

Life Bubble on



Part III Another World



Name: _____

Where is a suitable place for a life bubble?

Imagine that all life on earth was about to be destroyed by an asteroid 10 times larger than the one that wiped out the dinosaurs. The earth authorities have decided to save the human race by starting a colony on another planet in our solar system or even on a planet around a distant star.

As a scientist you have been asked to give your knowledge on such a mission.

SCIFACTS

A light year is not a *measure of time*! It is a measure of distance. In one year, light travels a *distance of 9 500 000 000 000 or 9.5×10^{12} kilometres*. This distance is called a light year.

Using data

The estimated distances from Earth to some stars and galaxies are listed below. How long would it take to reach each of them travelling at the speed of light (about 300000 km/s)?

Sun	Our own star	1.5×10^8 km
Proximo Centauri	the closest star after the sun	4.0×10^{13} km
Centre of Milky Way	our own galaxy	2.5×10^{17} km
Magellan Clouds	One of the closest galaxies	1.5×10^{18} km
Andromeda galaxy	One of the closest galaxies	1.4×10^{19} km
Quasars	Very distant objects	1.4×10^{23} km

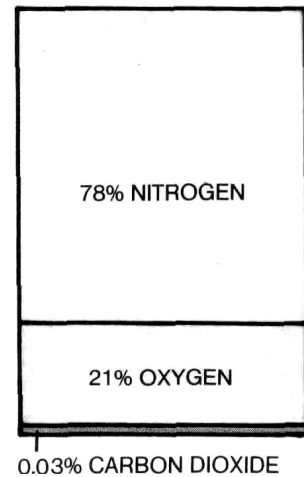
LIVING THINGS NEED AIR

Air contains two gases that are very important for living things. One is oxygen and the other is carbon dioxide. Oxygen makes up about 21% of the air, while carbon dioxide is a very small 0.03%.

When an animal breathes in air, its body uses the oxygen in the air. The other gases in the air are breathed out again. But why do living things need oxygen?

Animals and plants use food to give them energy for movement, growth and other body functions. Oxygen is needed to break down the food inside your body. When you are reading, watching TV or sleeping, your body uses only a small amount of oxygen, so you breathe slowly. However when you are active, you need more oxygen and you breathe faster and more deeply.

The process of getting energy from foods is called **respiration**.



(a) WALKING — a small amount of energy needed.



(b) RUNNING — a large amount of energy needed.

To eat is sweet

When food enters your digestive system it gets broken down into smaller and smaller pieces, eventually down to the size of molecules. These molecules are absorbed from your digestive system and passed into the bloodstream. They are then transported to all the other areas of your body. Glucose is one of the molecules that can be obtained from the breakdown of food. It is a simple sugar, made up of the elements carbon, hydrogen and oxygen. Glucose is a very important molecule because it is one that is involved in aerobic respiration.

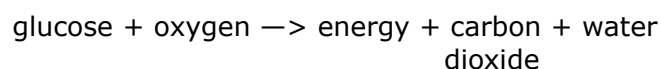
Take a breath

The other important molecule involved in aerobic respiration is oxygen. This molecule enters your body through your mouth and nose every time you take a breath. It is absorbed through the moist lining of your lungs and is then transported to the cells of your body by the blood.

chemical reaction

The glucose and oxygen molecules react together in your cells to produce carbon dioxide and water. Molecules called enzymes control the rate of the reaction. Energy is released during the reaction. Aerobic respiration takes place in mitochondria, which are specialised organelles inside your cells. As the energy is released, it is transported to sites where it is needed.

Aerobic respiration can be represented as the following word equation:



Respiration is sometimes described as a type of burning because it produces the same products as burning wood or petrol, and it also releases energy. However, in the mitochondria, respiration releases energy in stages and there are no flames associated with the reaction.

Living things Respire

Aim

To show that living things give out carbon dioxide.

