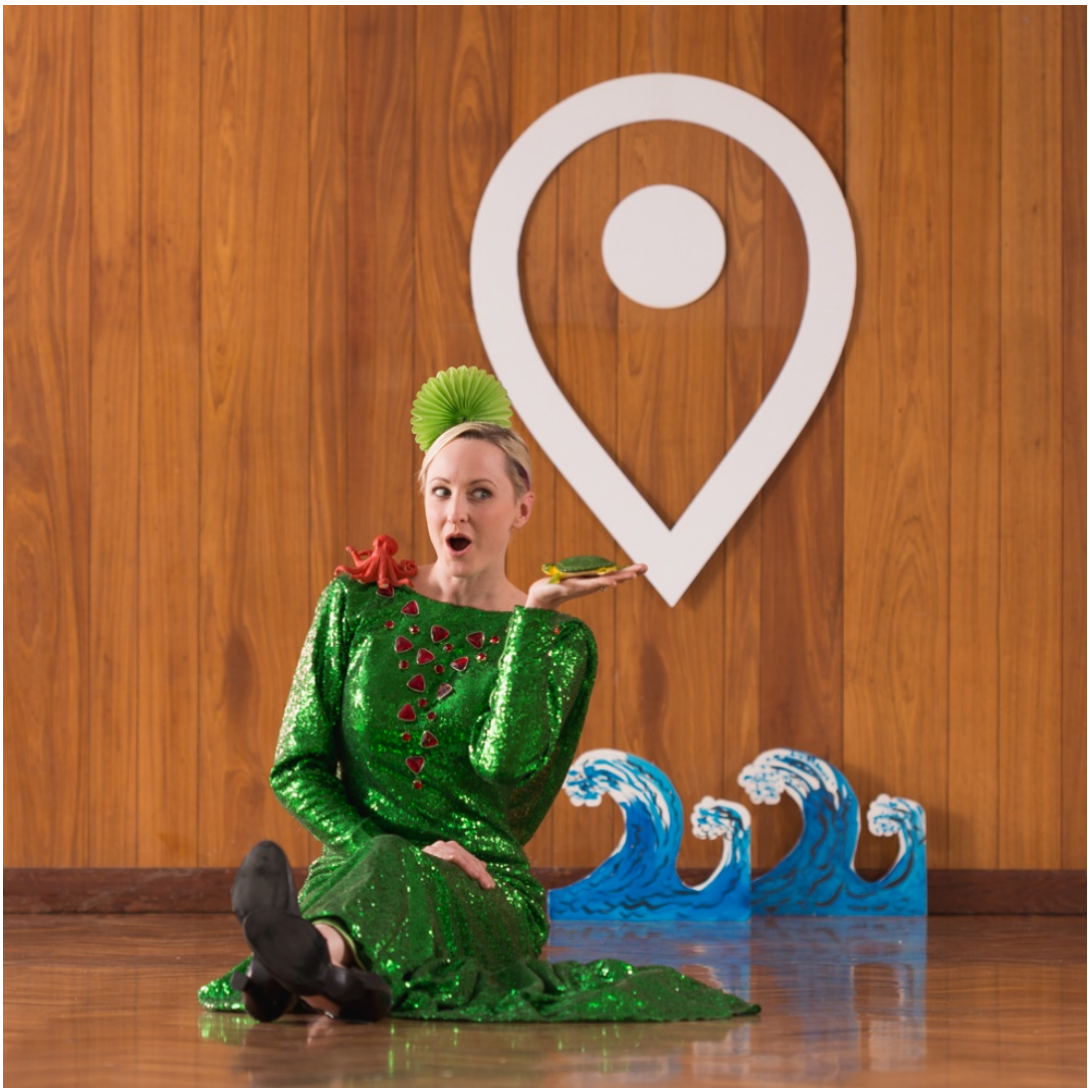
QUEENSLAND MUSIC FESTIVAL

REEF UP!

SCIENCE EXTENSION KIT



THE AUSTRALIAN CURRICULUM: SCIENCE

www.australiancurriculum.edu.au/f-10-curriculum/science/

KEY LEARNING OUTCOMES

- Understand the concept of biodiversity
- Recognise the difference between a native and invasive species
- Identify food webs and trophic interactions on the Great Barrier Reef
- Recognise the effects of extinction
- Learn the lifecycle of plastics
- Investigate the properties of plastics
- Determine effective recycling processes and the importance of minimising pollution
- Examine the process of biodegradation
- Understand and investigate the concept of pH and ocean acidification
- Identify the importance of ocean currents

THEMES

Reef UP!		
Biodiversity	Food Webs	Endangered Species
Recycling	Lifecycles	Invasive Species
Predator	Conservation	pH
Pollution	Plastics	Acidification
Extinction	Currents	

PRE-PERFORMANCE DISCUSSION/QUESTIONS

- Ask students what they already know about the key learning areas and themes.
- Ask the students to find and write definitions of each word in the themes table.
- Allow students to pick a word from the themes table and ask them to write about, draw or make a mind map of their understanding of the concept.
- Additional activities: create a play, film, dance, song or story-board inspired by some of the words you have discussed

