Department of
Education

GOVERNMENT OF
WESTERN AUSTRALIA

Biological Science

Year 6

Science

10 Day Print Course

ACTIVITY BOOK

First Published 2012

Department of Education

EQUIPMENT

cardboard (cereal box)

paper clips

digital camera

access to a live plant

computer (if you have access to a computer, use it to complete some tasks.)

Internet (optional)

Contents

Activity 1.1
Introducing the Upper Class!

Read all of the following before you begin your investigation and use a highlighter to identify key ideas:

Scientists believe there are over 10 million different types of plants and animals in the world. In order for this diversity of living things to be grouped in some logical way, scientists needed to look for similarities and relationships among them. In the 1750s, Swedish Botanist, Carl von Linnaeus developed a special system to name and organise all living things. He developed the first database of all known living things called the Linnaeus Taxonomy System.

This system gives scientists a specific set of rules to give a scientific name to each living organism by using either the Latin or Greek language. An example of this is the *Panthera Leo* which many of us recognise as the Lion.

Many animals or plants are quite similar to each other. Others are quite different. Animals and plants can be classified based on their similarities of physical features and characteristics. This system is continuing to grow as more and more species are discovered every day. The continuing work of taxonomists, to identify and record species, is critical to conservation efforts to protect the Earth's biodiversity. There are still many undiscovered species and each one has its own importance to the function and health of the planet.

The Linnean System of Taxonomy starts with very general classifications and then is broken down into more specific classifications. The basic hierarchy of ranks is in this order from general (Kingdom) to most specific (Species).

Kingdom **P**hylum **C**lass **O**rder **F**amily **G**enus **S**pecies

Kingdom Phylum Class Order Family Genus Species

Sometimes people will make up mnemonics to help them remember this system. For example:

Karen's **P**uppies **C**hew **O**n **F**urry **G**rey **S**quirrels
or
King **P**hillip **C**ame **O**ver **F**or **G**ood **S**paghetti

Create your own mnemonic in words and then illustrate it in the space below.

Activity 1.2

What is Classification and Why is it Important?

1. Who developed the Linnean taxonomy system of classification?

_____

2. When was it developed?

_____

3. What name is given to the scientists that used this system of classification?

_____

4. What languages do these scientists use to classify living things?

_____

5. Why do they use these languages?

_____

_____

6. What are the seven levels of classification in the Linnean taxonomy system?

_____

_____

7. How does the Linnean System protect species? Explain in your own words.

_____

_____

_____

_____

Activity 1.3

Kingdom Animalia!

Read the next three pages and highlight key ideas and then complete the tasks that follow.

The Kingdom classification has five categories as shown in the diagram below.
We can group all living organisms under one of these.

Kingdom

Metazoan (many celled)			Protozoan (one- celled)	
Animalia Organisms which: 1. Do not make their own food. 2. Are mobile .	**Plant** Organisms which: 1. Make their own food. 2. Are immobile 3. Their cell walls contain cellulose.	**Fungi** Organisms which: 1. Do not make their own food. 2. Are immobile.	**Protista** Organisms which: 1. Have a single cell with a nucleus (controlling part). e.g. algae	**Monera** Organisms which: 1. Have a single cell with no nucleus.

Each category of Kingdom can then be more specifically classified by phylum.
Below see a diagram which takes the Animal Kingdom and breaks it down into four Phylums (sub-groups).

Phylum

Kingdom: Animalia			
Chordata Organisms which: 1. Have an internal backbone.	**Arthropoda** Organisms which: . Have an exoskeleton (insect, spider, shrimp).	**Mollusca** Organisms which: 1. Live in a shell (snail, squid, clam, mussel)	**Annelida** Organisms which: 1. Have no backbone and do not live in a shell (segmented worm).

Each Phylum has its own sub-group. For example, Chordata (animals with backbones) has five Classes (sub-groups).

Class

Kingdom: Animalia				
Phylum: Chordata				
Mammalia Organisms which: 1. Suckle their young 2. Have hair on their bodies 3. Are warm blooded	**Aves** Organisms which: 1. Have wings. 2. Have feathers	**Reptilia** Organisms which: 1. Have scales. 2. Are cold blooded.	**Amphibia** Organisms which: 1.. Are cold blooded.	**Fish** Organisms which: 1. Breath through gills 2. Are cold blooded. 3. Have scales.

Each Class has its own sub-groups. For example, Mammalia has eight Orders (sub-groups).

Order

Kingdom: Animalia							
Phylum: Chordata							
Class: Mammalia (*has 29 Orders of which some are listed below)							
Carnivora	**Primates**	**Insectivora**	**Rodentia**	**Proboscidea**	**Chiroptera**	**Artiodactyla**	**Perissodactyla**
Dogs, Cats, Bears, Weasel	Humans, Monkeys	Moles, Shrew	Rats, Mice	Elephants	Bats	Sheep, Deer, Giraffe	Horse, Rhino

*Use keywords to search the internet for the full list.

Each Order has its sub-groups or Families. Carnivora or meat-eaters are shown in the next table.

Family

Kingdom: Animalia				
Phylum: Chordata				
Class: Mammalia				
Order: Carnivora (* Has 12 Families of which some are listed below)				
Canidae	**Felidae**	**Ursidae**	**Hyaenidae**	**Otarlidae**
Dogs	Cats	Bears	Hyena	Sea Lions

Use keywords to search the internet for the full list.

When two or more species share unique body structures or other characteristics, they are considered to be closely related and are placed together in a genus. Sometimes a genus might include only a single species if there is nothing else in the world that has similarities with it. The genus is the first part of the scientific name of a species and is always spelled with a capital letter and in italics.

See how Dingoes (*Canis dingo)*, Wolves (*Canis lupus*), Coyotes (*Canis latrans*) and Domestic Dogs (*Canis familiaris*) are related.

Genus

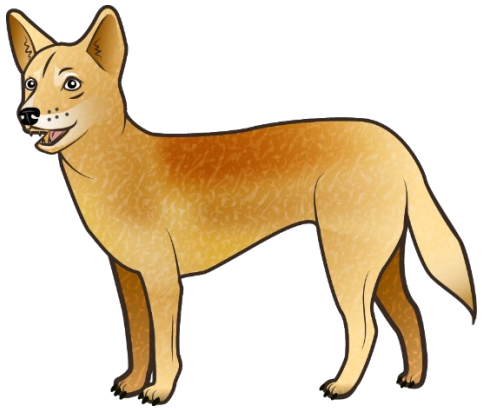
Kingdom: Animalia				
Phylum: Chordata				
Class: Mammalia				
Order: Carnivora				
Canidae: dog-like mammals (* There are five main Genus)				
Domestic And Wild Dogs	Wolf	Coyote	Fox	Jackal

***** Use keywords to search the internet for the full list.

A species consists of all the animals of the same type, who are able to breed and produce young of the same kind. For example, while any two great white sharks are in the same species, as are any two makos, great whites and makos are in different species (since they can't interbreed).

Species

Latin Name: *Canis dingo*
Common name: Dingo



Scientists have identified 1 318 000 Animalia species on the planet to date.

What am I?

Kingdom	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata	Chordata
Class	Reptilia	Reptilia	Reptilia	Reptilia
Order	Squamata	Squamata	Squamata	Squamata
Sub order	Serpentines	Lacertilia	Scincomorpha	Serpentines
Family	Elapidae	Varanidae	Scincidae	Pythonidae
Genus	Pseudonaja	Varanus	Lygosominae	Liasis
Species	P. affinis	V. giganteus	Tiliqua	L. olivaceus
Common name	Dugite snake	Perentie water monitor	Blue tongue skink	Olive python

These animals have four classifications in common.

What are they?

What do they mean? Use the glossary at the back of the book to help you.

At what point in the table do they start to have their own distinct characteristics? Highlight these on the table.

Activity 1.4

Kingdom Plantae

Plantae is one of the five Kingdoms of living organisms in the Linnean Taxonomy System. Plantae are grouped together as multi-cellular organisms which make their own food through the process of photosynthesis. They are also different from animals because plants are immobile (meaning they can't walk).

Plants and animals breathe in different ways. Animals exchange gases through their lungs by breathing in oxygen (O_2) and breathing out carbon dioxide (CO_2). Plants do the opposite. The process they use for gas exchange is called transpiration. This is where they breathe in CO_2 and breathe out O_2.

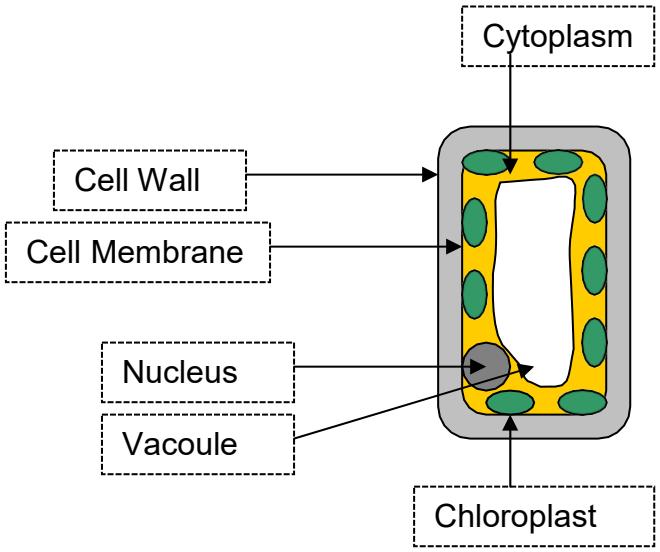
What is Photosynthesis?