Materials

- ◇ 4 vials and caps
- ◇ Bromothymol blue solution (no alcohol)
- ◇ A small square of cotton gauze and some thread
- ◇ Pond water
- ◇ Water-plant
- ◇ 3 germinating bean seeds

Method

PART A: Testing for carbon dioxide

- 1 Half fill a vial with pond water. Then add three drops of bromothymol blue solution. Shake the vial.
- 2 Use a straw to blow into the liquid

Is there a colour change? Record any colour change.



KEEP THIS VIAL FOR PART B.

The bromothymol blue will turn green, and then yellow, when carbon dioxide is present.

PART B: Testing living things

- 1 Wash four vials in tap water, then rinse them in pond water. Fill three vials with pond water. In the fourth vial, add pond water to a depth of about 1 cm. Then add three drops of bromothymol blue to the water in each vial.

Note: Bromothymol blue does not affect living things.

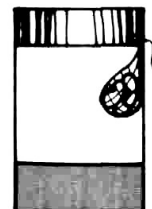
- 2 Put the cap on the first vial. This is your control tube. You will compare the colours of the other tubes with this one.
- 3 Place a piece of aquarium plant in the third vial. Put the lid on, and then place it in a dark cupboard.
- 4 Wrap up three or four germinating bean seeds in the cotton gauze to form a little bag. Tie it up with thread and suspend it above the liquid in the fourth vial.
- 5 Compare the colour of the liquid in the four vials with the vial from Part A.
- 6 Record the colour of the liquid in each vial after 20 minutes. Then leave them overnight and record the colour the next day.



Vial 1
CONTROL TUBE



Vial 2
WATER- PLANT



Vial 3
GERMINATING BEANS

Results

	Observation		
	20 minutes	Day 1	Day 2
Vial 1			
Vial 2			
Vial 3			

Questions and conclusions

1 What colour does bromothymol blue turn when carbon dioxide is present?

2 In which of the vials was carbon dioxide given off?

3 What was the purpose of the control tube?

4 Why did you place the vial containing the green plant in the dark?

5 Why did the germinating seeds in vial 3 give off carbon dioxide?

6 In which vials was respiration occurring?

WHAT'S IN A BREATH?

Materials

- Safety glasses
- Test tubes
- 2 straws
- Dropping bottle of bromothymol blue
- Limewater
- 2 x 250 ml beakers filled with iced water
- Cobalt blue indicator paper
- Paper towel

Method

- 1 Quarter fill one of your test tubes with tap water. Then add 5 drops of bromothymol blue and note the colour of the solution.
- 2 Gently breathe out through a straw into the test tube. Record the colour change.
- 3 Quarter fill the other test tube with limewater and note the appearance. Again, gently breathe out through a clean straw and record any changes to the colour of the limewater.
- 4 Allow a drop of tap water to fall on a small strip of cobalt blue indicator paper. Record the colour change.
- 5 Use the paper towel to wipe the outside of the two beakers of iced water. Breathe in deeply and then breathe out onto the outside surface of one of the beakers. Touch the fog that develops on the beaker with the cobalt blue indicator paper. Then touch the outside surface of the second beaker with the paper. Record any colour change.

Results

Test	Colour before	Colour after
Bromothymol blue solution in test tube		
Lime water in test tube		
Cobalt blue in tap water		
Cobalt blue on outside of beaker		

Questions and conclusions

- Bromothymol blue solution changes from blue to yellow when carbon dioxide is present. What does the colour change tell you about your breath?

-
-
- Lime water changes from clear to milky in the presence of carbon dioxide. Does this test indicate that carbon dioxide was present?
-
-

- Cobalt blue indicator paper changes from blue to pink when water is present. What does this test tell you about your breath?
-
-

