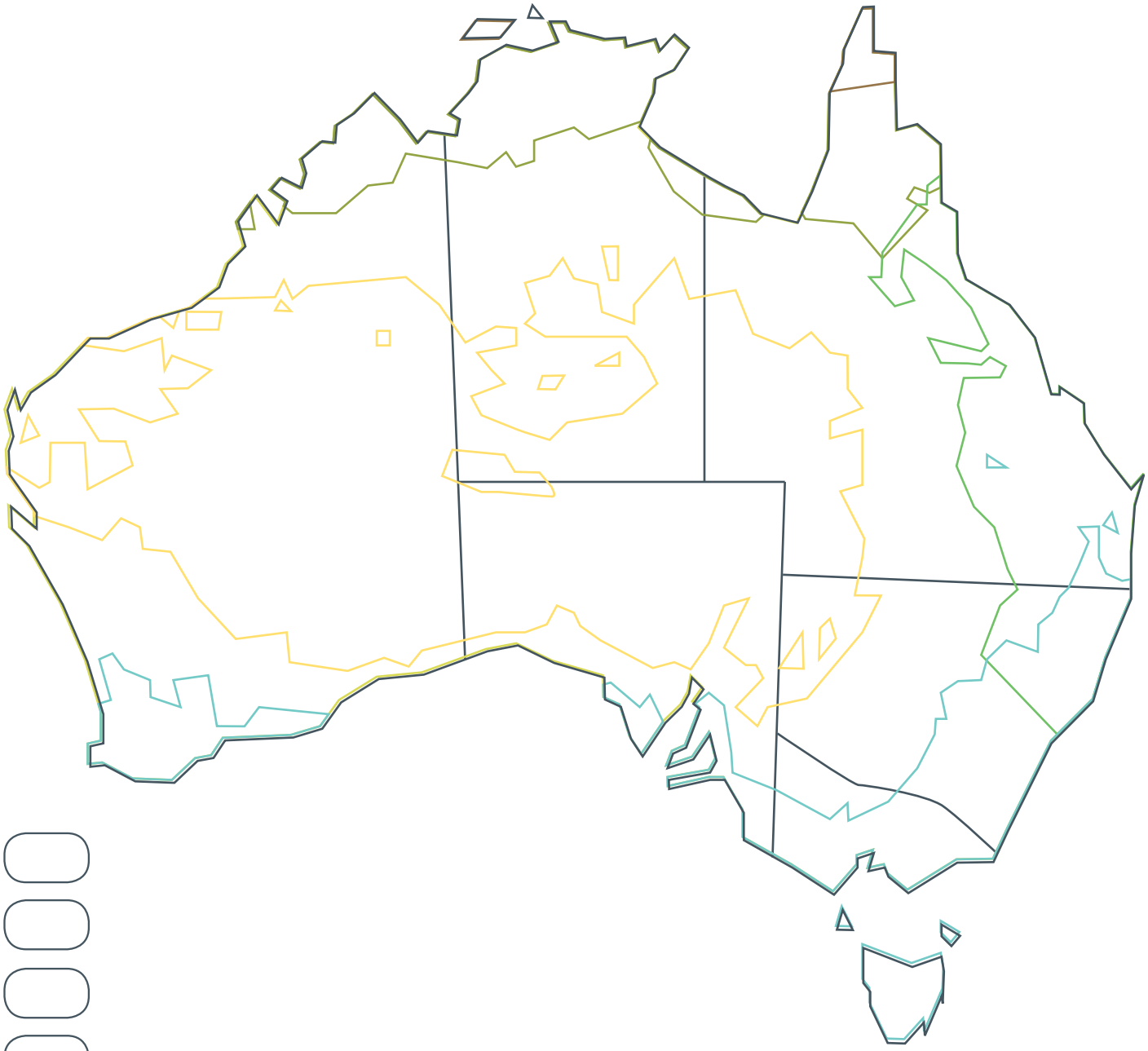
Chosen Location . . . . . .

Climate Type . . . . . .