AUSTRALIAN CURRICULUM LINKS

Year Level	Learning Area: Science
Prep	**Science Understanding** • Living things have basic needs, including food and water (ACSSU002) • Objects are made of materials that have observable properties (ACSSU003) **Science as a Human Endeavour** • Science involves exploring and observing the world using the senses (ACSHE013) **Science Inquiry Skills** • Respond to questions about familiar objects and events (ACSIS014) • Explore and make observations by using the senses (ACSIS011) • Engage in discussions about observations and use methods such as drawing to represent ideas (ACSIS233) • Share observations and ideas (ACSIS012)
Year 1/2	**Science Understanding** • Living things have a variety of external features (ACSSU017) • Living things live in different places where their needs are met (ACSSU211) • Everyday materials can be physically changed in a variety of ways (ACSSU018) **Science as a Human Endeavour** • Science involves asking questions about, and describing changes in, objects and events (ACSHE021) • People use science in their daily lives, including when caring for their environment and living things (ACSHE022) **Science Inquiry Skills** • Participate in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas and accessing information sources (ACSIS025) • Use informal measurements in the collection and recording of observations with the assistance of digital technology where appropriate (ACSIS026) • Use a range of methods to sort information, including drawings and provided tables (ACSIS027) • Represent and communication observations and ideas in a variety of ways such as oral and written language, drawing and role play (ACSIS029)
Year 3/4	**Science Understanding** • Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044) • Living things have life cycles (ACSSU072) • Living things, including plants and animals, depend on each other and the environment to survive (ACSSU037) • Natural and processed materials have a range of physical properties; These properties can influence their use (ACSSU074) **Science as a Human Endeavour** • Science involves making predictions and describing patterns and relationships (ACSHE050) • Science knowledge helps people to understand the effect of their actions (ACSHE062) **Science Inquiry Skills** • Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technology as appropriate (ACSIS055) • Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends (ACSIS057) • Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSIS060)\

Year 5/6	**Science Understanding** • Living things have structural features and adaptations that help them to survive in their environment (ACSSU043) • The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094) **Science as a Human Endeavour** • Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena (ACSHE081) • Scientific understandings, discoveries and inventions are used to solve problems that directly affect peoples' lives (ACSHE083) • Scientific knowledge is used to inform personal and community decisions (ACSHE217) **Science Inquiry Skills** • With guidance, plan appropriate investigation methods to answer questions or solve problems (ACSIS086) • Construct and use a range of representations, including tables and graphs, to represent and describe observations, patterns or relationships in data using digital technologies as appropriate (ACSIS090) • Compare data with predictions and use as evidence in developing explanations (ACSIS218) • Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS093)
Year 7/8	**Science Understanding** • Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions (ACSSU112) • Some of Earth's resources are renewable, but others are non-renewable (ACSSU116) **Science as a Human Endeavor** • Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations (ACSHE120) • Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE121) **Science Inquiry Skills** • Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships, including using digital technologies as appropriate (ACSIS129) • Summarise data, from student's own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions (ACSIS130) • Communicate ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (ACSIS133)
Year 9/10	**Science Understanding** • Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems (ACSSU176) • Chemical reactions, including combustion and the reaction of acids, are important in both non-living and living systems and involve energy transfer (ACSSU179) **Science as a Human Endeavor** • The values and needs of contemporary society can influence the focus of scientific research (ACSHE228) **Science Inquiry Skills** • Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (ACSIS169) • Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS170) • Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language. Conventions and representations (ACSIS174)

POST-PERFORMANCE QUESTIONS AND ACTIVITIES

BIODIVERSITY AND FOOD WEBS

Biodiversity refers to all living things – plants, animals and microorganisms – and their relationships with each other and the environment. These relationships mean that all living things rely on each other to survive, and each individual helps to keep nature in balance.

All living things need energy to grow, and to maintain and repair themselves. The main source of energy for life comes from the sun, and some organisms (known as producers) have found a way to capture the sun's energy to make their own food. When a producer is eaten, its energy is then passed onto another organism (known as consumers). This energy continues to be passed onto other living things as plants and animals are eaten. The way that energy is transferred through all living things in an area is known as a "Food Web"

Questions:

Prep

- What are some animals and plants that live on the Great Barrier Reef?
- Draw your favourite animal or plant that lives on the Great Barrier Reef.

Year 1 and 2

- What are some animals and plants that live on the Great Barrier Reef?
- Draw your favourite animal or plant that lives on the Great Barrier Reef.
- Can you give any examples of animals or plants that have moved into an area on the Reef where they did not live before?

Year 3 and 4

- What are some animals and plants that live on the Great Barrier Reef?
- Draw your favourite animal or plant that lives on the Great Barrier Reef.
- Think about all the animals and plants that live together on the Reef. What might happen if one of them disappeared forever?
- What is the scientific name for when a living thing disappears?
- What is the scientific name for when there are very low numbers of a living thing?
- What might happen to the animals living on the Reef if a new animal that did not live there before moved in?
- Can you give any examples of animals or plants that have moved into an area on the Reef where they did not live before?
- How do animals or plants move into areas where they did not live before?

Year 5 and 6

- What are some animals and plants that live on the Great Barrier Reef?
- Draw your favourite animal or plant that lives on the Great Barrier Reef.
- Think about all the animals and plants that live together on the Reef. What might happen if one of them disappeared forever?
- What is the scientific name for when a living thing disappears?