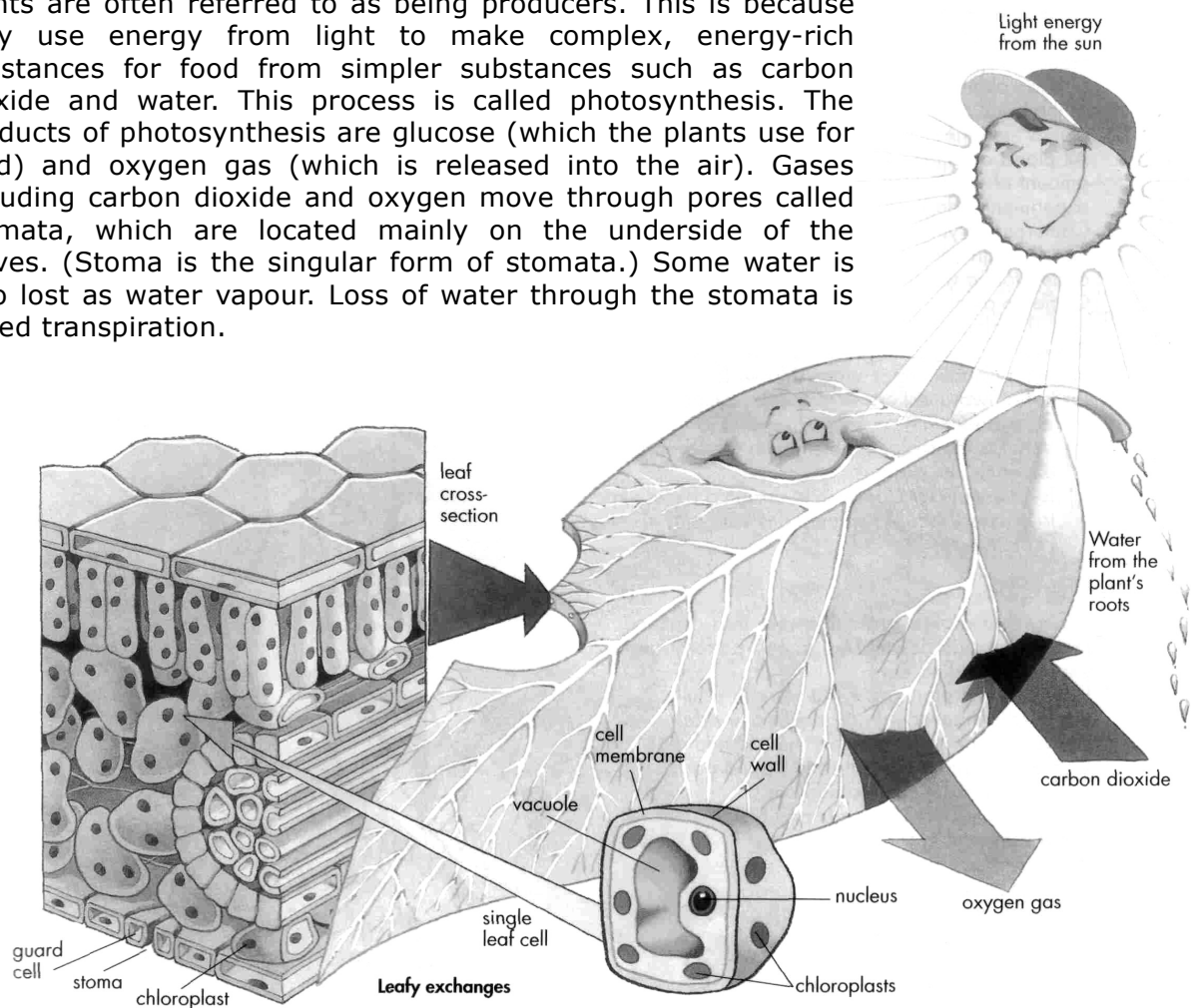
- What was the purpose of using the second beaker of iced water?
-
-

Leafy exchanges

Being green helps plants make their own food.