Area of Life *e.g. house and garden*	**Considerations** *e.g. cost of heating/cooling*

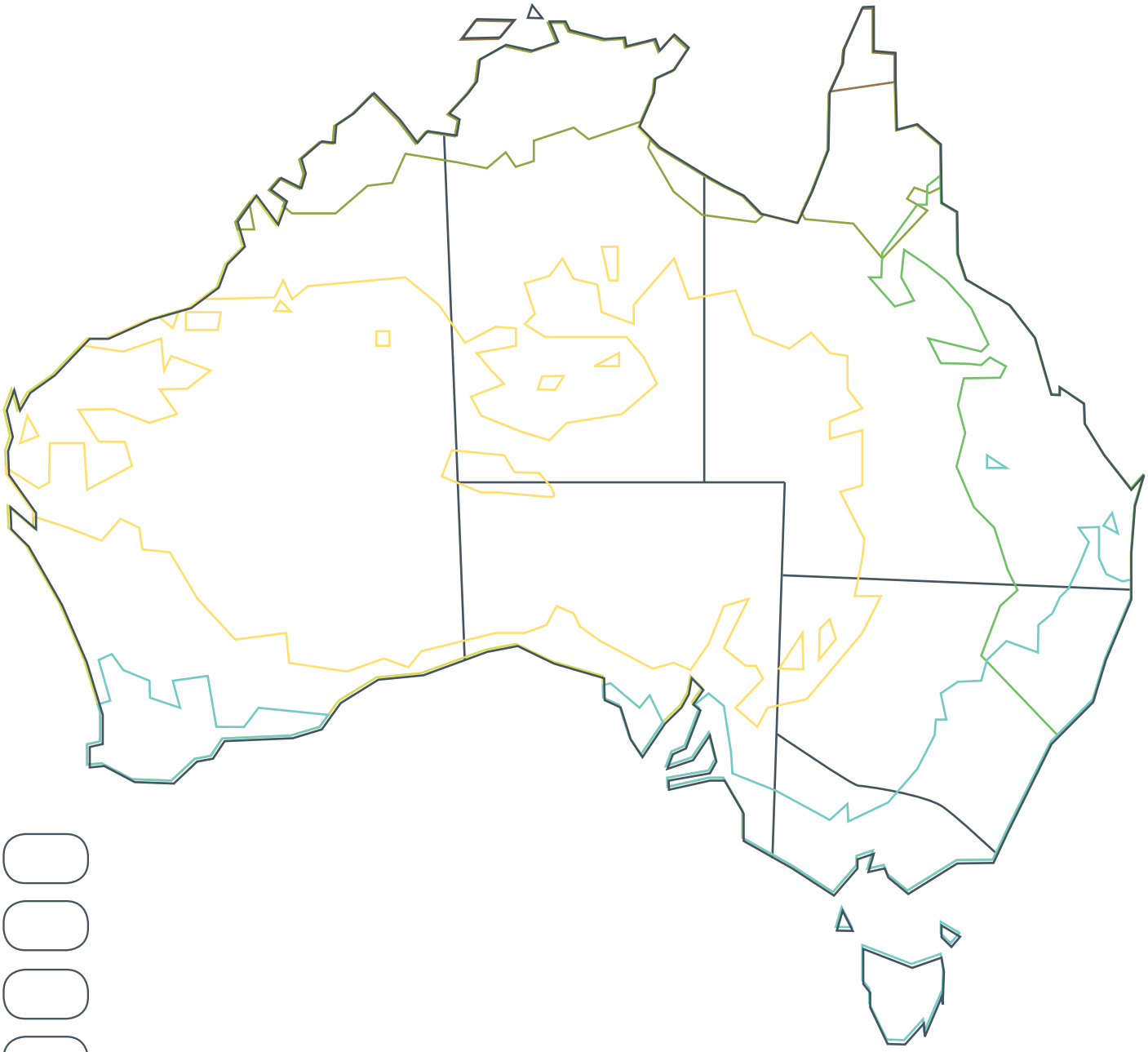
Connect – Wet and Dry Australia

Enlarge this sheet to A3 size. Research Australia's climate zones and collect pictures that represent each area. Paste these images onto the relevant areas of the map and colour in the key. Complete the map by marking the capital cities and any other geographic highlights. Add climate zone outlines to the map for Connect Activity.