- What is the scientific name for when there are very low numbers of a living thing?
- How can we help to protect an animal that has very low numbers?
- What might happen to the animals living on the Reef if a new animal - that did not live there before - moved in?
- What is the scientific name for an animal or plant that always lives in an area?
- What is the scientific name for an animal or plant that moves into an area where it did not live before?
- Can you give any examples of animals or plants that have moved into an area on the Reef where they did not live before?
- How do animals or plants move into areas where they did not live before?

Year 7 and 8

- Draw a food web that might exist on the Great Barrier Reef. Make sure to include the sun and top-level consumers like sharks.
- Looking at your food web, what might happen to the system if one of the plants or animals disappeared forever?
- What is the scientific name for when a living thing disappears?
- What is the scientific name for when there are very low numbers of a living thing?
- How can we help to protect an animal that has very low numbers?
- What might happen to the animals living on the Reef if a new animal - that did not live there before - moved in?
- What is the scientific name for an animal or plant that always lives in an area?
- What is the scientific name for an animal or plant that moves into an area where it did not live before?
- Can you give any examples of animals or plants that have moved into an area on the Reef where they did not live before?
- How do animals or plants move into areas where they did not live before?
- There are many organisms that spend part, if not all, of their lifecycle on a reef. Name some animals living in reef environments that are important to people and explain why they are important.

Year 9 and 10

- Draw a food web that might exist on the Great Barrier Reef. Make sure to include the sun and top-level consumers like sharks.
- Looking at your food web, what might happen to the system if one of the plants or animals disappeared forever?
- What is the scientific name for when a living thing disappears?
- What is the scientific name for when there are very low numbers of a living thing?
- How can we help to protect an animal that has very low numbers?
- What might happen to the animals living on the Reef if a new animal - that did not live there before - moved in?

- What is the scientific name for an animal or plant that always lives in an area?
- What is the scientific name for an animal or plant that moves into an area where it did not live before?
- Can you give any examples of animals or plants that have moved into an area on the Reef where they did not live before?
- How do animals or plants move into areas where they did not live before?
- There are many organisms that spend part, if not all, of their lifecycle on a reef. Name some animals living in reef environments that are important to people and explain why they are important.
- In what ways are reefs different to other aquatic environments, and why are they so important for marine life?

Answers:

What are some animals and plants that live on the Great Barrier Reef?

Coral, sponges, algae, anemones, plankton, fish, starfish, rays, eels, turtles, birds, dugongs, sharks…

Draw a food web that might exist on the Great Barrier Reef. Make sure to include the sun and top-level consumers like sharks.

These will vary student to student but should include a producer like plankton/ocean plants, and move up through larger animals like sponges and fish, all the way through to top-level consumers like turtles, dolphins and sharks. Not all species have to be linked either! Energy flow can also be drawn into the food web for more advanced students.

Looking at your food web, what might happen to the system if one of the plants or animals disappeared forever?

If one species disappears it can affect the whole dynamic of the food web. Some animals will not have enough food if their main prey species goes extinct. Other animals only have one type of prey, which means unless they can find something else to eat their own numbers will decline.

What is the scientific name for when a living thing disappears?

Extinction

What is the scientific name for when there are very low numbers of a living thing?

Endangered

How can we help to protect an animal that has very low numbers?

Protecting and conserving endangered species, and informing the public of ways they can help to save a species (e.g.: throwing back fish when fishing).

What might happen to the animals living on the Reef if a new animal that did not live there before moved in?

The new animal might eat all of their food or take over their habitat. This is called competition. Competition can be very threatening for the native species.

What is the scientific name for an animal or plant that always lives in an area?

Native species

What is the scientific name for an animal or plant that moves into an area where it did not live before?

Invasive or introduced species

Can you give any examples of animals or plants that have moved into an area on the Reef where they did not live before?

Green muscles, species of algae and barnacles, lionfish….

How do animals or plants move into areas where they did not live before?

Transported in by people by accident (e.g. in/on a boat) or on purpose (e.g.: for hunting or to keep another species under control).

There are many organisms that spend part, if not all, of their lifecycle on a reef. Name some animals living in reef environments that are important to people and explain why they are important.

Fishing is a huge industry in Australia; therefore a lot of fish that spend part/all of their lifecycle on the reef can be fished for food.

Coral itself is important for land protection, as it can reduce the severity of storms and tsunamis.

Biodiversity on the Reef is of huge importance to the tourism industry.

In what ways are reefs different to other aquatic environments, and why are they so important for marine life?

Coral reefs are the most diverse of all marine environments. They support a huge number of organisms throughout different stages of their life cycle. They provide a nursery ground for young organisms and protection for others that require hiding places. Coral reefs supply an abundance of food and this supply is reliable and year round.

LIFECYCLE OF PLASTICS

Plastics are man-made materials that can be moulded into many shapes. They are usually made out of chemicals that are extracted from fossil fuels, are cheap and can be used for many purposes. Humans like using plastics because they last for a really long time. Unfortunately, this is bad for the environment, because nothing in nature can break plastic down. This means once plastic is thrown away, it can make its way into soil, lakes, rivers and oceans, and exist there for a really long time!