Plants such as grasses, trees, algae, and phytoplankton collect energy from the sun and convert it into food to grow plant tissue such as leaves, stems or seaweeds. They do this through a process called "photosynthesis."

Photosynthesis (Photo = Light/ Synthesis = Making Something)

Photosynthesis takes place in green leaves in cells that are called chloroplasts. Plants cells are like small factories. These cells feed the plant by using light to convert carbon dioxide and water into food and oxygen.

Diagram of a Plant Cell

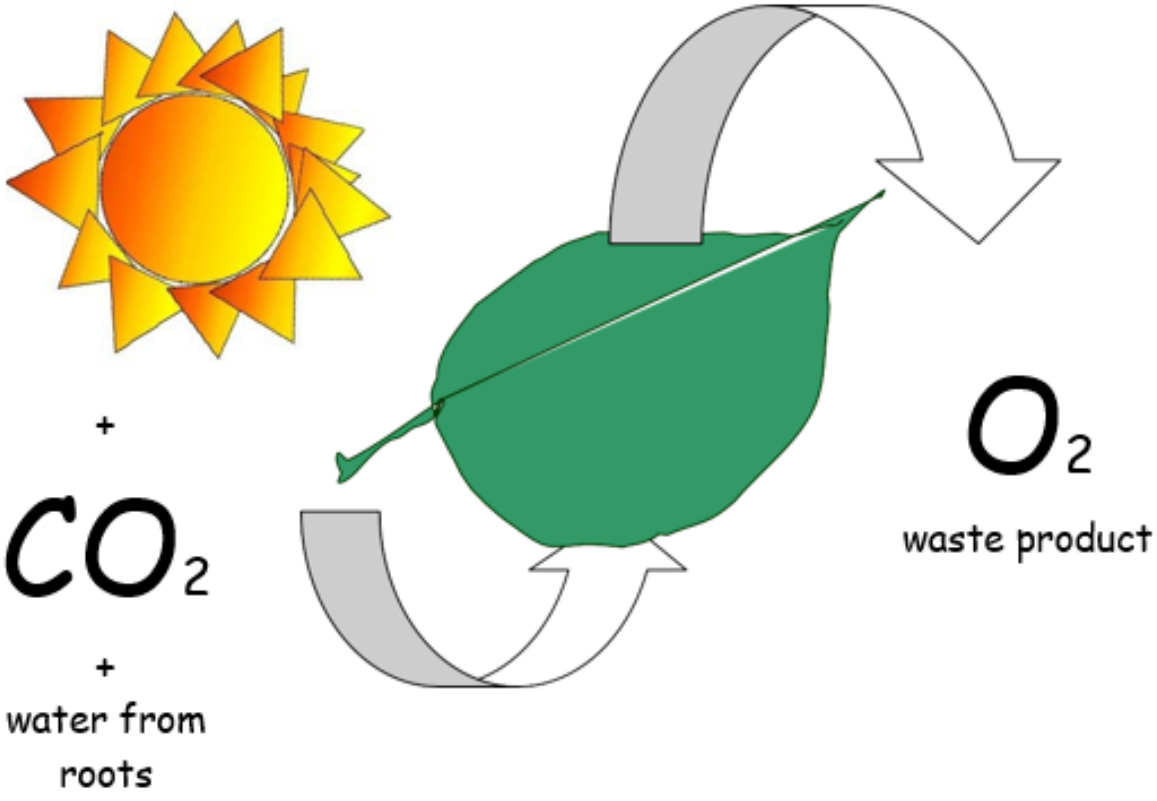


Plants get carbon dioxide from the air through their leaves, and water from the ground through their roots. Light energy comes from the sun.

The oxygen produced is a waste product and is released into the air from the leaves through a process called transpiration. The glucose produced can be turned into other substances, such as starch, which is used as stored energy for the plant. Plants also sweat through small holes called stomata which are usually found on the underside of the leaf.

We can show photosynthesis in a word equation, where light energy is shown in brackets because it is not a substance:

carbon dioxide + water (+ light energy) = glucose + oxygen



Every living organism in Kingdom Animalia depends on Kingdom Plantae to some degree. Photosynthesis by plants is very important for two reasons. One, it is the first step in the food chain. Plants are Primary Producers and provide food for Secondary and Tertiary levels of the food pyramid. Without them, the animal species on the planet would disappear.

Secondly, when plants are going through the process of photosynthesis, the waste product they produce is oxygen. It is essential for all living things. Kingdom Plantae is sometimes known as the “lungs” of the Earth.

1. List the three characteristics that distinguish Kingdom Plantae from animals and other living organisms.

2. What does the word immobile mean for plants?

3. What three components do plants use to produce their own food?

4. What is the name of the substance plants create as food?

5. Explain the importance of the Kingdom Plantae and photosynthesis to the planet. Give an example and use your own words.

Activity 1.5
Chloroplast Investigation

In this activity, you are going to investigate the chloroplast cell. Read *Scientific Inquiry* at the back of this book before you start your investigation. Use the following pages to record your work.

Equipment:

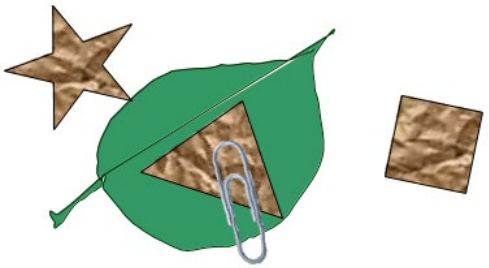
- a live tree or shrub with broad flat leaves
- cardboard (cereal box)
- scissors
- paper clips

Procedure:

1. Choose a live tree or shrub with broad flat leaves that you can use for an experiment.

2. Do not remove the leaves from the plant. If you use a house plant, place it near a window where it will get plenty of sunlight. Choose 3 different leaves for your testing.

3. Using the cardboard, cut out 2 of the same 3 small geometrical shapes like a star, square or triangle. Make sure your shapes are big enough to make a patch that will cover nearly half of the plant leaf.



4. Take a photo of the leaf by itself. Use a paperclip to attach each of the first shape on a leaf so that there is one piece of cardboard on the top of the leaf and one directly under it on the bottom of the leaf. In other words, the leaf is sandwiched between the two pieces of cardboard.

5. Do the same for the second and third geometrical shapes.

6. Take photos of the leaves with the cardboard shapes attached.

7. Make notes about the weather each day and add them to your observations.

8. After four days, remove the shapes from the leaves and observe each of the leaves that had a shape covering it. Take photos of these.

9. Compare the areas on the leaf that were covered with the shapes to other parts of the leaf. Think about the changes you have seen and complete the following activity sheet.

1. Questioning and Predicting

Hypothesis: What do you think will happen to the leaf after four days?

Equipment (List the equipment you'll need.):

Planning and Conducting:

Variables are the things that could change and affect the outcome of the experiment. If you change too many variables the test will not be fair. The variables in this investigation are listed below.
Cross the ones you **must keep the same**. Tick the one you will change.

o The leaves
o The amount of time
o The cardboard placement
o The paperclip placement Fair

Test: How will this make it a fair test?

What safety will you consider?

Collecting Data:

Now, it is time to do your testing. Do the testing **at least three times** to make sure your data is not by chance. Show the data you collected by placing the photos in the tables on the next page.

What have you observed? Describe the similarities and differences between the leaves.

Leaf with Star Shape		
Before	During	After

Leaf with Square Shape		
Before	During	After

Leaf with Star Shape		
Before	During	After

Processing and Analysing the Data:

Did you get similar results every time? Why or why not? If you have a magnifying lens, compare the areas of the leaves that had the cardboard cut-outs and those that did not. What can you see?

Evaluating and Communicating:

What does your data tell you? What importance does sun light have to a leaf? How does this relate to photosynthesis?

Was your prediction correct? Why or why not?

What would you do to improve your investigation?