Explore – Wet and Dry Australia

Enlarge this sheet to A3 size. Research the climate zones of Australia and add them to the map below, using coloured pencils and a key. States, Territories and capital cities should also be labelled. Complete this poster by providing information boxes that outline the main features of each climate zone.



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Templates

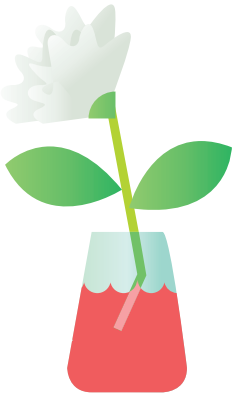
Template	Description
Detailed Lab Report	Use the numbered titles and instructions to assist in writing a complete laboratory report at a primary school level.
Graphic Timeline	Complete each square of the timeline with an image or diagram of your activity or experiment. Annotate your images with additional information using the space provided.
Lotus Diagram	Write your main topic in the centre of the page and expand each subtopic in the squares around it. Copy these topics into the centre squares of the next part of the lotus and surround these with new subtopics.
Plus, Minus, Interesting (PMI)	Consider the different parts of your problem or issue and write them down in the sections provided. Review your lists and summarise your findings in the space provided..
Predict, Observe, Explain (POE)	Complete each section (Predict, Observe and Explain) before, during and after each experiment.
Ranking Ladder	Complete the pertinent details about your topic and use the ladder to rank your responses to the issues or problems, with the most important issue at the top and the least important at the bottom.
Ripple Effect	Write the question you want answered in the drop, then complete the ripples with all of the potential answers and consequences.
Scientific Lab Report	Use the numbered titles and instructions to assist in writing a complete laboratory report at a secondary school level.
Storyboard	Plot out your film, play or animation with basic illustrations, a story outline, and notes about the mood, sounds and other effects required.
Story Map	Complete each of the boxes to outline and plan a story from start to finish.

Detailed Lab Report

Use the numbered titles and instructions below to assist you in writing your laboratory report. Ensure you include the appropriate information under each heading.

1. Title: What is your experiment about?	
2. Introduction/ Purpose: What do you want to learn during this experiment?	
3. Hypothesis: What do you think will happen during your experiment?	
4. Materials: Use dot points to list all the equipment you will need.	
5. Procedure: What steps did you take during this activity? Number each of your steps.	
6. Results: What did you observe during your experiment? Use tables, graphs and/or diagrams to record your results.	
7. Discussion: Use your own words to describe what happened and why you think you achieved the results you did.	
8. Conclusion: What did you learn? Compare the results of your activity with your hypothesis.	

Graphic Timeline



Use images or diagrams to complete this visual timeline. Each square should show a significant change and indicate the relevant time/date. Captions may be added to help clarify your timeline.

Title: . . . . . .

	Date/time
	Date/time
	Date/time
	Date/time
	Date/time
	Date/time
	Date/time

Lotus Diagram

Start with your main idea in the centre square before using the surrounding squares to break your idea into subtopics, and explore them even further.
Teacher Tip: Print this page in colour to help students follow the lotus format more easily!

	Subtopic 3			Subtopic 4			Subtopic 5	
			Subtopic 3	Subtopic 4	Subtopic 5			
	Subtopic 2		Subtopic 2	Main topic	Subtopic 6		Subtopic 6	
			Subtopic 1	Subtopic 8	Subtopic 7			
	Subtopic 1			Subtopic 8			Subtopic 7	

Plus Minus Interesting (PMI)

Think about the different parts of your problem or issue and write them down in the Plus, Minus or Interesting columns. Once you have completed the table, summarise your findings with a conclusion.

Plus Write down the positive results of taking a particular action	**Minus** Write down the negative results of taking a particular action	**Interesting** Write down the implications and possible outcomes of taking a positive, negative or indecisive action
Conclusion:		

Predict Observe Explain (POE)

Repeat the Predict, Observe, Explain process for each experiment you undertake.