Prep

- What kinds of plastic materials have you seen in waterways, in the ocean or at the beach?
- What might happen to an area if too much plastic built up there?
- Even though plastics do not disappear, how do they get broken down into small pieces for fish and other organisms accidently to eat?

Year 1 and 2

- What kinds of plastic materials have you seen in waterways, in the ocean or at the beach?
- What might happen to an area if too much plastic built up there?
- How can plastics in the environment get into your body?
- Even though plastics do not disappear, how do they get broken down into small pieces for fish and other organisms accidently to eat?

Year 3 and 4

- What kinds of plastic materials have you seen in waterways, in the ocean or at the beach?
- What might happen to an area if too much plastic built up there?
- How can plastics in the environment get into your body?
- Can you think of anything other than plastic that could make the environment sick?
- Even though plastics do not disappear, how do they get broken down into small pieces for fish and other organisms accidently to eat?

Year 5 and 6

- What kinds of plastic materials have you seen in waterways, in the ocean or at the beach?
- Why do not plastics break down well?
- What might happen to an area if too much plastic built up there?
- How can plastics in the environment get into your body?
- Can you think of anything other than plastic that could make the environment sick?
- What are the main forms of plastics that get stuck in our waterways and what are the consequences of this?
- Even though plastics do not disappear, how do they get broken down into small pieces for fish and other organisms accidently to eat?

Year 7 and 8

- Why do not plastics break down well?
- How does plastic's inability to break down affect natural ecosystems?
- How can plastics in the environment affect the health people?
- What is the scientific name for contaminating substances like plastic that are released into the environment?

- Can you think of any substances other than plastics that could contaminate the environment?
- What are the main forms of plastics that get stuck in our waterways and what are the consequences of this?
- Although plastics aren't biodegradable, how do they get broken down into small pieces for fish and other organisms accidently to eat?

Year 9 and 10

- Why do not plastics break down well?
- How does plastic's inability to break down affect natural ecosystems?
- How can plastics in the environment affect the health people?
- What is the scientific name for contaminating substances like plastic that are released into the environment?
- Can you think of any substances other than plastics that could contaminate the environment?
- What are the main forms of plastics that get stuck in our waterways and what are the consequences of this?
- Although plastics aren't biodegradable, how do they get broken down into small pieces for fish and other organisms accidently to eat?
- Create a table and compare the similarities and differences of at least 3 types of plastic (e.g.: PET, PVC, PS).

The more you know – almost every piece of plastic ever made still exists today!

Answers:

What kinds of plastic materials have you seen in waterways, in the ocean or at the beach?

Drink bottles, plastic wrapping, and plastic bags…

Why do not plastics break down well?

Because there are no natural bacteria in the environment that can break it down.

How does plastic's inability to break down affect natural ecosystems?

It can build up in ecosystems, block waterways, leech chemicals, injure animals that think it is food, trap or entangle animals, squash and smother natural plants and bacteria…

How can plastics in the environment affect the health people?

Plastics can leech chemicals into the environment, which can be harmful to human health. They can also build up in animals that we would normally eat and so we also ingest them.

What is the scientific name for contaminating substances like plastic that are released into the environment?

Pollution/pollutant

Can you think of any substances other than plastics that could contaminate the environment?

Toxic chemicals, smoke released from electricity generation…

What are the main forms of plastics that get stuck in our waterways and what are the consequences of this?

Plastic bags and bottles, Styrofoam, balloons, lighters, toothbrushes, and discarded or lost fishing gear such as lines, nets and buoys. These pollutants build up on beaches and in waterways where they can be eaten or cause entrapment and injury. They can also leech chemicals into the environment.

Although plastics aren't biodegradable, how do they get broken down into small pieces for fish and other organisms accidently to eat?

Wave action can break down plastics over time into tiny pieces.

Create a table and compare the similarities and differences of at least 3 types of plastic (e.g.: PET, PVC, PS).

Will vary depending on chosen plastics.

ACTIVITY: ALL CAUGHT UP!

When rubbish is released into the ocean, animals and plants can become trapped or tangled in it. This is an activity that can teach students how hard it can be to find and collect food if an animal has become tangled in plastic.

What you will need:

- A bucket of small objects like blocks or pegs
- A list of ocean animals

Method:

- Gather students into groups of 3.
- Give each group an animal – they will act as this animal when collecting "food".
- Ask each student to go to the bucket and pick up as many objects, or "food", as will fit in both their hands.
- Walk the objects back to the table and record how many pieces of food each animal could find and eat when it is healthy.
- Tell each student to put one hand behind their back (to simulate being tangled in plastic) and go back to the bucket to collect as much food as they can in the other hand.
- Walk the food back to the table and record how many pieces were collected when the animal wasn't able to use all of its limbs.
- Compare how much food was collected when each animal was healthy and when it was caught in plastic.
- Discuss how being caught in plastic or rubbish might affect the life of a sea animal.

EXPERIMENT: ARE ALL PLASTICS CREATED EQUALLY?

Depending on their structure, plastics have different properties that we can measure. For example, you can test a plastic's malleability (bendiness), resistance to heat, and reaction in different solvents. These various characteristics make certain plastics better or worse at certain jobs.