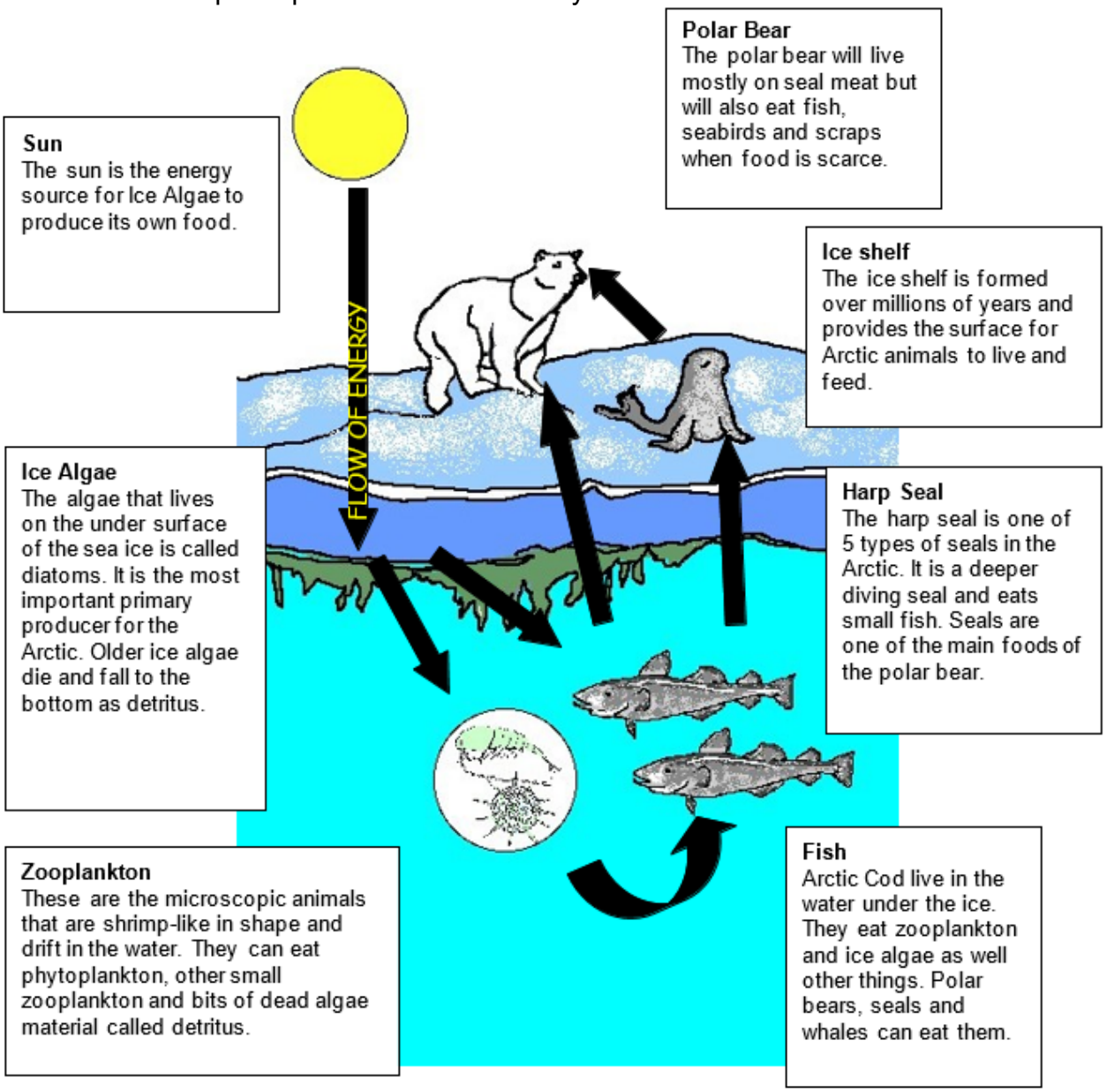
Activity 2

Food Webs and Ecosystems

Read all of the following before you begin your investigation:

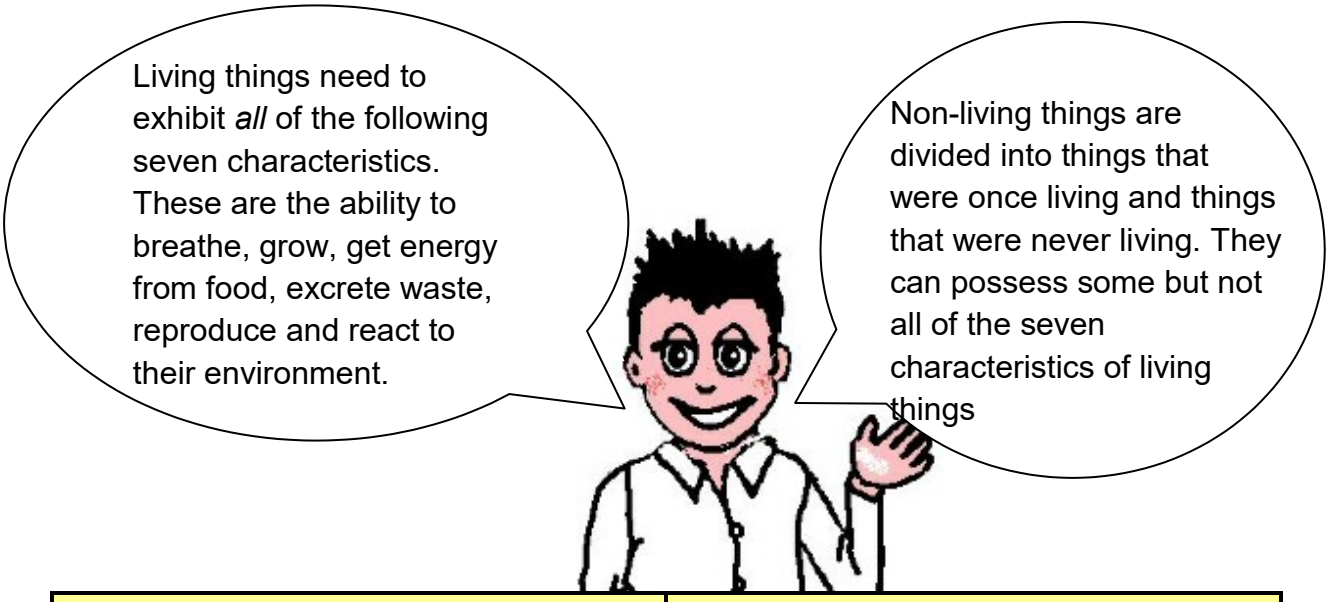
When animals live in a food web (a community of organisms where there are several interrelated food chains), they use parts of the surrounding environment too. Living things need non-living things like weather, sun, soil and air to survive. When living and non-living things interact, they make an “ecosystem”. Ecosystems come in different sizes. The greatest example of a huge and complicated ecosystem is the planet Earth. However, some entire ecosystems can fit under a rock or even live in a jar.

Here is an example of parts of an Arctic ecosystem:



A coral reef is an ecosystem with both living and non-living elements. The living things need some of the non-living things to survive.

In the following table, brainstorm some of the living things and the non-living things you might find in a coral reef. Some examples have been given to get you started.



Living things	Non-living things
zooplankton	sun

Activity 2.1

Coral Reef Connections

Read all of the following and highlight key ideas before you begin your investigation:

Hundreds of different types of plants and animals live in a coral reef. They are connected to each other through the flow of energy which creates a food web under water. Plants such as algae, phytoplankton and seagrass collect energy from the sun and convert it into plant tissue such as leaves, stems or seaweeds through the process called "photosynthesis."

This activity will look at a complex web of food and eating relationships that exist in a coral reef. You will create a diagram of a coral reef through making connections between some of the organisms that live there.

It is your challenge to create a complex food web of the coral reef by matching the clues, to the names and the pictures of organisms that live in a coral reef.

Equipment you will need:

- scissors
- Clue cards
- Coral reef organism names
- Coral reef organism pictures
- 1 large sheet of newsprint paper
- glue
- felt tip pen

Procedure:

1. Read the clue cards and label and examine the pictures of the Coral Reef organisms on the following pages.
2. Cut out all the cards.

3. Match the clue cards with the labels and pictures cards to make stacks of three with the picture cards on top.

4. Based on the clue card information, arrange the organisms according to *what-eats-what,* until they are all placed.

5. Glue them to the newsprint or two pieces of plain paper that are taped together.

6. Draw arrows to represent the flow of energy (to show the direction: **X** *is eaten by* ***Y*** between the picture cards. Do this in pencil first.

CLUE CARDS

My friends and I come in many related shapes. We can only be seen though a magnifying glass or microscope. We spend our time drifting through the waters in the reef. Some of my group eat tiny algae plants and some eat each other.	My body is soft because I have no shell or backbone. I hide in cracks and holes in the reef. I spray a cloud of inky water to hide from Eels and Grouper fish that are my predators. I eat clams and snails with my eight arms. I can change my skin colour quickly.
I live with others of my kind in a colony. Together we make up the coral reef. I protect myself with tentacles and stingers. As I grow I leave a stony skeleton behind me. I like to eat small drifting animals called “zooplankton.” I am nibbled on by Parrotfish and Foureye Butterflyfish.	My house is a hard tube, I built myself. It looks like an underwater flower. I can hide from predators by drawing myself quickly into my tube. I can catch tiny, drifting animals called “zooplankton” with my gills. My fine, feather-like gills are on my head and they filter my food
I make my own food using energy from the sun. I am part of the plant family and grown on the sandy bottom between the reef and land. My leaves are long and thin. I provide shelter for animals that hide among my leaves. Turtles and Dugongs eat me.	I have a backbone and fins that help me to swim. I eat with a mouth that looks like a bird beak. My scales are brightly coloured. I chew on the algae which grow on dead coral and inside the coral polyps. If I’m not careful, the Barracudas will eat me.
I have a backbone and fins that help me to swim. My favourite food includes zooplankton, the soft polyps of corals and various worms. My shape is round and I have extra eyes. My “extra eyes” fool bigger fish such as the Barracuda that try to eat me.	I have a soft backbone and skeleton which are made of cartilage My skin looks smooth but is very rough to the touch. I am a carnivore and therefore, only eat meat. I have hundreds of razor sharp teeth. I am at the top of the food chain. I like to eat dugongs, dolphins, and fish.
I am part of the plant species. Some of my species are so small they drift in the water without being seen while others grow large, leafy and grass like. I can grow on stones or dead coral but when I drift, I’m called *phytoplankton*. I get energy from sunlight and need water, and substances dissolved in water to live. Animals like snails, parrotfish, and other small fish eat me.	I have a backbone and fins that help me to swim. My body is long and smooth and I can swim very fast. I eat many small fish such as four-eyed butterflyfish and parrotfish with my very sharp teeth. My main predator is humans that sometimes catch me to eat.
I am a mammal with a large body flippers and a tail. I move very slowly in the water. I am an herbivore as I have a diet of sea grass. Sometimes I am called a sea cow. Tiger sharks like to hunt me for their food.	I swim with my four flipper-like legs. I carry my house and use it to protect me from predators. I breathe air but can hold my breath for a long time. I eat sponges and sea grasses. My eggs are laid on beaches buried in the sand.
I can’t swim and I like to eat algae. I am an herbivore. I live in a spiralling shell. I lay my eggs in the sand. Spiny lobsters and octopuses like to eat me.	I have gills, fins and tiny scales on my smooth body. I have large fierce jaws. I have a backbone. I ‘m not a snake but I look like one. I like to eat octopuses and small fish.