Title: . . . . . .

Topic/Activity	
Predict Before you start, think about what might happen. Write down your prediction.	
Observe During your experiment/ activity, use your senses to observe what is happening. Record your observations. You may want to include diagrams.	
Explain After you have finished your experiment/activity, try to explain what happened. You may need to do some research to complete this section.	

Ranking Ladder

Ranking ladders help to consider all possible responses to a question or circumstance, rather than just an obvious response or knee-jerk reaction. This tool ensures you consider and justify your responses.

Complete the table below then use the ladder to rank your responses to the issue/problem, with the most important at the top and the least important at the bottom.

Task: . . . . . .

State the issue/problem in your own words:

. . . . . .

. . . . . .

Brainstorm all of the possible answers,
then rank them using the ladder : . . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

Justify your most important response: . . . . . .

. . . . . .

. . . . . .

. . . . . .

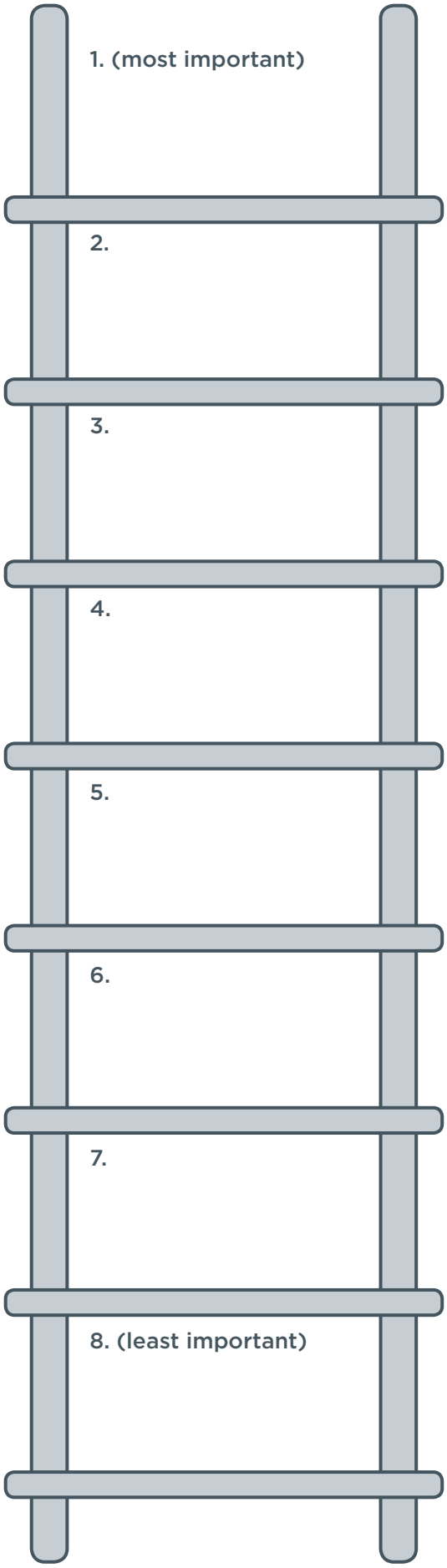
Justify your least important response: . . . . . .

. . . . . .

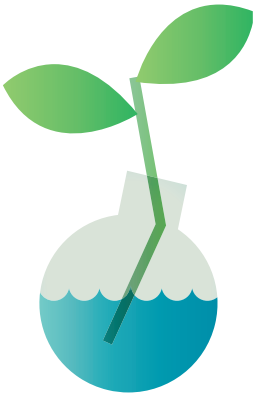
. . . . . .

. . . . . .