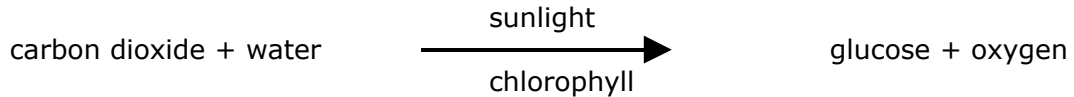
Solar powered

Plants are often referred to as being producers. This is because they use energy from light to make complex, energy-rich substances for food from simpler substances such as carbon dioxide and water. This process is called photosynthesis. The products of photosynthesis are glucose (which the plants use for food) and oxygen gas (which is released into the air). Gases including carbon dioxide and oxygen move through pores called stomata, which are located mainly on the underside of the leaves. (Stoma is the singular form of stomata.) Some water is also lost as water vapour. Loss of water through the stomata is called transpiration.



Why plants are green

Plants are green because they contain the green pigment chlorophyll. This pigment is found in chloroplasts inside the cells. Chlorophyll traps energy from sunlight so that it can be used in photosynthesis ('light' + 'putting together'). The reaction for photosynthesis is shown below.



Plants need light to be able to photosynthesise. In the dark, no photosynthesis occurs. Like other living things, however, plants respire and require oxygen all the time.

Sugary sweet – the many journeys of glucose

- Plants may use the glucose made by photosynthesis in four main ways:
- energy to be used straight away
- stored energy can be changed into starch or oil and stored in the stems, roots, seeds and fruits
- used to make cellulose for the cell walls
- combined with minerals and used to make proteins and other substances for plant growth.

Plants use the glucose for energy to stay alive or they change it into other useful substances such as **protein** and **starch**. The oxygen gas, which is formed, can be used by the plant to produce energy or it can be released into the air.

Zooming in to where the action is

Using a light microscope you may be able to see the chloroplasts within cells as small, green, roundish shapes. These are the 'mini-factories' that use the energy from sunlight to make glucose.

Searching for stomata

Materials

- sticky tape
- leaves (a variety)
- microscope slide
- light microscope

Method

- Place a piece of sticky tape onto the underside of a leaf, firmly press it down and then carefully remove it.
- Stick the tape on a clean microscope slide and observe through the microscope.

1. Draw and describe what you see.
2. Repeat the procedure for the topside of the leaf.
3. Repeat the procedure for different types of leaves.

Results

Diagram of the underside

Diagram of the topside

Activates

1. Why are plants called producers?

2. State the name of the process by which plants make their own food and four ways that they use this food.

3. List the requirements, products and reaction for photosynthesis.

4. Where are stomata found and what is their function?

5. State four different ways in which plants may use the glucose made from photosynthesis.

Testing leaves for starch

AIM

To test leaves for the presence of starch.

MATERIALS

- Leaf (students could try different leaves)
- Beaker of hot water
- Methylated spirits
- Hot plate
- Test-tube
- Test-tube rack
- Petrii dish
- Tongs
- Iodine solution
- Pipette

METHOD

Warning: Methylated spirits is flammable. Do not handle methylated spirits near a flame.