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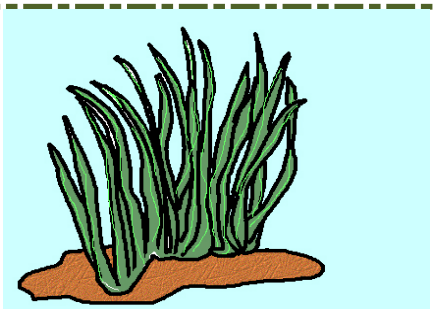
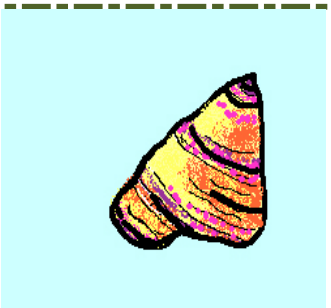
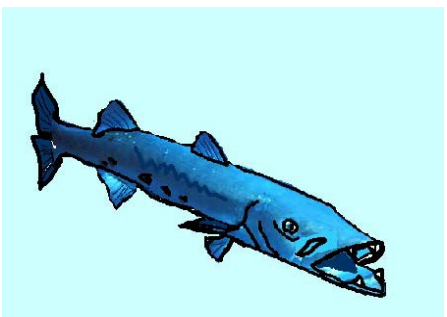
ORGANISM LABELS

Seagrass	Green Sea Turtle
Zooplankton	Parrotfish
Octopus	Tiger Shark
Algae	Coral Polyp
Barracuda	Four-eyed Butterfly fish
Feather Duster Worm	Dugong
Moray Eel	Snail

CORAL REEF ORGANISM PICTURES







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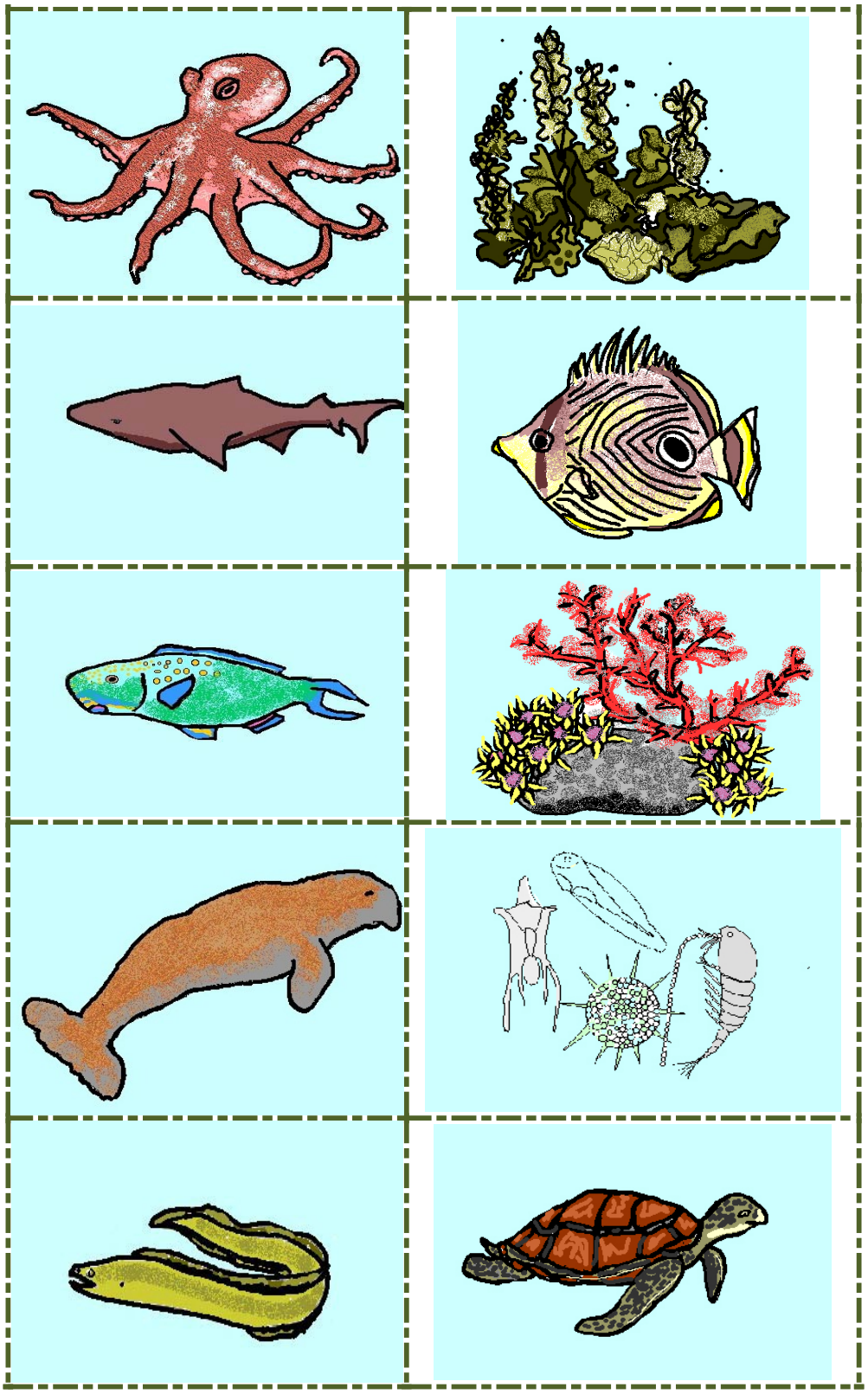

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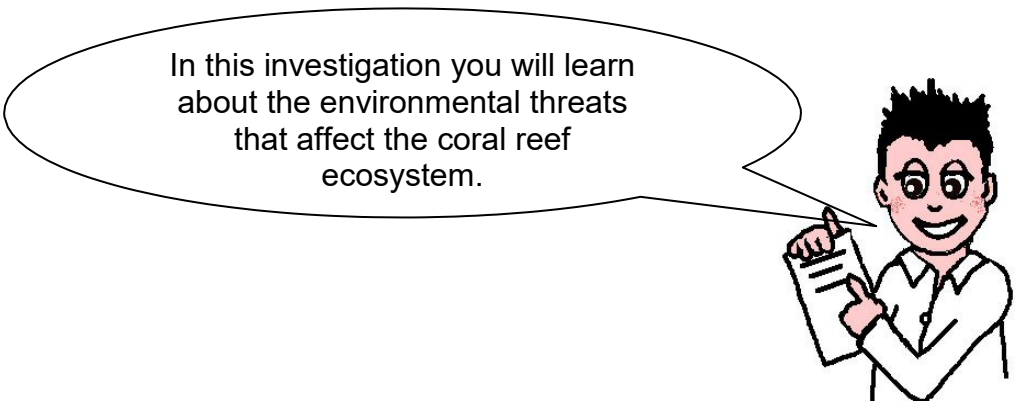
Activity 3

The Great Barrier Reef Ecosystem Report



Read the following before you begin your investigation and report:

In this investigation you will prepare a written report about the environmental threats which affect the ecosystem of the coral reef. The information can be found by reading the article "The Importance of Coral in the Great Barrier Reef" which you will find in the following pages of this pack. Work carefully as you will have less guidance than in the previous investigations.

How to Prepare a Written Report

A scientific report contains four main sections.

1. **A Title:** This title should be about the topic of the report.

2. **An Investigation Focus/Introductory Paragraph**: This is what you want to find out by doing your research. It is a question which you would like to answer.

3. **The Body:** In this section, describe in writing what you found out from doing your research. It would be appropriate to use paragraphs to separate different topics and ideas. You could include diagrams, graphs or tables to present your findings. These should be labelled and titled and could be done on the back of your report sheets.

4. **Conclusion:** This paragraph should summarise the most important part of what you found out.

***IMPORTANT:** Use full sentences to write your report. Use paragraphs to separate your ideas.

Your report should include the following things:

- ✓ A written section (a couple of paragraphs) on the elements that make up the Great Barrier Reef ecosystem. Include some of the animals and plants that live in the Great Barrier Reef and how they interact with each other and with the non-living aspects of this ecosystem. (It would be impossible to include all of the species but make sure you have included enough to make links between organisms.)

- ✓ A paragraph or more to discuss one of the threats to the Great Barrier Reef and how this affects the ecosystem you have written about. What would happen to the ecosystem if the threat continued? What are some of the solutions to this threat? Write a conclusion which summarises the importance of your findings.