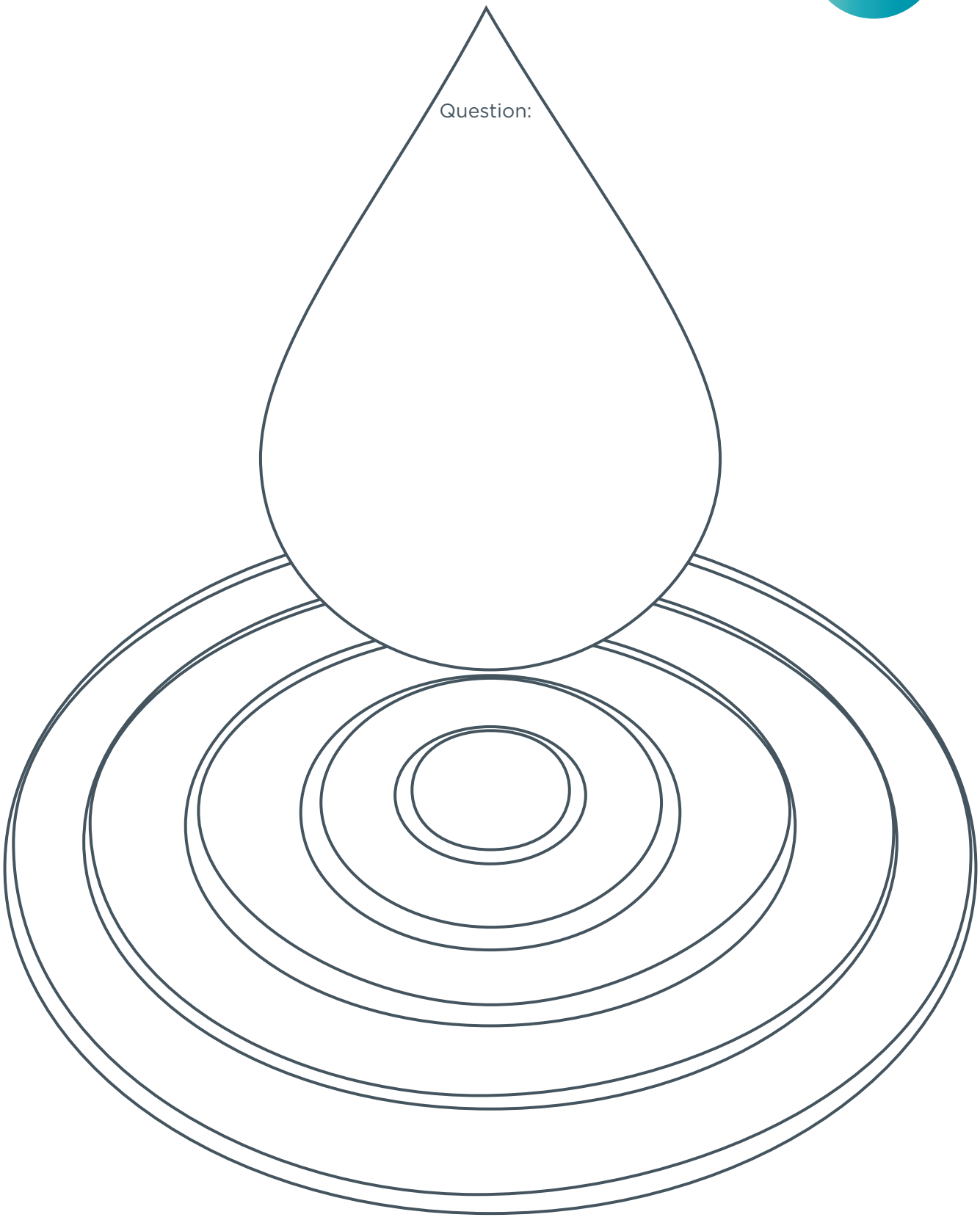
(If you can't justify a response, you should remove it from your list entirely.)



Ripple Effect



Write your question in the centre of the drop and consider all the potential consequences. Write down each consequence in a ripple. See how many ripples you can fill in—you may need to add some of your own!