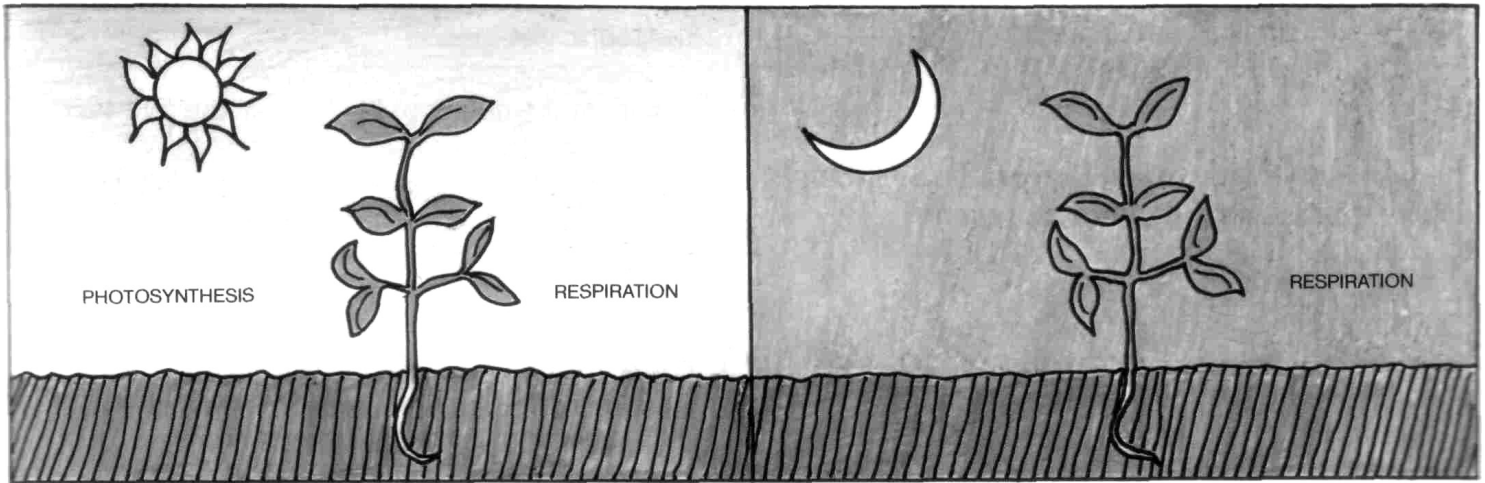
1. Boil a leaf in a beaker of hot water for about 30 seconds.
2. Remove the leaf from the water and place it in a test-tube. Keep the water boiling.
3. Keeping well away from a flame, add methylated spirits to the test-tube so that the leaf is covered.
4. Place the test-tube into the beaker of boiling water and heat until the green chlorophyll is removed from the leaf.
5. Carefully remove the test-tube from the beaker of boiling water and remove the leaf.
6. Place the leaf back into the beaker of boiling water for a few minutes to soften it.
7. When the leaf is soft, remove it from the water and place it in a petri dish.
8. Add 4 drops of iodine on the leaf. Areas of starch turn blue. Other areas turn brown.

RESULTS

Draw a diagram to show areas where starch has been stored in the leaf.

Respiration and photosynthesis

Like animals, plants use food and oxygen for growth. That is, plants respire. However, plants are able to make their own food and oxygen. Therefore, in the daytime, green plants respire and photosynthesise. At night, only respiration occurs. During the daytime, photosynthesis may produce sugar at a faster rate than it can be used or carried away



from a leaf. Many plants convert this extra sugar into starch that is temporarily stored in their leaves

Activates

1. Complete the following sentences.

- (a) Animals use the _____ in the air and breathe out _____
- (b) The air contains about _____.% oxygen.
- (c) Living things need oxygen to break down _____.
- (d) Respiration supplies plants and animals with the _____ needed for growth and movement.

2. Some of the statements below are false. Pick the false ones and make them true by changing the words in *italics*.

- (a) More oxygen is used when an animal is running than when it is resting.
- (b) Oxygen is given out when plants respire.
- (c) There is far more carbon dioxide in the air than oxygen.
- (d) Food is broken down in respiration and made in photosynthesis.

3 Fill in the blank spaces.

Process	Gas taken in	Gas given out
Respiration		
	Carbon dioxide	

Sunlight and Plants

AIM

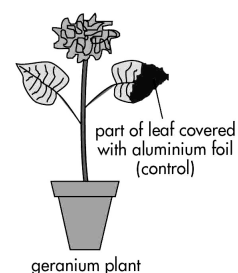
To show that sunlight is needed for photosynthesis.

MATERIALS

- Young geranium plant
- Aluminium foil
- 250 ml beaker
- 500 ml beaker
- Hot plate
- Matches
- Starch solution
- Iodine
- Alcohol
- Water
- Test-tube holder
- Test-tube
- Test-tube rack

METHOD

1. Secure a piece of aluminium foil to the front and back of part of a geranium leaf (with the leaf still attached to the plant). Leave the plant in sunlight for several days.