- ✓ Diagrams and images: Demonstrate your knowledge by creating diagrams and/or other visual presentations to support your written report. In a diagram or other interesting visual presentations, you should include both living and non-living aspects of the Great Barrier Reef and the threat that you have included in your written report. Title and label your diagrams.

Instructions for your investigation:

1. Read the following “The Importance of Coral in the Great Barrier Reef” article and take notes about the organisms from this ecosystem that you would like to include in your report.

2. Write your draft report on the “My Science Report Draft” page which follows.

3. Edit your draft for spelling, punctuation and grammar. Check that you have followed the report writing format and that you have separated your ideas into paragraphs.

4. The report should be written in your own words. Make sure you properly list your references (where you found your information). See “Referencing Help” at the back of this book for examples.

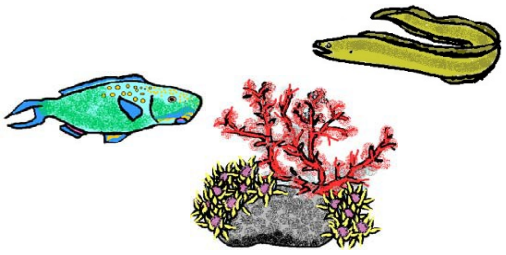
5. Create a finished report as a hand-written or computer document.

6. Use keywords to search websites for further research:

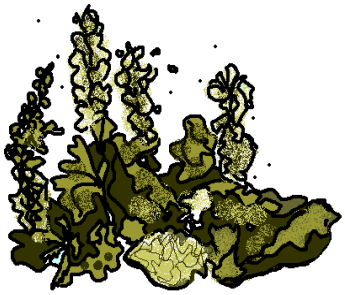
The Importance of coral in the Great Barrier Reef

The Great Barrier Reef is the world's largest coral reef system. It is composed of roughly 3,000 individual reefs and has 900 islands. It stretches for over 2,500 km and covers an area of approximately 350,000 km². The reef is off the coast of Queensland in the northeast area of Australia in the Coral Sea. A large part of the reef is protected by the Great Barrier Reef Marine Park. It provides the basis to a unique and vast ecosystem and supports a huge diversity of life. Many of these species are endemic (only found here) and many are endangered.

Four hundred species of corals, both hard corals like brain coral and soft corals like sea fans and sea whips, are found on the reef. Many species of sea life rely on the coral for food and shelter like the Parrotfish which nibbles its surfaces and the Moray Eel which lives in its crevasses.

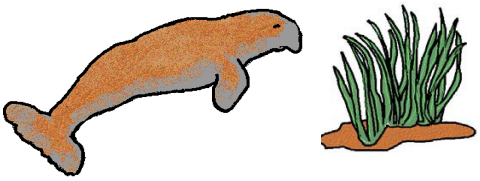


Corals reproduce by releasing their eggs and sperm into the water. This is called spawning. Most corals on the same reef spawn at exactly the same time. During a mass spawning, the water is filled with brightly coloured bundles of eggs and sperm. The sperm and egg cells join to form larvae called planulae. The planulae drift in the ocean as plankton for up to thirty days and can be eaten by many other animals. When a planula finally settles, it turns into a single coral polyp. This polyp divides to make two polyps, and each new polyp continues to divide, eventually forming a coral colony. Corals spawn only once a year. It is not known why corals spawn at the same time, but some ecologists think that the answer might be related to the fact that spawning always occurs a night or two after the full moon. On different reefs, coral spawning happens at different times of the year. On the Great Barrier Reef, corals spawn in late spring or early summer, often in November.



Along with the coral, live hundreds of species of marine algae (seaweed and kelp). This also provides the herbivores and omnivores of the Great Barrier Reef with an abundant source of food and shelter.

Seagrass plays an important role to animals of the reef as well. Seagrass meadows are the nursery grounds for many young fish and crustacean species like tiger prawns. The young come into the seagrass meadows for protection against predators. The seagrass also supports numerous and abundant types of bacteria and algae which are fed upon by tiny crustaceans and snails. Seagrasses are fed upon by herbivores such as the dugong which ingests leaves and rhizomes, and the green sea turtle which eats its leaves only.



With new fish species found in the Great Barrier area every year, the total count is approaching 2,000. It will likely keep rising. So will the estimates of 4,000 molluscs and at least 350 hard or reef-building, corals. Researchers counted more than 250 types of shrimps on the reefs just around Heron Island, near the Great Barrier's southern end. One volleyball-size coral chunk there yielded 1,441 worms from 103 species.

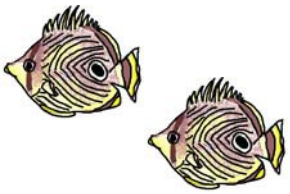
The Great Barrier Reef provides an important and complex ecosystem where 1000s of species rely on each other and the supporting environment for their existence.

Environmental Threats to the Reef

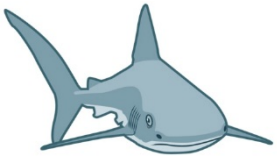
Corals are highly sensitive to environmental changes. The most significant threat to the Great Barrier Reef is climate change. Rising ocean temperature, occurred in the summers of 1998, 2002 and 2006, and caused mass "coral bleaching" events. Coral will die if the water temperature changes by more than a degree or two beyond its normal range. Once the coral dies there is a disruption to the ecosystem and an incredible domino effect. The species which rely on the coral will either die or (if they can) move away. Those species which rely on the species which feed on the coral will die next and so on until the whole ecosystem collapses.

Scientists are concerned that the reef is dying faster than it can re-generate itself. Recently, they have been making an effort to collect sperm and embryonic cells during coral spawning. These cells are being frozen to create a bank of these valuable organisms. They will be used to help restore coral populations.

Climate change causes problems for other forms of life on the Great Barrier Reef as well - some fish preferred temperature range leads them to seek new areas to live. This can lead to chick deaths in seabirds that prey on the fish. Climate change will also affect the population and available habitat of sea turtles.

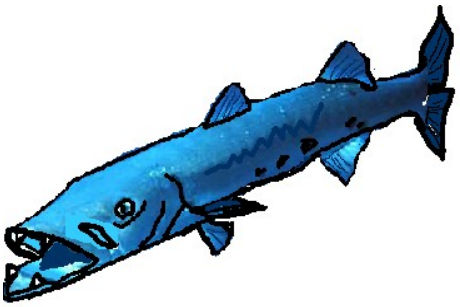


Another problem which occurs is from the rivers of north eastern Australia, which can provide significant pollution to the Reef. This can be a big threat, especially during tropical flood events. Almost all of this pollution is coming from farms. Overgrazing by farm animals strips the land of vegetation. When it rains, water runs from farmland because there is little vegetation to slow it down. This water is polluted with fertiliser and pesticide used by the farmers. This reduces the water quality in the Reef and can cause too much algae to be formed. A coral reef can easily be swamped in algae which smother the coral by blocking sunlight. The coral cannot complete photosynthesis, making it difficult to produce its own food, and therefore, to survive. This, once again, can begin the collapse of the ecosystem.



The crown-of-thorns starfish is a coral reef predator which preys on coral polyps. Large outbreaks of these starfish can devastate reefs. In 2000, an outbreak contributed to a loss of 66% of live coral cover in a sample research area in a study by the CRC Reefs Research Centre. Outbreaks are believed to occur in natural cycles, made worse by poor water quality and overfishing of a mollusc called the Giant Triton which is one of the starfishes' predators.

The unsustainable overfishing of important species can cause the disruption to food chains vital to life on the reef. Fishing also impacts the reef through increased pollution from boats, accidental catch of unwanted species (such as dolphins and turtles) and reef habitat destruction from trawling, anchors and nets. In places where local fishing causes reef damage, education programs have been run to teach people about reef protection. As of the middle of 2004, approximately one-third of the Great Barrier Reef Park is protected from plant and animal species removal of any kind, including fishing, without written permission.



There are many other threats to the Great Barrier Reef as well. These include shipping accidents, oil spills, poaching and natural events like tropical cyclones. The Great Barrier Reef is struggling with man-made and natural threats to its survival. It is of extreme importance to do all we can to reduce human impacts in order to maintain the delicate balance of this remarkable ecosystem.

My Science Report Draft Name:_____

Title

Introductory paragraph/Investigation focus

Body *in paragraphs* (Attach extra sheets if you need more room)

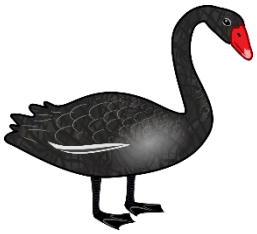
Concluding paragraph

Activity 4

Adaptations to Extreme Environments

Read the following before you begin your investigation:

The growth and survival of living things is directly affected by their ability to adapt to sometimes extreme environmental conditions. An adaptation is the way an animal's body or behaviour has changed over generations to help it survive, or live, in its environment. Animals with the right physical features will survive to mate with others that have the more successful features and in turn, over many generations, the species will evolve with the stronger features. Each of these adaptations specialise individual species and make them unique in their characteristics.



Some basic physical features of adaptation are things like the shape of a bird's beak which allows it to eat certain foods or the colour of an animal's fur or skin which may allow it to camouflage from its predators. These are physical adaptations.