Scientific Lab Report

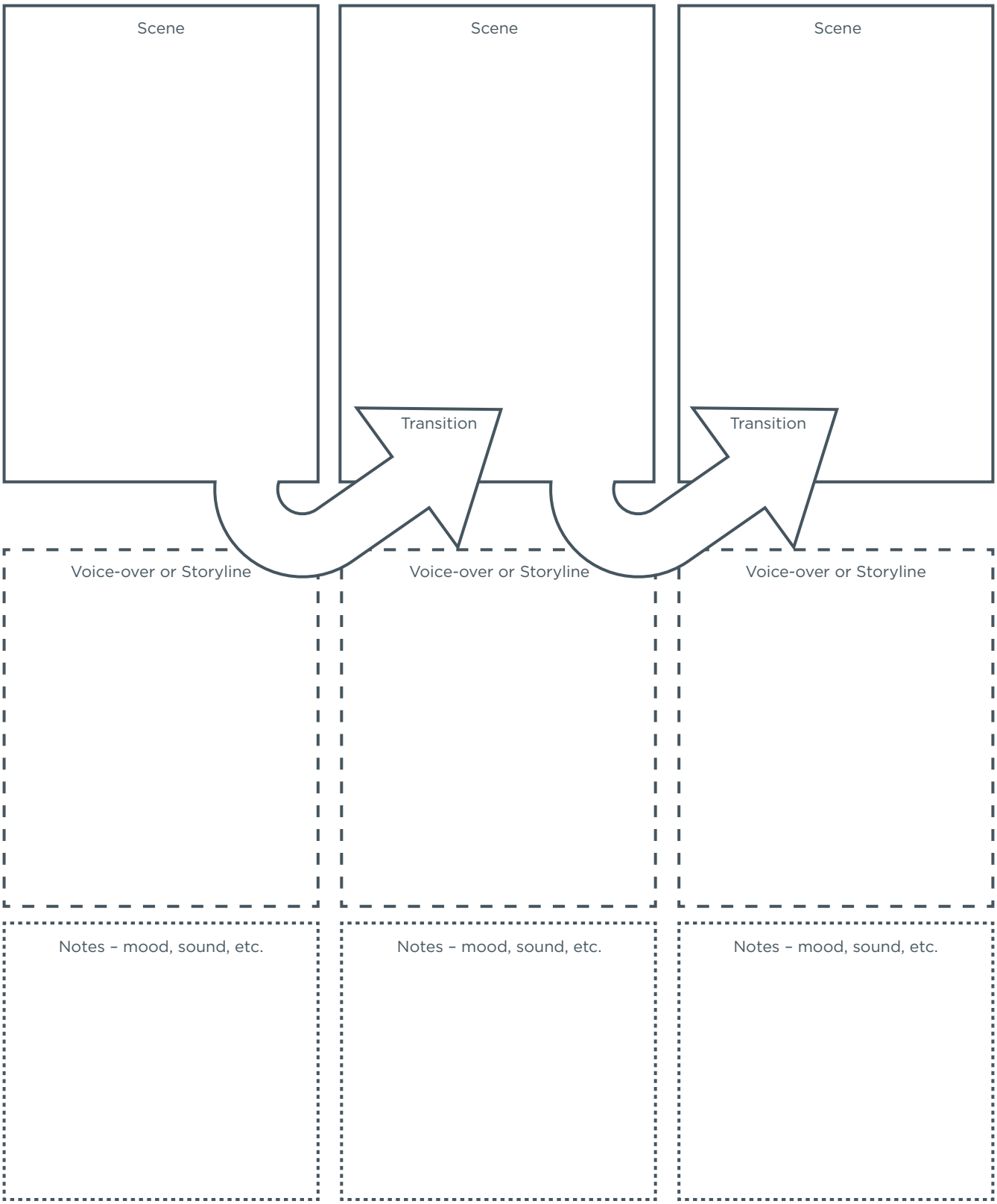
Use the numbered titles and instructions below to assist you in writing your laboratory report. Ensure you include the appropriate information under each heading.