What you will need:

- Objects made of different types of plastics – you can determine the form of plastic by looking on the packaging.
- Scissors and scalpels
- Marker
- Bunsen burner
- Heat Pad
- Tripod
- 6 beakers
- Hydrochloric Acid (HCl)
- Salt Water
- Fume hood
- Stopwatch
- Worksheet (on next page)

Method:

- Choose three objects made of 3 different forms of plastic
- Cut 3 small strips of similar size from each object and label each strip according to the form of plastic
- Record on the worksheet what types of plastics you have chosen and all observations taken during the experiment
- In the fume hood, pour 100ml of HCl into 3 of the beakers, and 100ml of salt water in the remaining 3 beakers. Take two strips of each plastic and place one into a beaker of HCl and one into a beaker of salt water. Label appropriately and leave to react for at least 10 minutes
- Test the malleability of each plastic by taking the remaining strip and bending. Record observations of how well the material bends and if there is a crease left behind. Does the plastic return to its original state or does it remain deformed after you stop bending it?
- Test the heat resistance of the various plastics by taking the strip of plastic and attaching it to the tripod, placed above the Bunsen burner. Record what happens when you turn the flame on. Does the plastic melt? Does it change shape and colour? Use a stopwatch to time how long it takes to see any difference in the material
- Return to the plastic in the beakers of solvents. Can you see any difference in the form of the plastic in either of the beakers? What do you notice is similar about all three forms of plastic in each of the solvents? From this experiment can you infer what happens to all forms of plastic when they reach the ocean?

Worksheet:

Sample No./ Plastic Type	Malleability	Heat Resistance	Reaction in Solvent	
			Acid	Salt Water
Sample 1 Plastic: _____				
Sample 2 Plastic: _____				
Sample 3 Plastic: _____				

EXPERIMENT: MICRO BEADS – TINY PLASTICS WITH HUGE IMPACTS!

They are those annoying little beads of plastic hanging around in many of our cosmetics and cleaning products. Even though you use them, you would not eat them. After we have washed them down the drain, micro beads can have huge impacts on our natural environment. They are made of plastic meaning they do not degrade naturally for a long time, and because they are so tiny, microorganisms easily ingest them. Plankton then eats these tiny organisms, and so the cycle continues up and up through the food web in a process called "biomagnification".

Because the plastics do not break down and cannot be excreted, at any one time a fish could have thousands of micro beads in their body. These ingested plastics have negative impacts on the quality of life for aquatic organisms. Now think about how many fish and seafood products an individual human might consume in a year…. That is a lot of plastic potentially floating around in our bodies.

What you will need:

- A bottle of cosmetic product containing micro beads
- 1 beaker filled with 250ml water
- 1 empty beaker
- 1 stirrer
- 1 sheet of filter paper

Method:

- Take a tablespoon (20ml) of product and place in beaker of water. Stir until it appears dissolved (plastics will never truly dissolve, however micro beads are so small they will appear to be dissolved to the naked eye)
- Fold the filter paper into a cone shape and place in the mouth of the empty beaker
- Pour the liquid through the filter paper
- Allow the paper to dry, then count the number of micro beads remaining on the filter paper
- Answer the questions below

Question 1

a. How many micro beads were counted on the sheet of filter paper?

b. Convert this value to number of micro beads per tablespoon of product.

Question 2

a. If a tablespoon equates to approximately 20ml of product, how many tablespoons of product would be in your container?

b. Approximately how many micro beads would be suspended in your container of product?

Question 3

a. How many of these containers of products do you think an average person would use in one year?

b. Estimate how many people you think might be using this product in a year.

c. According to your estimates, approximately how many micro beads do you think could be released into the environment every year?

EXPERIMENT: BREAK IT DOWN – HOW QUICKLY DO EVERYDAY ITEMS DEGRADE IN THE ENVIRONMENT?

Compost bins help to decompose natural products into readily usable nutrients for your garden. However, the conditions required to break down natural products do not appear to have the same effects on all materials we use in our homes. This means that not all our household items will break down naturally and quickly, and this can be harmful for the environment.

What you will need:

- The remains of a piece of fruit, such as an apple core or a banana skin
- A piece of biodegradable packaging
- A plastic bag
- Dirt
- Three containers big enough to fit the materials and some dirt
- Water
- Labels and markers
- A sunny spot to leave the containers
- Worksheet (see below

Method:

- Collect one of each required household material – one piece of fruit, one piece of packaging and one plastic bag
- Label each container with the name of each item (i.e.: one container for the piece of fruit, one for the packaging, one for the bag)
- Fill the container ½ full with dirt
- Put the item into the container and cover with dirt to the top of the container
- Water the dirt a little bit and put the lid on
- Place each container in a sunny place and leave for 2 weeks
- After two weeks, uncover the item in the container and record observations of how well they have broken down
- Answer the remaining questions on the worksheet (next page)

Worksheet:

Question 1

List the state of decomposition for each item after two weeks of being buried

Household Item	State of Decomposition

Question 2

a. What conditions do you think allow compost bins to break down natural waste so well?

_____
_____
_____

b. How were these conditions replicated in your experiment?

_____
_____
_____

c. Why do you think these conditions do not result in a similar level of decomposition of other items?