A behavioural adaptation includes things like when a lizard plays dead to avoid a predator or when a bird migrates to find food because winter has come.

Instructions for this investigation:

1. Choose one animal or plant that has adapted to an extreme environment (for example: Antarctic or the desert).

2. Research how this organism has adapted either physically, behaviourally or both to this environment.

3. Use the following activity sheets to record your research.

4. Present your findings in a final report. It may be done as a written report, a digital presentation, an audio or video recording. Make sure your edited draft is returned for marking as well as your published project.

5. Use keywords in a search engine to find out facts for your investigation. Write the information in your own words and use the **Referencing Help** page to ensure you correctly acknowledge where you found the information you used.

Adaptations to an Extreme Environment

Brainstorm animals or plants that you know of which live in extreme environments in the space below.
Highlight those you will research.

Research the organisms you have chosen and the environment where they live. Use the space below and the back of this sheet to write notes about what you have found.

1. Organise your notes into like ideas and write draft paragraphs about your findings. You can use the “How to Write a Report” format from the last activity to write your draft or create a storyboard if you are doing an audio or visual presentation. Label and stapled any draft work to these pages.

2. Use *Referencing Help* to properly reference your information.

3. If you are including photos, diagrams or drawings, label them or include text which describes why they are included.

4. Create your final piece of work to showcase your research.

Referencing Help

When publishing your own science reports, it is very important to acknowledge where you found the information that you have used. Below are examples of some common ways of researching and how they are referenced.

Book with Author

Happy Penguin wrote a book called “My Antarctic Home” in 1985. If you use his book for your research then you would reference it like this:

Penguin, H 1985, *My Antarctic Home*.

Encyclopaedias

If you use the Encyclopaedia Britannica, Volume 100, written in 1984 and read pages 55-72 an article called Penguin Adaptations then your reference needs to look like this:

'Penguin Adaptations' 1984, *Encyclopedia Britannica*, vol.100, pp.55-72.

Internet

If you go to the internet and you search for a webpage and read about penguin feathers, your reference will look like this (Note that the title of the page is in italics and accessed means the day you looked at it):

Penguin Feathers 1986, accessed 21 March 2012, <http://www.seaworld.org/animal-info/info-books/penguin/physical-characteristics.htm>.

On-line Image

Many images are copyrighted but many allow you to use the image if it copyright free. It may require an attribution (the name of the photographer. Some of these can be found on Wikipedia if you click on the photos. They still need to be acknowledged like this (Image Name, Photographer’s name, the date you accessed it, the <URL>.

Felis_leo.jpg, image by Susie Sherr accessed 21 March 2021, <http://lookingup.org/up/File:Felis_leo.jpg>.

Note: Arrange references in alphabetical order by the first word, which is usually an author’s last name or family name.

Glossary

Amphibia – *on both sides* originally referring to living on land or in water. This group of cold-blooded animals with backbones includes toads, frogs, newts, caecilians and salamanders.

Animalia – Organisms that do not make their own food but are mobile.

They include vertebrates and non-vertebrates. Also includes sponges, worms, molluscs, arthropods (insects).

Arthropods - Animals with external skeletons, such as crustaceans (lobster, crab etc.) spiders and the true insects.

Aves - A class of animals composed of the birds, which are warm-blooded, egg-laying vertebrates primarily adapted for flying with wings and feathers.

Chloroplast - A cell that contains chlorophyll and is the site where photosynthesis and starch formation occur.

Chlorophyll - A green substance which gives leaves their colour. Chlorophyll absorbs energy from sunlight which a plant uses to make food.

Chondrichtyes – Cartilaginous fishes are jawed fish with paired fins, paired nares, scales, two-chambered hearts, and skeletons made of cartilage rather than bone. This includes Sharks, Rays and Skates.

Chordata – Animals that have a spinal cord

Class - A taxonomic rank below Phylum and above Order. A set, collection, group, or configuration containing members regarded as having certain attributes or traits in common; a kind or category.

Family – It is a way scientists group similar geneses together.

Genus - Two or more species that share unique body structures or other characteristics are considered to be closely related and are placed together in a genus. Sometimes a genus might include only a single species if there is nothing else in the world that has similarities with it. The genus is the first part of the scientific name of a species and is always spelled with a capital letter and in italics.

Hierarchy – Having a structure of multiple levels.

Kingdom – in science is a taxonomic rank which is the highest level in the Linnaean Taxonomic System.

Mammalia – These are warm-blooded, air-breathing animals with backbones (vertebra), hair, three middle ear bones and mammary glands.

Molluscs – Animals with external shells, such as snails

Osteichthyes – A taxonomic group of fish that have bony, as opposed to cartilaginous, skeletons.

Order - This considers different family groupings. A creature can have its order or family changed as more information is learned.

Photosynthesis - The process by which starch is formed in the chlorophyll-containing tissues of plants exposed to light.

Phylum – A taxonomic rank below Kingdom and above class and a botanical term for division.

Plantae – Organisms that make their own food and are mobile.

Their cell walls contain cellulose. Plantae include algae, mosses, ferns, trees and flowering plants.

Procaryota - Virus, bacteria and blue-green algae.

Protista - Organisms that are one celled and have a nucleus within its cell. It includes microscopic creatures including protophyta, unicellular algae, protozoa and fungi.

Reptilia - Includes members of a class of air-breathing, cold-blooded vertebrates which are characterized by skin covered in scales and/or scutes.

Species - A species consists of all the animals of the same type, who are able to breed and produce young of the same kind. For example, while any two great white sharks are in the same species, as are any two makos, great whites and makos are in different species (since they can't interbreed).

Squamata – scaled-reptiles

Stomata - A very small hole in the surface of a leaf. Oxygen and carbon dioxide from the air enter through the stomata; oxygen, carbon dioxide and water vapour leave through the stomata.

Taxonomy – is the science of identifying and naming species.

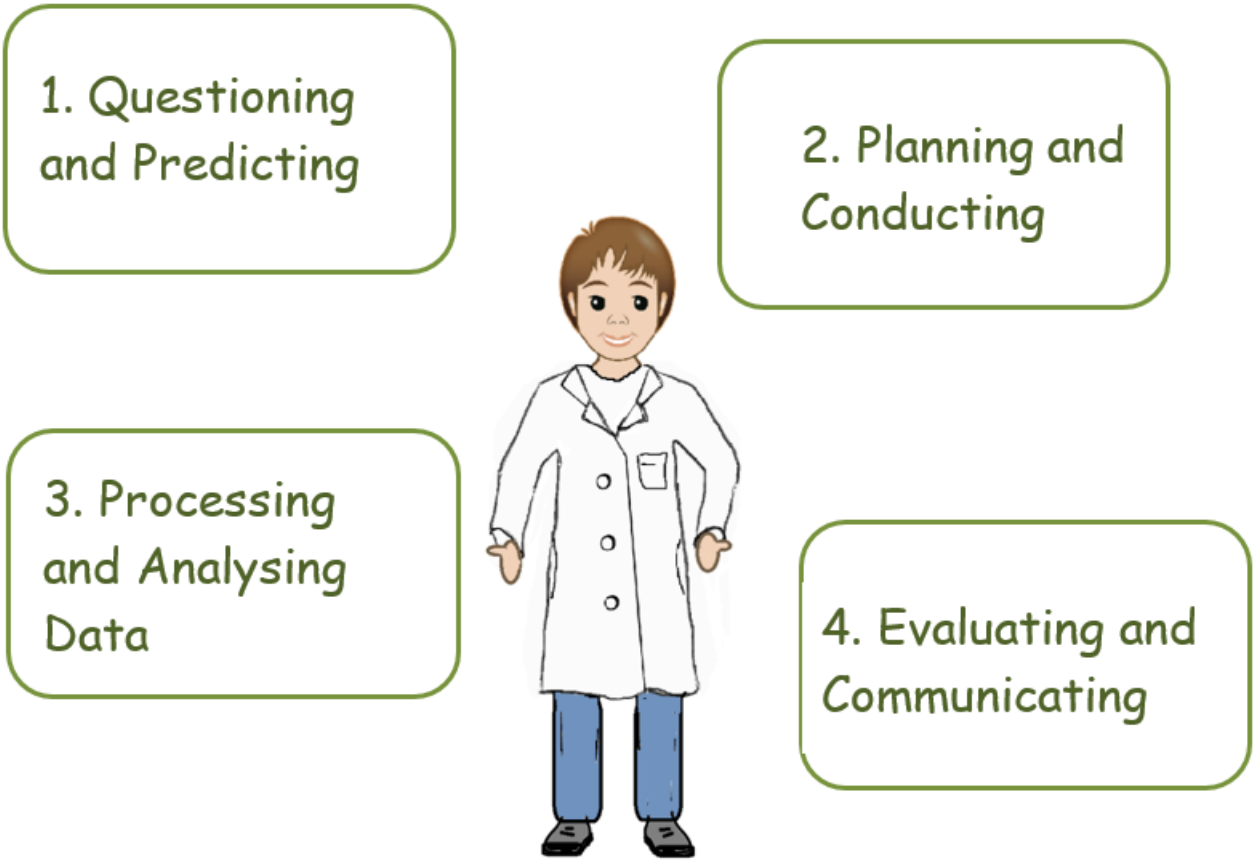
Taxonomist – a scientist that identifies and names species of living organisms.