1. Title: The title should be brief (ten words or less) and describe the main point of the experiment. An example is: "Effects of Water on Broad Bean Growth Rate". Try to begin your title using a keyword rather than an article like 'The' or 'A'.	
2. Introduction/Purpose: The introduction explains the objectives or purpose of the experiment.	
3. Hypothesis: A hypothesis outlines what you expect will happen during your experiment and why.	
4. Materials: Use dot points to list all the equipment you will need.	
5. Methods: Describe and number the steps you completed during your investigation. Include enough detail so that anyone could read this section and copy your experiment. Note: Diagrams should be pencil drawings and not sketches, and should be labelled.	
6. Results: Describe in words what the data means and include any tables, charts or graphs.	
7. Discussion: Explain the data you collected and decide whether or not your hypothesis was correct. You might also like to include any mistakes you made while conducting the investigation, and describe ways the study might have been improved.	
8. Conclusion: The conclusion is 2-3 sentences that sum up what happened in the experiment; whether your hypothesis was accepted or rejected, and what this means.	

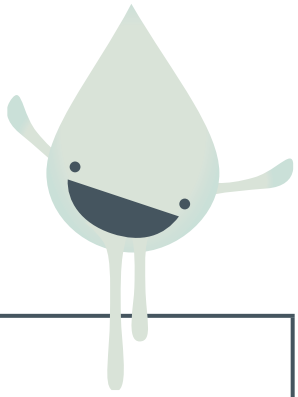
Storyboard

Plot out your film, play or animation by filling in the details for each scene below. You can draw images or write dot points to explain each scene. Print as many sheets as you need to plot out your entire storyline.

Title: . . . . . .



Story Map



Title: . . . . . .

SCENE

Where:

When:

CHARACTERS

Major Characters:

Minor Characters:

Challenge/Event 1

Challenge/Event 2

Challenge/Event 3

How the Challenges are Overcome:

Now that you've completed your plan, fill in the details and write your full story!

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Glossary

Adhesion: the attraction of different molecules to one another.

Altitude: the height of an object or point, especially above sea level on Earth.

Aquifer: an underground layer of permeable rock or other geological formation that holds water, especially one that supplies the water for wells, springs, etc.

Atmosphere: the gaseous envelope surrounding Earth; the air.

Billabong: a dead-end body of water extending from a river that forms a backwater or stagnant pool.

Bore water: water accumulated in aquifers below ground but available for farm use by sinking a bore pipe in the aquifer. May discharge naturally to the surface or need to be pumped.

Brackish: a mixture of seawater and freshwater.

Capillary action: the movement of water within the spaces of a porous material due to the forces of adhesion, cohesion and surface tension.

Catchment (open): a public area of land that collects rainfall and directs it to a low lying body of water. The water only needs minimal treatment before it can be distributed as drinking water.

Catchment (closed): an area of land that is closed to public access, where rainfall water is collected and directed to a low lying body of water. The water only needs minimal treatment before it can be distributed as drinking water.

Channel: a natural or man-made course through any shallow body of water to ensure a lane of safe travel for vessels. This body of water is sometimes referred to as a canal.

Climate: the prevailing weather conditions of a region: temperature, air pressure, humidity, precipitation, sunshine, cloudiness, and winds throughout the year, averaged over a series of years.

Cloud: a visible collection of particles of water or ice suspended in the air, usually at an elevation above the Earth's surface.

Cohesion: the intermolecular attraction that holds molecules together.

Condensation: the change of the physical state of matter from a vapour into liquid; when vapour cools, the molecular structure changes and it becomes a liquid.

Dam: a barrier built across a stream or river to control the flow or raise the level of water; small man-made water storages on farmland that capture stormwater run-off and groundwater that can be used in times of low or no rainfall for stock and domestic use or irrigation purposes.

Drought: a period of dry weather that is inadequate for the needs of crops, animals and humans, generally due to an extended period of low rainfall.

Ecosystem: a system formed by the interaction of a community of organisms with their environment.

Embodied water: the water used in the production of goods or services, e.g. 4,650 litres of water is required to produce 300 g of beef; this number considers preparation of food required to feed the beef, transportation, land management, etc.

Erosion: the process by which the surface of the Earth is worn away by the movement of water, glaciers, winds, waves, etc.

Estuary: the tidal mouth of a river where the river meets the sea; a mix of freshwater and saltwater (aka brackish).

Evaporation: the change of a substance from a liquid state to a gaseous state. This process is accelerated by an increase in temperature and a decrease in atmospheric pressure.

