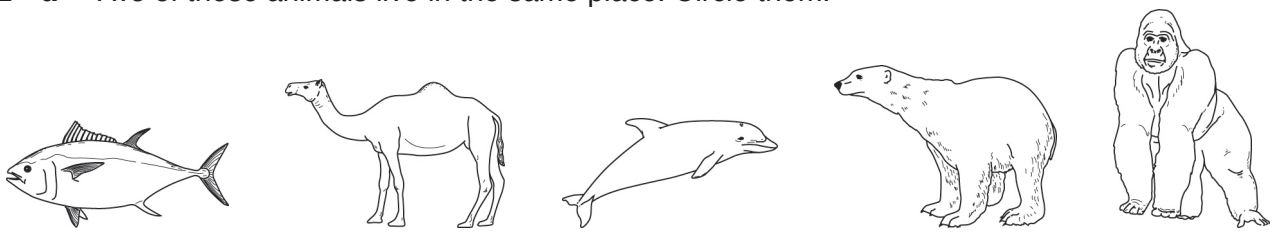
Name _____ **Class** _____ **Date** _____

1 What is a habitat? Tick *one* box.

- ☐ a place where an organism lives
- ☐ the name of a jungle animal
- ☐ a type of building
- ☐ a place built by humans for animals to live

2 **a** *Two* of these animals live in the same place. Circle them.



b Look at the animals you have circled. Describe *one* difference between them that you can see.

_____

c Describe *one* similarity between them that you can see.

_____

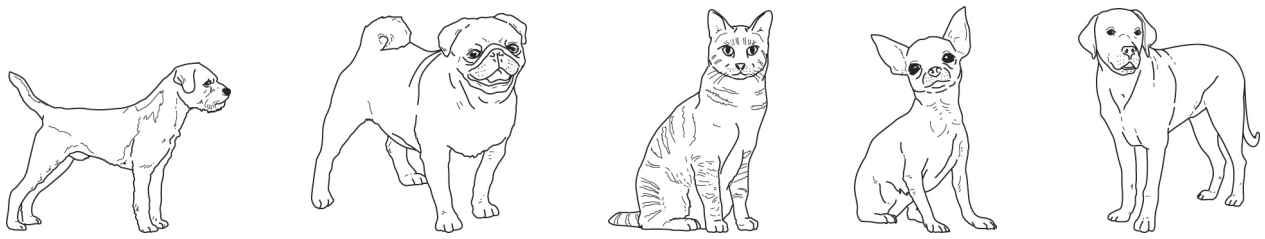
d What word is used to describe differences between organisms?

_____

3 The following statements describe ways in people can be different. Draw a line from each statement to *one* of the boxes on the right to say whether the difference is continuous or discontinuous.

height	
shoe size	continuous
tongue rolling	
length of hair	discontinuous
having a broken arm	

4 **a** Which *one* of these animals is the most different to all the others? Circle the animal.



b Explain why it is the most different. Use the word 'species' in your answer.

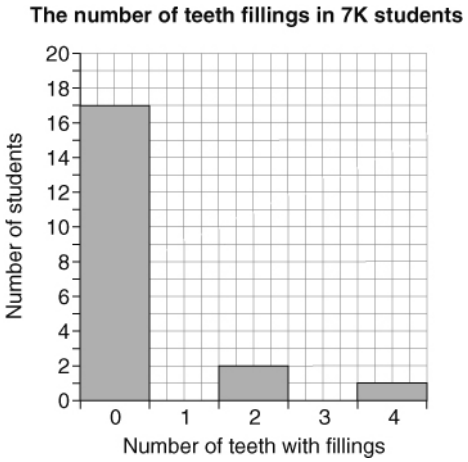
_____

I can…

- identify variations
- classify variation as continuous and discontinuous.

Name _____ **Class** _____ **Date** _____

1 a The chart on the right shows how many fillings students in 7K have. Some of the data is missing. Eight students have one filling and two students have three fillings. Add this data to the chart.



b What is a chart like this called? _____

c Explain why the chart is also an example of a frequency diagram.

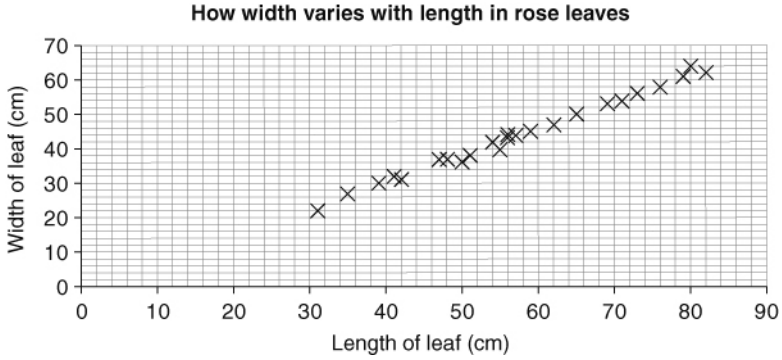
_____

_____

d Which variable is the independent variable? _____

e Which is the dependent variable? _____

2 a The graph on the right shows how the lengths of rose leaves vary with their widths. One point is missing; the length of one leaf was 25 cm and its width was 20 cm. Plot this point on the graph.



b What is a graph like this called? _____

c Is there a relationship between the two variables? _____

d Explain your answer to part **c**.