_____
_____
_____

Question 3

a. Besides making your gardens healthy, what else could natural waste be used for in society?

_____
_____
_____

b. What are some strategies that could reduce how much plastic is released into the environment?

_____
_____
_____
_____

CORAL BLEACHING

When you look at coral you can see the hard outer skeleton. However, healthy coral relies on a relationship between the coral skeleton and algae! The coral and the algae work together to survive: algae need a safe place to live and in return provide coral with food. When coral becomes stressed due to fluctuations in temperature or pollution, it releases the algae. In doing so it accidently removes its main source of food. This makes coral become white, or bleached, and leaves it at risk of developing diseases and death. Coral bleaching is currently having a huge impact on the Great Barrier Reef. The last major bleaching event in 2016 was the worst in history, with 22% of coral becoming bleached.

Questions:

Prep to Year 4

- What examples can you think of where two things work together and both benefit?

Year 5 and 6

- What examples can you think of where two things work together and both benefit?
- What is the scientific name for a relationship where both parties benefit from working together?

Year 7 and 8

- What examples can you think of where two things work together and both benefit?
- What is the scientific name for a relationship where both parties benefit from working together?
- What are the impacts of coral bleaching for the Great Barrier Reef?

Year 9 and 10

- What examples can you think of where two things work together and both benefit?
- What is the scientific name for a relationship where both parties benefit from working together?
- What are the impacts of coral bleaching for the Great Barrier Reef?

Answers:

What examples can you think of where two things work together and both benefit?

Bees and flowers, people and bacteria, clownfish and anemone…

What is the scientific name for a relationship where both parties benefit from working together?

Symbiotic relationship – mutualism

What are the impacts of coral bleaching for the Great Barrier Reef?

Coral bleaching can assist in the spread of coral disease and can ultimate lead to the death of the reef. This will destroy the reef ecosystem that so many species rely upon to live.

OCEAN ACIDITY AND ACIDIFICATION

pH is an important measure that scientists use to determine if a material is more acidic or alkaline. It works along a scale of 1 – 14, where 1 is most acidic, 14 is most alkaline, and 7 is neutral. Pure water has a pH of 7, meaning it is neither acidic nor alkaline. However, the ocean water has a slightly higher pH, meaning it is more alkaline than pure water. It is important that the pH of the ocean does not vary too greatly, as it is delicately balanced to allow marine life to thrive.

Climate change directly affects our oceans - ocean acidification occurs when high levels of carbon dioxide from the atmosphere are absorbed into the ocean. The carbon dioxide works to break down coral and shells, releasing vast amounts of carbonate and in turn lowering the pH of the water.

Questions:

Year 7 and 8

- What is the pH of the ocean?
- What effect does acidification have on plants and animals?

Year 9 and 10

- What is the pH of the ocean?
- What effect does acidification have on plants and animals?
- What chemicals drive the acidification of the ocean?
- What processes lead to the ocean becoming more acidic? Draw a diagram to assist in explaining your answer.

Answers

What is the pH of the ocean?

pH = 8.1

What effect does acidification have on plants and animals?

Ocean acidification makes it harder for calcifying species to make their calcium structures such as shells, reefs, and exoskeletons. These organisms are important at the lower end of the food web, which will have carry-on effects in higher-level consumer populations.

What chemicals drive the acidification of the ocean?

Carbon dioxide, carbonic acid, carbonate ions, hydrogen ions.

What processes lead to the ocean becoming more acidic? Draw a diagram to assist in explaining your answer.

Diagram should include carbon dioxide movement from the atmosphere into the ocean, and carbon dioxide break down of coral and shells, which releases carbonate into the water. Older students can also include chemical reactions in their diagrams.

EXPERIMENT: TESTING PH

pH illustrates along a scale how acidic or alkaline a liquid is. There are many ways that the pH of a liquid can be tested; however one of the easiest ways is to use Litmus paper.

What you will need:

- 3 beakers
- Distilled water
- Vinegar
- Bicarbonate Soda
- Litmus paper

Method:

- Fill each beaker with 250ml distilled water and label 1- 3
- Use Litmus paper to determine initial pH of each beaker
- Leave Beaker 1 as plain water
- To Beaker 2, add 15ml of vinegar and stir until combined
- To Beaker 3, add 15g of bicarbonate soda and stir until dissolved
- Use Litmus paper to determine the final pH of each beaker
- Record the pH and the colour that corresponds with each solution
- Create a graph that displays the change in pH for each beaker

Table 1

Beaker	Water (ml)	Initial pH	Litmus Colour	Additive g/ml	Final pH	Litmus Colour
1						
2						
3						

Create a graph in the space below

EXPERIMENT: FERTILISING OUR OCEANS

Acidification due to the breakdown of carbonate is not the only problem facing our oceans. Agriculture is a huge industry in Australia, and farmers often use fertiliser to help their crops to grow and stay healthy. Although these fertilisers do assist crops, they have some negative side effects that can be detrimental to aquatic life. When it rains, chemicals such as nitrate and phosphate leach from the fertiliser and soil, and become washed into waterways, before eventually arriving in the ocean.