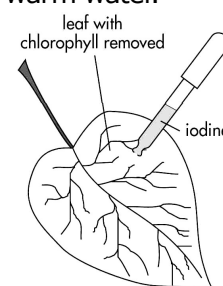


Note: The covered part of the leaf is the control. Any differences you find between the uncovered part and the control must be due to the effect of sunlight.

2. Boil some water in the 500 ml beaker.
3. Remove the leaf from the plant.
4. Remove the aluminium foil from the leaf and immediately plunge the leaf into boiling water. This will kill and soften the tissues.
5. Pour the alcohol to a depth of 1 cm into the 250 ml beaker.
6. Place the leaf into the alcohol. Place the 250 ml beaker into the 500 ml beaker containing the boiling water.

Notes: this acts as a double boiler: you should never boil alcohol directly.

7. When the alcohol has turned green and the leaf has gone pale, wash the leaf in warm water. You have now extracted the chlorophyll from the leaf.
8. Place some starch solution into a test-tube. Add several drops of iodine. What colour does it turn? Starch (sugar) turns blue-black when tested with iodine.
9. Drop iodine on the leaf.
10. Draw the leaf. Shade the area that turns blue-black.



Results

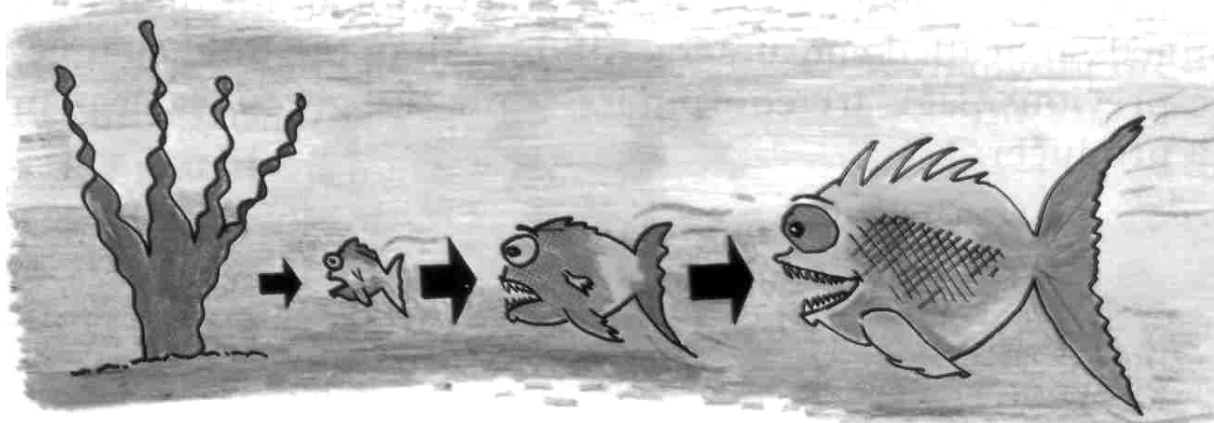
DISCUSSION

1. Which area changed colour: the part exposed to sunlight or the part covered with the aluminium foil?

2. What substance is produced when a green leaf is exposed to sunlight?

Ecosystems

The animals and plants which live together in a particular place usually depend on each other for food. In a pond, for example, small fish eat the green plants, bigger fish eat the small fish and so on. A simple way of showing how animals and plants depend on each other is to draw a food chain. A food chain shows what eats what.



A food chain shows the way in which energy flows from one living thing to another. Green plants use the sun's energy to make carbohydrates, fats, and proteins — the substances used for growth. Animals eat plants and the stored energy in the plants passes to the animals.