Scientific Inquiry

In this course, you will be doing science investigations. It is important you are familiar with the Science Inquiry Process. Discuss the following information with your home tutor to make sure you understand the process of science inquiry. It is important that you refer to this information when you are completing the investigations in this course.

Use a highlighter to show key items in your reading. You will need to refer to this information when you are completing the *My investigation* sheet.

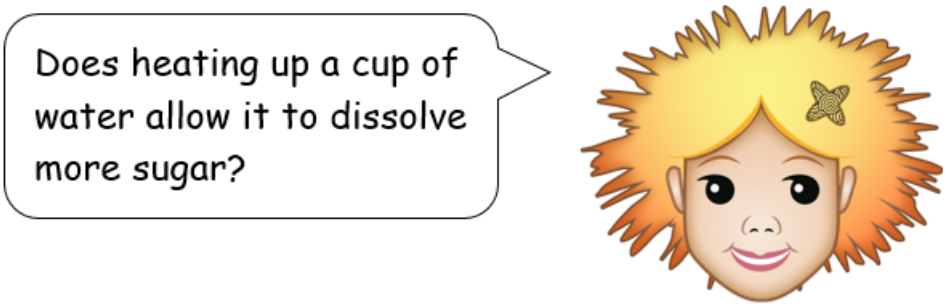
A Science Investigation has four parts to think about:



Questioning and Predicting

a) The Investigation Question

To start you need to state what it is that you are going to investigate. This is written as a simple question. How, when, which, why, can or does should be used to start your question.
IMPORTANT: The investigation should be something you can measure.

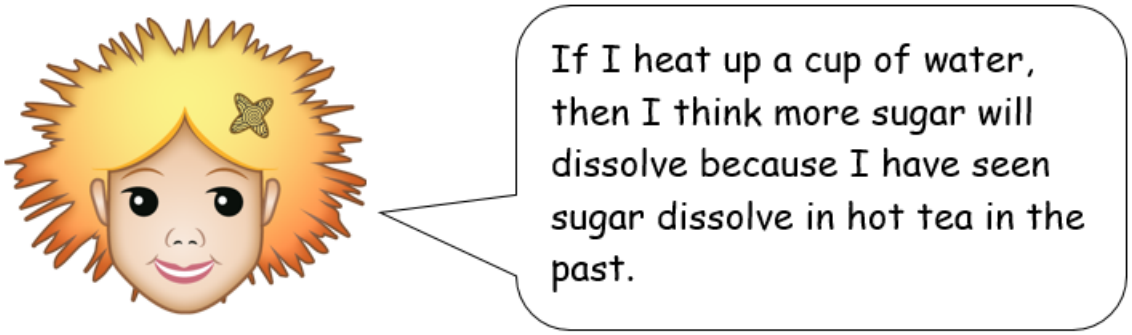


b) The Hypothesis

The **hypothesis** is an *educated guess* what will happen. This is more than just a guess. It is a guess based on some knowledge or experience that you might already have but it needs an experiment to support or prove it. You are making a prediction.

An ***If… then…because*** statement in a hypothesis tells the reader what you believe will happen in an investigation when something is changed, so you can see the effect of the change.

It is written like this:
"If (I do this), then I think (this) will happen because (based on something you know or have experienced)."



Planning and Conducting

a) The Equipment / Materials

What equipment do you need to test your hypothesis? Check the list of all of the equipment you will need for your investigation and gather it before you start.

b) Fair Testing and Variables

Conducting a fair test is the most important part of doing a good, scientific experiment so that your results will not be questioned. This means that you really need to make sure you are testing only one thing. To ensure that your experiment is a fair test you must be careful about your variables. Variables are the things that could change and affect the outcome of the experiment. There are three kinds of variables.

The **Independent Variable** is the one which you will change and is what you are testing.

The **Controlled Variables** are the ones you will keep the same. The

Dependent Variable is the one you will be measuring.

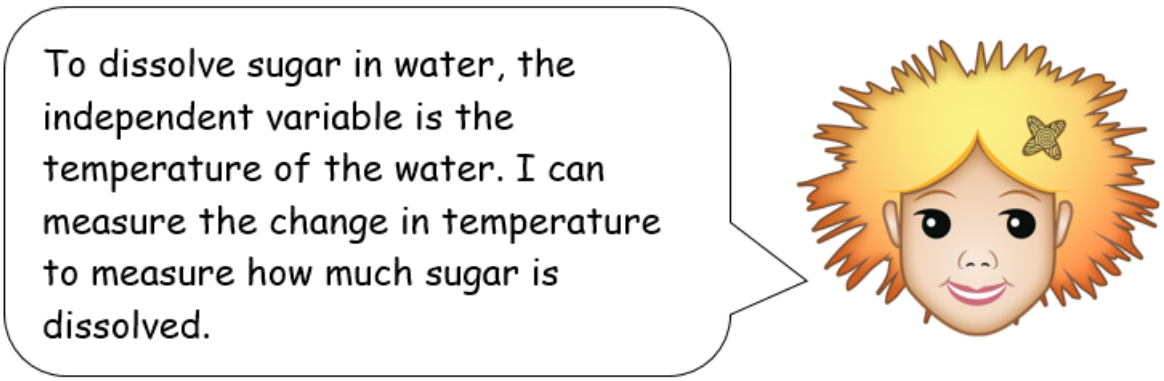
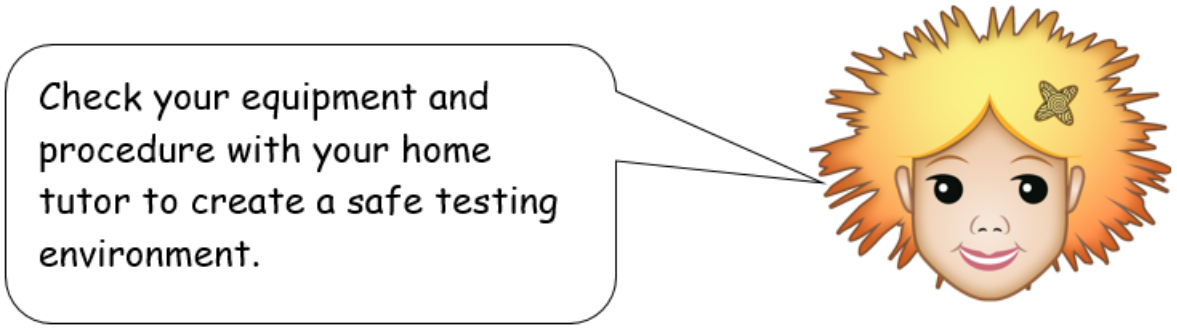


Table of variables			
Question	Independent variable to be tested (what I will change and measure	Controlled variables)that I need to keep the same	Dependent variable (data to be collected)
Does heating a cup of water allow it to dissolve more sugar?	Temperature of the water	• The type of sugar • The type of cup • Amount of stirring • Amount of water in each cup	Amount of sugar that dissolves completely, measured in teaspoons

c) Safety

What will you do to keep this investigation safe? What could go wrong to make your experiment unsafe? Write down what you did to make your experiment safe. For example, “When I used the kettle to boil water, my home tutor plugged in the kettle and handled the hot water so I wouldn’t burn myself.”



d) The Method / Procedure

How will you conduct the experiment? The method or procedure describes what you will do in your experiment in numbered steps. Clearly write down the steps for each part of your experiment on your investigation sheet.

e) Collecting Data

What are you going to measure? Decide on the best way to collect the information you find while testing the variable. Prepare a sheet of paper for a table, tally or note taking. In the water and sugar experiment, you might create a table which looks like this:

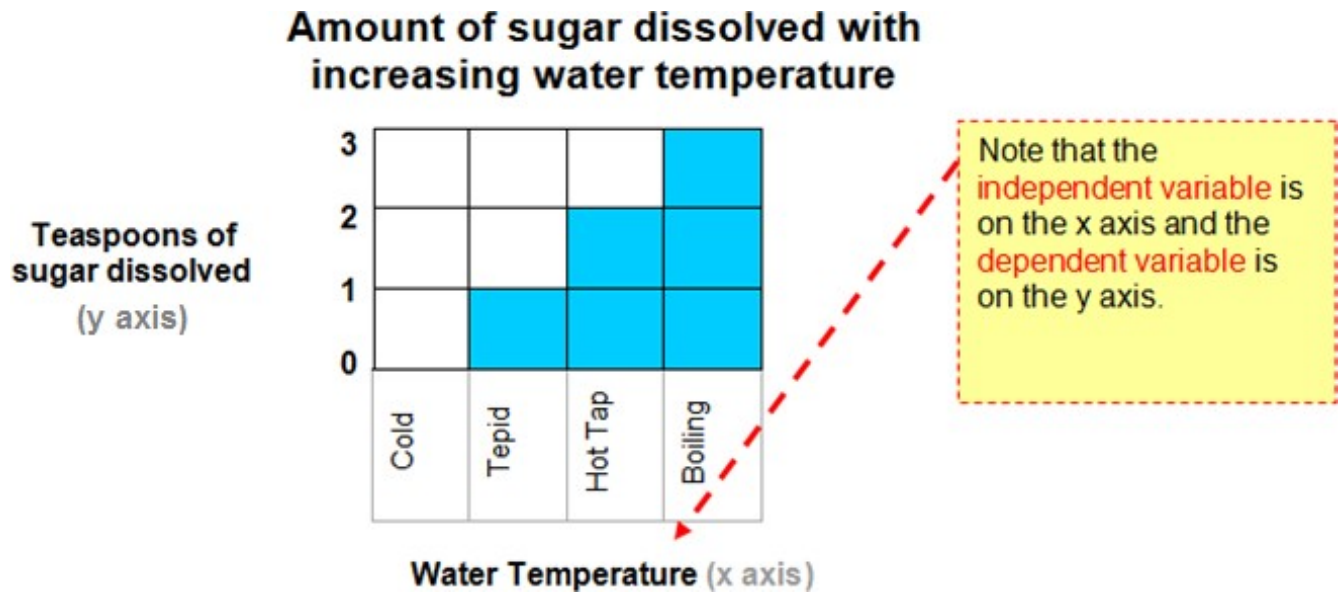
Trial 1		Trial 2		Trial 3	
Water temperature	**Amount of teaspoons of sugar dissolved**	**Water temperature**	**Amount of teaspoons of sugar dissolved**	**Water temperature**	**Amount of teaspoons of sugar dissolved**
Cold	0	Cold	0	Cold	0
Tepid	0	Tepid	1	Tepid	1
Hot tap	2	Hot tap	2	Hot tap	1
Boiling	3	Boiling	3	Boiling	3