_____

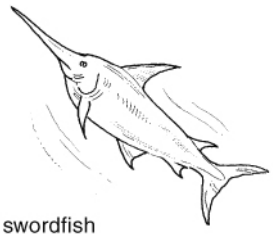
_____

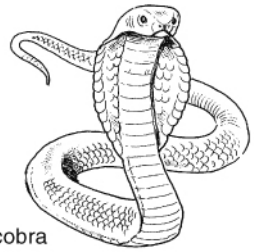
I can…

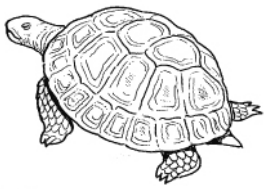
- identify and plot data on different types of charts and graphs
- identify independent and dependent variables.

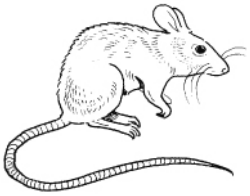
Different species of animals


dinosaur
reptile


swordfish
fish

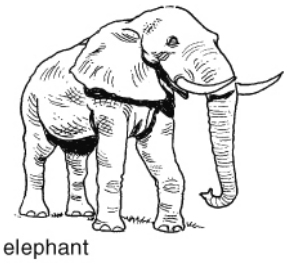

cobra
reptile


tortoise
reptile

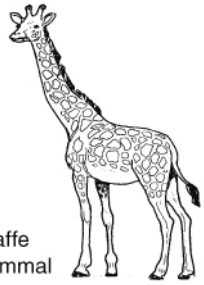

mouse
mammal

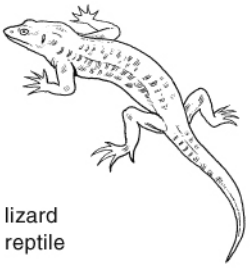

frog
amphibian

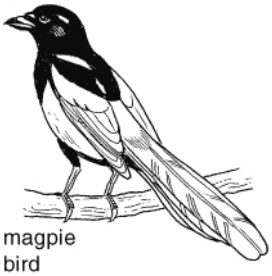

parrot
bird


elephant
mammal


human
mammal


giraffe
mammal

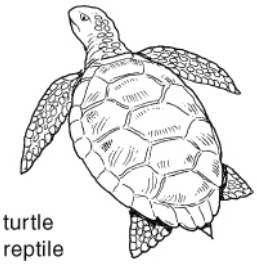

lizard
reptile


magpie
bird

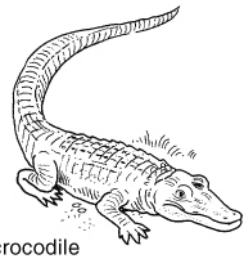

perch
fish


lion
mammal

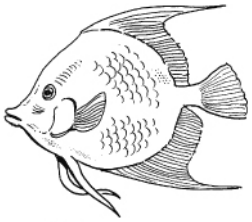

owl
bird


turtle
reptile

Different species of animals


crocodile
reptile

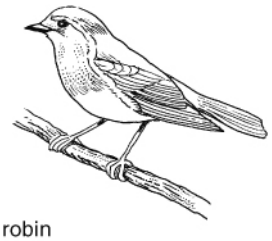

salamander
amphibian

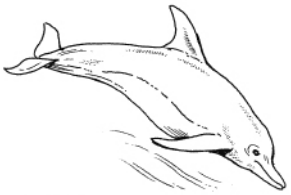

angel fish
fish

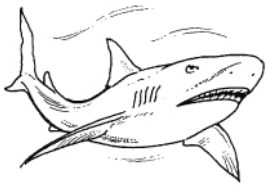

bat
mammal


gerbil
mammal

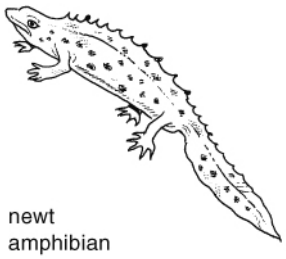

zebra
mammal


robin
bird

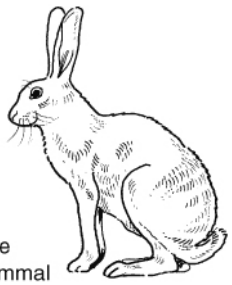

dolphin
mammal

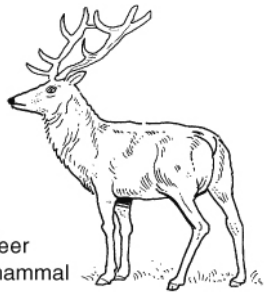