The food chain in figure to the right can be written simply as:

Green Plant → Grasshopper → Kookaburra

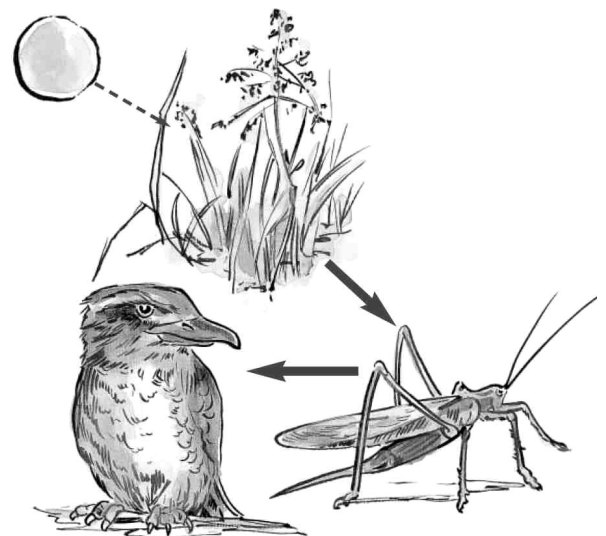
The arrows show the direction in which the energy (food) goes.

Food chains usually begin with green plants, because they can make their own food. For this reason, green plants are called **producers**. On the other hand, animals cannot make their own food. They rely on green plants or other animals for their food. Animals are called **consumers**. All the fish in the food chain on the above are consumers, while the green water-plant is a producer

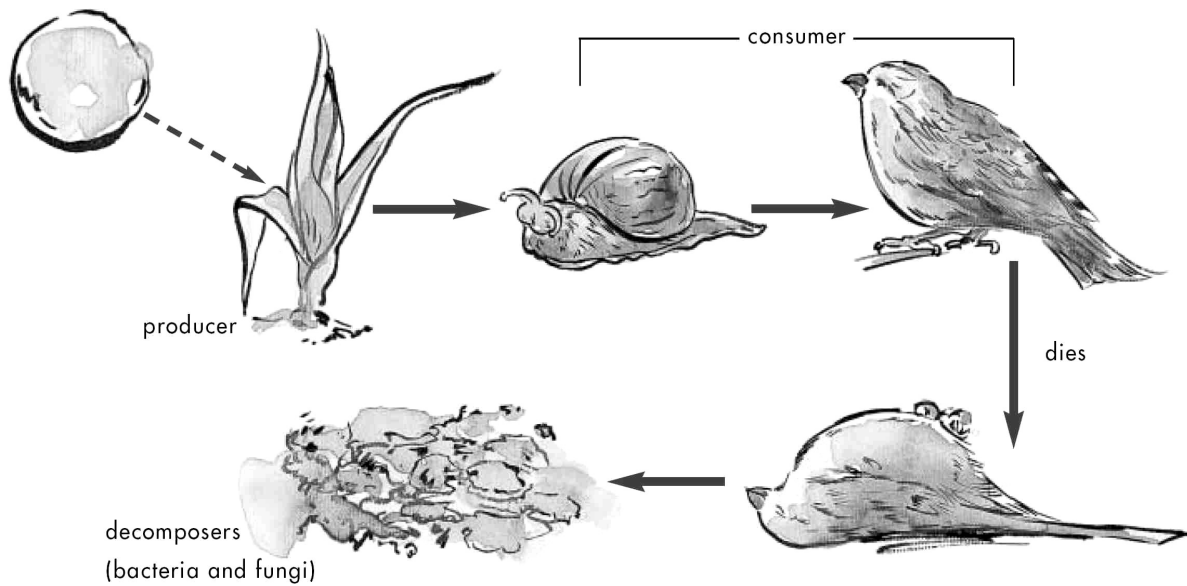
Animals are unable to make their own food and must consume (eat) plants or other animals to obtain food. Animals are therefore called consumers.

If a plant or animal dies without being eaten its body is broken down by decomposers.

Decomposers are living things such as bacteria and fungi that live off the energy in dead



plants and animals. Decomposers are able to get the energy they need as they break down dead matter.



The five lists below include a number of living things that feed on one another. For each list, place the animals and plants in what you think are the correct order. Label the producers and consumers. Check your food chains with those of your partners. Discuss any differences.