The process of this nutrient build up in bodies of water is referred to as “eutrophication”. Eutrophication increases the amount of nutrients available in a system, and as a result, huge algal blooms can develop. These algal blooms reduce the amount of other nutrients available and can block sunlight, limiting the growth of other organisms. Much of the coastline that runs alongside the Great Barrier Reef is currently used for agriculture, and for this reason, fertiliser run off and eutrophication are having a huge impact on the health of the reef system.

What you will need:

- Δ 2 beakers
- Δ Distilled water
- Δ 4 tablespoons salt
- Δ 50ml liquid fertiliser
- Δ Litmus paper

Method:

- Fill each beaker with 250ml water and 2 tablespoons of salt
- Record the initial pH of each beaker
- To one beaker, add 50ml liquid fertiliser and stir until combined
- Label each beaker as either control or contaminated
- Use Litmus paper to determine the pH of your control sample, and the sample contaminated with fertiliser
- Record your observations and answer the questions in the worksheet (next page)

Worksheet:

Table 1:

Beaker	Salt Water (ml)	Initial pH	Litmus Colour	Additive g/ml	Final pH	Litmus Colour
1						
2						

Question 1

What is the difference in pH between the control sample (which replicates the ocean) and the contaminated sample (which replicates ocean water contaminated with fertiliser run off)?

_____

_____

Question 2

a. What are some additional implications of fertiliser run off on a reef?

_____

_____

_____

b. How can we reduce the risks of fertilisers leaching into the ocean?

_____

_____

_____

Question 3

When designing a protected marine park like that of the Great Barrier Reef, what other factors do you think need to be considered so that the aquatic area can really be protected?

_____

_____

_____

Create a graph illustrating the change in pH between the control and contaminated samples:

OCEAN CURRENTS

Oceans are never still - water is constantly moving in what we know as currents. Some of these currents are spontaneous and constantly changing. You might have felt currents like this when swimming at the beach and finding a rip, which eventually disappears with the turn of the tide. Other currents are more permanent, like the East Australian Current, which always runs along the east coast of Australia. Ocean currents are responsible for transporting nutrients and sand, assisting in organism migration, and modifying and stabilising the climate.

Questions:

Year 1 and 2

- How is sand transported from one place to another?

Year 3 and 4

- How is sand transported from one place to another?
- Some islands throughout the Great Barrier Reef Marine Park, like Heron Island, are made entirely of sand. Where does this sand come from?
- What can cause some beaches to retain too much sand, and for others to not gain enough sand?

Year 5 and 6

- How is sand transported from one place to another?
- Why are currents important in oceans? Why are they particularly important for reefs?
- Some islands throughout the Great Barrier Reef Marine Park, like Heron Island, are made entirely of sand. Where does this sand come from?
- What can cause some beaches to retain too much sand, and for others to not gain enough sand?

Year 7 and 8

- Why are currents important in oceans? Why are they particularly important for reefs?
- Some islands throughout the Great Barrier Reef Marine Park, like Heron Island, are made entirely of sand. Where does this sand come from?
- What can cause some beaches to retain too much sand, and for others to not gain enough sand?

Year 9 and 10

- Why are currents important in oceans? Why are they particularly important for reefs?
- Some islands throughout the Great Barrier Reef Marine Park, like Heron Island, are made entirely of sand. Where does this sand come from?
- How are ocean currents important for the lifecycles of many marine organisms?

Answers:

How is sand transported from one place to another?

Ocean currents.

Some islands throughout the Great Barrier Reef Marine Park, like Heron Island, are made entirely of sand. Where does this sand come from?

This sand has been transported over time from other beaches south of the Reef. It is transported in strong ocean currents, which weaken in the vicinity of the Reef.

What can cause some beaches to retain too much sand, and for others to not gain enough sand?

If the ocean currents change, big storms erode beaches, human impact from building ocean walls and groynes….

Why are currents important in oceans? Why are they particularly important for reefs?

Currents transport sand to new places and can play an important role in transporting larvae or in the migration of some marine life.

How are ocean currents important for the lifecycles of many marine organisms?

Ocean currents can transport larvae or juveniles to a new habitat so they can continue to grow. The can also assist in the migration of adults and new babies.

ACTIVITY: FLOATING ON WATER

Most of Earth is covered in water. The water we drink is called fresh water, and we need this to live. However, the water that animals swim in in the ocean is a little bit different. It's called salt water. What kinds of animals live in salt water? Let's see what's so different about fresh and salt water.

What you will need:

- 2 bowls
- Water
- Salt
- A few little objects like shells or toy sea animals

Method:

- Fill one bowl with water.
- Fill the second bowl with warm water and mix in ½ cup of salt until dissolved.
- Divide the objects and place half in the fresh water bowl and half in the saltwater bowl.
- Ask the students what they can see. What is different about the two bowls?
- Ask the students why they think it is important that the ocean is salty.

ACTIVITY: MINI OCEAN

Make your own mini ocean, complete with sand and shells, and watch the waves roll around. What happens to the sand and shells when you make gentle waves? What happens when you make big waves? Do they move around a lot or stay in a similar spot?

What you will need:

- A large bottle or jar with a tight fitting lid
- Water
- Oil
- Food colouring
- Sand or fine glitter
- Very small shells

Method:

- Clean the jar or bottle, and add some sand or fine glitter, and little shells to the bottom.
- Fill to halfway with water.
- Add a few drops of whatever food colouring you like.
- Fill almost to the top with oil, leaving a small air bubble.
- Close the lid tightly. You can glue the lid closed for extra security.
- Gently shake the bottle or jar and watch the tide and waves of your mini ocean.