Flood: inundation of normally dry land by overflow of water from a usually confined area.

Freshwater: water with less than 500 parts per million (ppm) of dissolved salts. Freshwater can be found on Earth as icecaps, glaciers, billabongs, dams, lakes, rivers and streams, and underground as groundwater in aquifers and underground streams.

Groundwater: the water beneath the surface of the ground, consisting largely of surface water that has seeped down; the source of water in springs and wells.

Impermeable: a material through which substances, such a liquids or gases, cannot pass.

Infiltration: the seepage of water into soil or rock.

Infographic: a graphic representation of an idea or message that presents complex information clearly and efficiently.

Lake: a large body of relatively still water surrounded by land.

Molecule: the smallest physical unit of an element or compound.

Natural disaster: any event or force of nature that has catastrophic consequences, such as avalanche, earthquake, flood, forest fire, hurricane, lightning, tornado, tsunami and volcanic eruption.

Natural hazard: the threat of a naturally occurring event that will have a negative effect on people or the environment.

Ocean: the continuous body of saltwater that covers over 70% of the Earth's surface, including the Atlantic, Pacific, Indian, Arctic and Antarctic oceans.

Organic: derived from living matter; natural.

pH: the measure of acidity or alkalinity of a chemical solution. Anything neutral, for example, has a pH of 7. Acids have a pH lower than 7, bases (alkaline) have a pH higher than 7.

Pollution: the introduction of harmful substances or products into the environment.

Potable: water that is suitable for drinking.

Precipitation: any form of water, such as rain, snow, sleet or hail, that falls to the earth's surface.

Puddle: a small body of standing water (often rainwater) on the ground.

Reservoir: a natural or artificial place where water is collected and stored for use, especially water for supplying a community, irrigating land, furnishing power, etc.

River: a large natural stream of freshwater flowing along a definite course, usually into another body of water (ocean, lake, sea, river), being fed by tributary streams. Small rivers may also be called a stream, creek, brook or tributary.

Salinity: the salt or dissolved salt content found in a body of water or soil.

Saltwater: water that contains 35,000 parts per million (ppm) of dissolved salts; approximately 97% of Earth's water is saltwater, held in the major ocean areas of the Atlantic, Antarctic, Indian, Pacific and Arctic.

Secondary treatment plant: a series of machines and equipment that filter and remove contaminants from water intended for drinking.

Sewage treatment plant: a series of machines and equipment that remove contaminants from wastewater to produce environmentally safe liquid and solid bi-products to dispose of or reuse.

Solvent: a substance that dissolves another to form a solution.

Spring: underground water that is held in the soil and in pervious rocks that flows freely out of the ground.

States of matter: the distinct forms that different phases of matter take on, such as solid, liquid and vapour.

Terrarium: a glass container, chiefly or wholly enclosed, for growing and displaying plants.

The Dreaming: an ancient time of the creation of all things by sacred ancestors, whose spirits continue into the present, as conceived in the mythology of the Australian Aborigines.

Transpiration: the passage of water through a plant from the roots through the vascular system to the atmosphere.

Turbidity: not clear or transparent because of stirred-up sediment or the like; clouded; opaque; obscured.

UV: ultraviolet; electromagnetic radiation with a wavelength shorter than visible light, hence invisible to humans; emitted by the sun's rays.

Volume: the amount of space, measured in cubic units, that an object or substance occupies.

Water cycle: the continuous movement of water on, above and below the earth's surface.

Water table: the level below which the ground is saturated with water.

Water quality: the physical, chemical and biological characteristics of water; drinking water in Australia must reach the standards outlined in the Australian Drinking Water Guidelines (ADWG).

Weather: the state of the atmosphere with respect to wind, temperature, cloudiness, moisture, pressure, etc.

Wetland: a lowland area, such as a marsh or swamp, which is saturated with moisture, especially when regarded as the natural habitat of wildlife.

Xylem: a compound tissue in vascular plants that helps provide support and that conducts water and nutrients upward from the roots, consisting of tracheids, vessels, parenchyma cells and woody fibres.