FOOD CHAIN 1	FOOD CHAIN 2	FOOD CHAIN 3	FOOD CHAIN 4	FOOD CHAIN 5
fox	large fish	frog	algae	buffalo
grass	small fish	grasshopper	fish	grass
rabbit	snail	kookaburra	tadpole	lion
	water-plant	leaf	water-bird	
		snake		

Activates

1. Complete the following:

- a. Food is an example of stored _____
- b. Green plants get their energy from _____
- c. The arrows in a food chain show the _____ in which the energy goes.
- d. A consumer cannot make its own _____

2 Some of the following statements are *incorrect*. Pick the incorrect ones and make them correct by changing the words in *italics*.

- (a) A snake is a *producer*.
- (b) Snails and slugs both feed on garden plants. Therefore they are both *consumers*.
- (c) Food chains usually begin with *consumers*.
- (d) The energy in the bodies of living things originally comes from the *sun*.

3 The food chains below are missing certain animals or plants. Choose the animals or plants from the list on the right to complete the food chains.

- a. _____ → cow → human
- b. Leaves → snail → _____ → cat
- c. Algae → small fish → _____
- d. Water-plant → _____ fish → water-bird
- e. Grass → bug → _____

- | |
|---|
| DOLPHIN
SPIDER
GRASS
BIRD
SNAIL |
|---|

4 The food chain below is *incorrect*.

spider ← praying mantis → bug ← grass Write down why you think it is incorrect, then draw the correct food chain.

Cane toads—biological control gone wrong

In 1955 grey back beetles, cane beetles, were the enemy of the sugar cane farmers in Queensland, munching their way through the sugar cane crops. A decision was made to introduce a predator to control the cane beetle population, but not enough research had been done beforehand.

A sack load of *Bufo marinus*, better known as the 'cane toad', was imported from Honolulu by the Queensland Government. It was thought that the cane toads would munch their way through the beetles, so that the crops would be free of the pest.

Instead, being without any natural enemies, the cane toads have destroyed the local ecology, as they have found a wide range of new food sources. They have multiplied at an alarming rate, thriving in the tropical climate and spreading further south. Cane toads have been sighted in parts of New South Wales in recent times.

While the beetles have now disappeared, the cane toads have become a big problem, attacking other native insects. They have become an ecological disaster as well as an economic problem on the east coast of Australia.

DECONSTRUCTING A REPORT

1. Why did someone write this article?

2. For whom is this text written?

3. The first paragraph is a general statement introducing the topic to be described. Label it as classification. The next three paragraphs describe different aspects of the problem. Label each paragraph with the following descriptions.

Description: effect of predator on the environment.

Description: introduction of control predator.

Description: response of control predator to new environment.

4. A verb is used to describe an action. Underline the verbs in each paragraph.
5. What is the noun for each of the verbs listed in question 4?
6. What is biological control? Why is it an alternative to using chemical pesticides?

Find each of the following words.

SUNLIGHT
BACTERIA
STOMATA
GLUCOSE

CONSUMER
BIOLOGICAL
ENERGY
HUMAN

DECOMPOSER
RESPIRATION
CHLOROPHYLL
STARCH

PRODUCER
PHOTOSYNTHESIS
FOOD
FOODCHAIN

O S P S C O N S U M E R D S O R G O Y N E C R
R C E P R R P B H S C H U O S T E M C M I R T
C S P Y F U O I P H O T O S Y N T H E S I S O
G S S L N C I O C C O G H P E M M G T E A R S
L R N L A S G L U C O S E R T O N E T R O N O
R F L Y A M R O L B A H G B A C T E R I A O E
A E C H I G R G L S G Y T E E E A C C N E I D
C O S P M S C I A D T P P O S U N L I G H T D
D N P O U D S C S S L R T S T O M A T A T A E
A A I R P T T A O T O N R S D R H A H U I R E
T L A O A M D L R D A O A S H C N I M U N I G
Y P R L G P O T U M R R M E D E H H N F U P D
C C A H O S C C U H E S C O R T N L F N E S I
U H S C O C E H E E L F O H G S H F O O D E U
P I C Y E R R E T D E F O O F R R Y E H A R M
H C M T R I R N G G N O L E O N L P N G U N R