What data did you collect from your experiment? Collecting data is a very important part of doing an experiment as you need to be able to show what happened. Be accurate in your measurement and observations and record them as you go. You need to **trial your experiment at least three times**. This will give you a pattern or a trend to help you with your conclusion. It will show if your results are true.

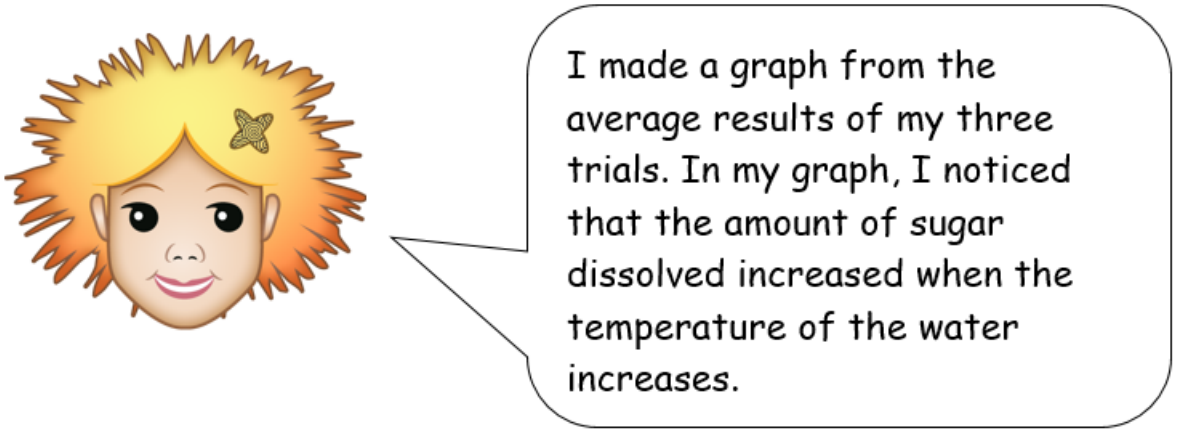
Processing and Analysing Data

a) The Results

What are the results of your trials? Your data should be displayed in a scientific manner by using a **table, graph or diagram**. If you add the results of your 3 trials together and divide by 3 you will find the average (mean) result between your 3 trials. In the tap experiment, you could make a bar graph from the information you have collected which might look like this:



Make sure you title and label your graph. You also need to write a **summary sentence** about your results too.

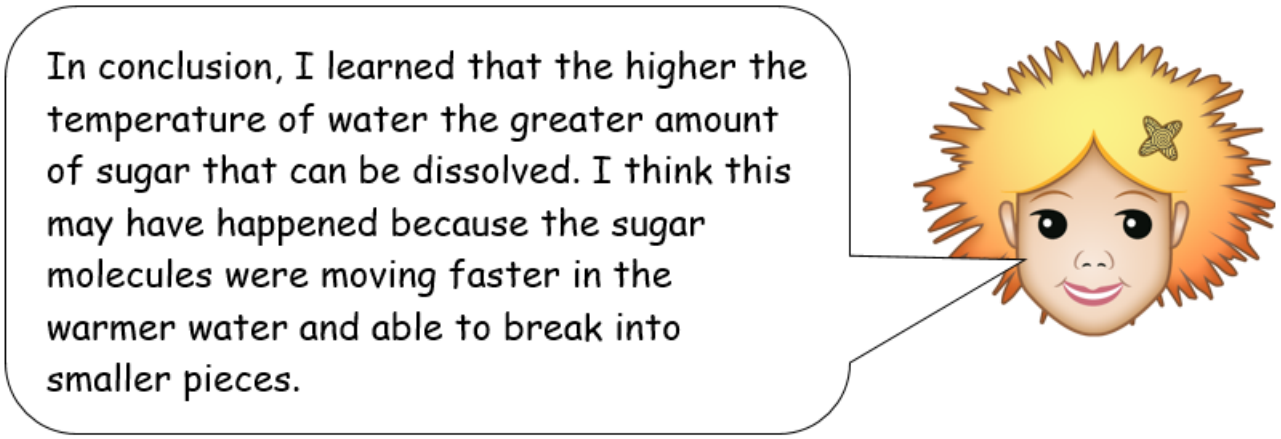


Evaluating and Communicating

a) The Conclusion

What did you learn from doing the experiment? In just a few sentences, you will give **an explanation** of what happened in your experiment. You also need to explain **why** this happened. Think about the science behind the results you have shown. In this statement, try to use the correct scientific terms from your experiment.

Using the dissolving sugar experiment you might say:



b) My Hypothesis

Was your hypothesis correct or incorrect? Explain why you think you came up with these results. Did you run a fair test and were your results similar over the three trials? Describe the outcome. "Here's what I thought might happen, and here's what actually happened because..."

c) Problems

What problems did you have doing this investigation? Perhaps you could not control one of the variables. Perhaps you had a mishap which affected your results. Explain any problems you had.

d) Improvements

How could you improve your investigation (fairness, accuracy)? Are there variables which you could have made more consistent? Did you miss any variables that should have been controlled during your experiment?

Science Inquiry Reflection

Name: _____

Place a tick in the columns that reflect your skills and understandings.

Questioning and Predicting	always	sometimes	with help
I can identify a problem I need to investigate.			
I can make a sensible prediction before I do the test.			
I know which variables I would change or measure.			
I can make it a fair test.			
I identify the variable I will change, the variable I will measure and the variable that I must keep the same			
Planning and Conducting			
I can use pictures and words to say what happens.			
I can measure and record my results in observations, diagrams or as tables of results. I have used a digital camera to record and compare my observations.			
I can be careful my measurements are accurate and can do at least three trials of each test.			
I can effectively use secondary sources of information (like the internet, books			
Processing and Analysing Data			
I have considered the best type of graphical representation to show my data.			
I summarise the data I have collected.			
I have used accurate labelled diagrams to			
Evaluating And Communicating			
I can say if what happens was what I predicted.			
I can explain the difficulties I had in doing the investigation and make suggestions for improvements.			
I can communicate ideas, findings and solutions			

Biological Science Reflection

Name: _____

Place a tick in the columns that reflect your skills and understandings.

	always	sometimes	with help
I can give reasons for classifying organisms.			
I can group a variety of organisms on the basis of similarities and differences in particular features.			
I can use hierarchical systems such as kingdom, phylum, class, order, family, genus, and species to classify organisms.			
I understand the use of scientific conventions (like italics and Latin names) for naming a species.			
I recognise the difference between how animals get their food and how plants make their own food from the sun.			
I can research organisms that live in extreme environments such as Antarctica or a desert.			
I can consider the effects of physical conditions causing migration and hibernation.			
I can predict the likely consequences for a species when removing its habitat (such as the effects of coral bleaching on the animals which rely on coral for food and shelter).			
I understand that groups of organisms lived in the past and that their adaptations helped them to survive in their environment.			
I can make connections between living and non-living things in an ecosystem.			
I can construct food webs to describe relationships involved in food chains, show the flow of energy and describe the different roles of living things.			
I understand how changing aspects of the environment (like climate change) can affect organisms.			
I can make predictions about the effects of environmental changes on living things.			
I can describe the effects of change on an ecosystem, such as coral bleaching, fire or land clearing affecting food availability for animals.			

Human Endeavour Reflection

Name: _____

Place a tick in the columns that reflect your skills and understandings.

Nature and Development of Science	always	sometimes	with help
I understand that scientists test predictions by gathering data.			
I know that scientists use evidence to develop explanations of events and phenomena.			
I can give an example of some of the research Australian scientists have been conducting to prevent catastrophic natural events such as coral bleaching.			
I can identify some contributions Australian scientists have made to the study of human impact on environments (such as the Great Barrier Reef) and to local environmental management programs.			
Use and Influence of Science			
I understand that through continual investigation, scientists plan for early detection of catastrophic natural events in order to minimise their impact.			
I have considered how human activity in the community can have positive and negative effects on the sustainability of ecosystems.			

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Revised 2020

Year 6

Department of Education

BIOLOGICAL SCIENCE