shark
fish

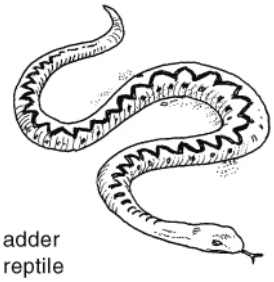

tiger
mammal

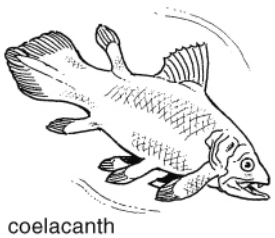

newt
amphibian


penguin
bird

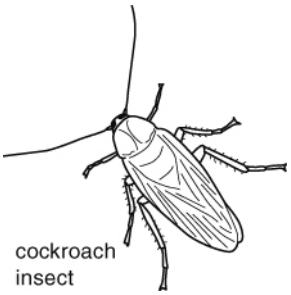

hare
mammal


deer
mammal


adder
reptile

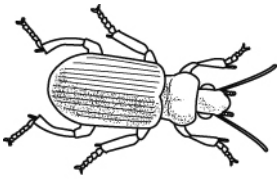

coelacanth
fish

Different species of animals

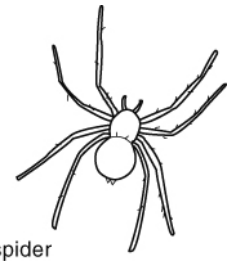


cockroach
insect

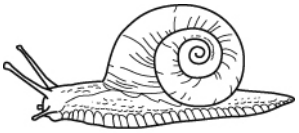
leech
worm



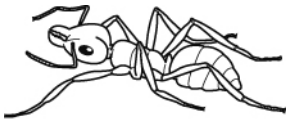
beetle
insect



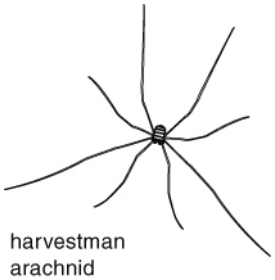
spider
arachnid



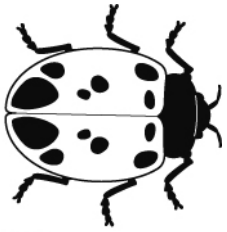
snail
mollusc



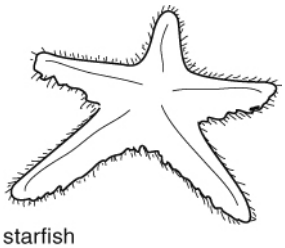
ant
insect



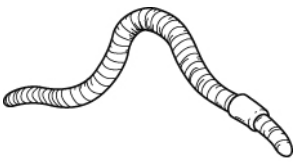
harvestman
arachnid



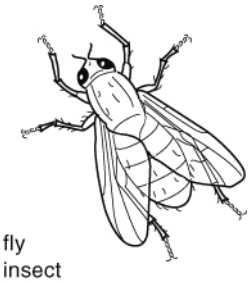
ladybird
insect



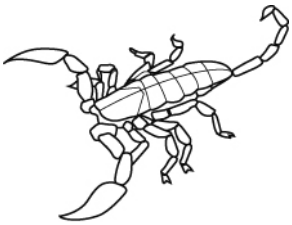
starfish
echinoderm



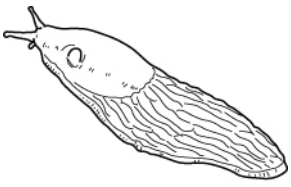
earthworm
worm



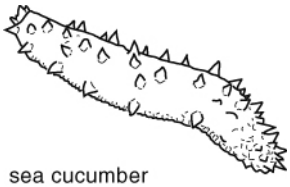
fly
insect



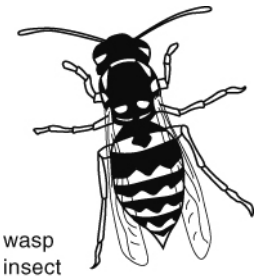
scorpion
arachnid



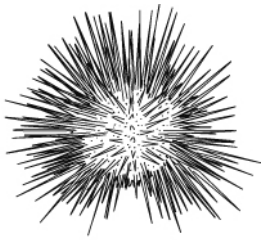
slug
mollusc



sea cucumber
echinoderm



wasp
insect



sea urchin
echinoderm

Name _____ **Class** _____ **Date** _____

Use this table to record some of the features of the animals you observe.