RECYCLING

One man's trash is another man's treasure. Recycling – reusing old materials – can benefit the environment in many ways. Firstly, recycling removes reusable waste from landfills and allows it to be used for a new purpose. This means the amount of waste we are leaving behind is reduced, including the amount that is released into the environment. Secondly, recycling reduces the amount of energy required to create products from raw materials, lowering carbon emissions during production.

Questions:

Prep

- What kinds of materials can be recycled?
- Why do you think we need to recycle?
- Estimate how many items in your kitchen at home could be recycled.

Year 1 and 2

- What kinds of materials can be recycled?
- How do you know if an item can be recycled?
- Why do you think we need to recycle?
- Estimate how many items in your kitchen at home could be recycled.
- Make a poster or slideshow about the importance of Reduce, Reuse and Recycle. Use examples of how people use this slogan.

Year 3 and 4

- What kinds of materials can be recycled?
- How do you know if an item can be recycled?
- Why do you think we need to recycle?
- Estimate how many items in your kitchen at home could be recycled.
- Make a poster or slideshow about the importance of Reduce, Reuse and Recycle. Use examples of how people use this slogan.

Year 5 and 6

- What kinds of materials can be recycled?
- How do you know if an item can be recycled?
- Why do you think we need to recycle?
- Estimate how many items in your kitchen at home could be recycled.
- "Reduce, Reuse and Recycle", or the 3Rs, is a slogan adopted by recycling programs. What does each word mean, give an example of how you could use each word, and explain how this slogan helps the environment.
- Research and make a poster or slideshow that illustrates the importance of Reduce, Reuse and Recycle. Use examples of how people use this slogan to minimise their waste.

Year 7 and 8

- What kinds of materials can be recycled?
- How do you know if an item can be recycled?
- Why do you think we need to recycle?
- "Reduce, Reuse and Recycle", or the 3Rs, is a slogan adopted by recycling programs. What does each word mean, give an example of how you could use each word, and explain how this slogan helps the environment.
- Research and make a poster or slideshow that illustrates the importance of Reduce, Reuse and Recycle. Use examples of how people use this slogan to minimise their waste.

Year 9 and 10

- What kinds of materials can be recycled?
- How do you know if an item can be recycled?
- Why do you think we need to recycle?
- "Reduce, Reuse and Recycle", or the 3Rs, is a slogan adopted by recycling programs. What does each word mean, give an example of how you could use each word, and explain how this slogan helps the environment.
- Research and make a poster or slideshow that illustrates the importance of Reduce, Reuse and Recycle. Use examples of how people use this slogan to minimise their waste.

Answers:

What kinds of materials can be recycled?

Glass, paper, cardboard, aluminum, clothes, some plastics…

How do you know if an item can be recycled?

The triangle symbol will be on the packaging in most cases. The number in the triangle represents what kind of recyclable the product is. You can also research on the Internet if an item can be recycled.

Why do you think we need to recycle?

It's important to recycle because we do not have an unlimited supply of resources. Reducing waste and pollution is also important because they have major negative impacts on the environment. It takes a lot of energy to make new products, which big contributor to climate change and pollution.

"Reduce, Reuse and Recycle", or the 3Rs, is a slogan adopted by recycling programs. What does each word mean, give an example of how you could use each word, and explain how this slogan helps the environment.

Reduce – the amount of waste you throw away. E.g.: buy less plastic.

Reuse – items for different purposes. E.g.: reusing glass jars for storage.

Recycle – convert waste into reusable material. E.g.: put cleaned glass and paper in the yellow bin.

This slogan helps the environment because it reduces the amount of waste we put into landfill, reduces how much pollution we create, and reduces carbon emissions from new product production.

Estimate how many items in your kitchen at home could be recycled.

Answers will vary.

ACTIVITIES: RECYCLING

- Bring in a container of waste and ask the students to identify which items can be recycled. You could then place these items in a bucket or container with water and little toy sea animals and ask the students to "help clean up the ocean" by sorting what can be recycled and what has to be thrown away.
- Design and build something using only recycled products (like a robot or an animal!).

WHAT YOU HAVE LEARNED: CONSERVATION OF THE GREAT BARRIER REEF

The Great Barrier Reef is such an important ecosystem, thriving with an abundance of life. However, as you have learned, there are currently many threats facing life on the Reef.

- Create an advertisement to inform the general public of what the Great Barrier Reef is, why it is so important, what threatens its survival, and how we can actively help to preserve it into the future.
- Incorporate artwork, posters, and a song/jingle/poem, into a short film or performance.
- Get creative and make your own costumes and props.

ADDITIONAL RESOURCES

The Coral Battleground – Judith Wright (1977)

http://mocomi.com/biodiversity/

http://www.ecofriendlykids.co.uk/biodiversitynature.html

http://www.ecofriendlykids.co.uk/ClimateChangeGlobalWarming.html

http://www.ecofriendlykids.co.uk/litterwaste.html

http://www.recycling-guide.org.uk/rrr.html