Name of animal	Type of animal	Does it have markings on its body (e.g. stripes)?	How many legs does it have?	Does it have antennae?	Anything else of interest

I can…

- make careful observations
- identify variations.

Name _____ **Class** _____ **Date** _____

Here are 30 fingerprints taken from different people's right index fingers (the finger next to the thumb).

Classify each fingerprint into *one* of these three basic types:

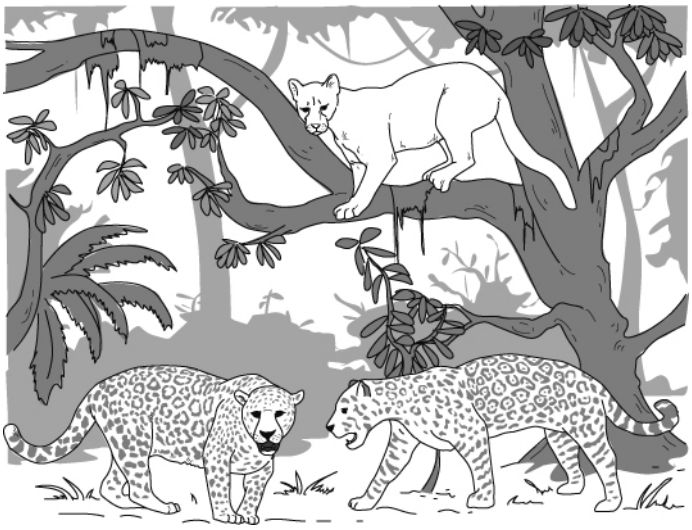
loop arch whorl

I can…

- make careful observations
- identify variations.

Name _____ **Class** _____ **Date** _____

1 Look at the drawing.



a Suggest a name for this place.

_____

b What is the name for a place where an animal lives?

_____

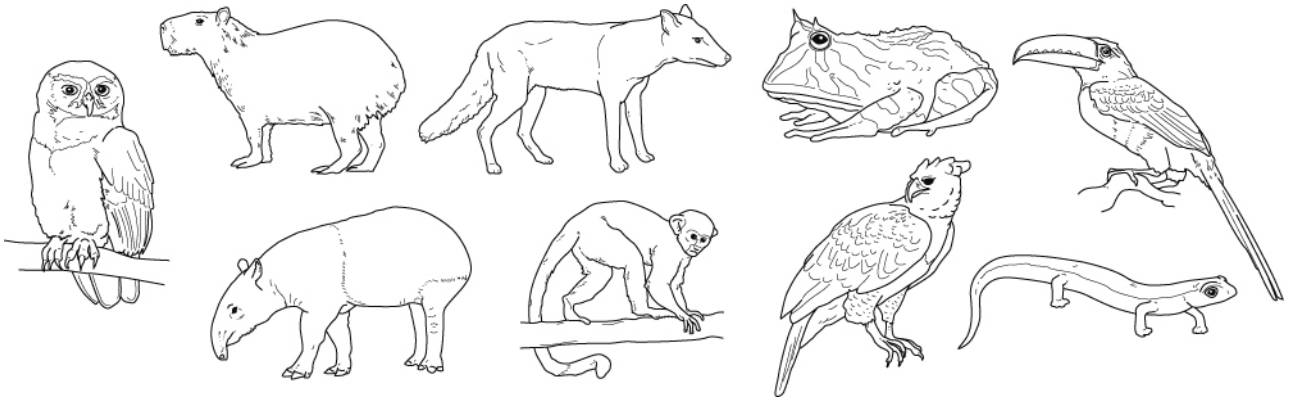
c Describe *one* variation between the two jaguars in the drawing.

_____

d Describe *one* variation between the jaguar and the puma (in the tree).

_____

2 The drawing shows some other animals that live in the same place. They are vertebrates (which means that they all have a backbone). However, some are mammals (have hair), some are birds (have feathers) and some are amphibians (have a moist skin).



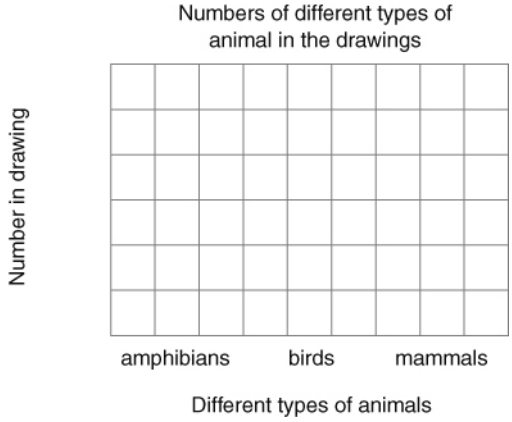
a How are the animals in the drawings the same?

_____

b How do they differ? Give *one* way.

_____

c Count up the numbers of each different type of vertebrate and complete the bar chart.

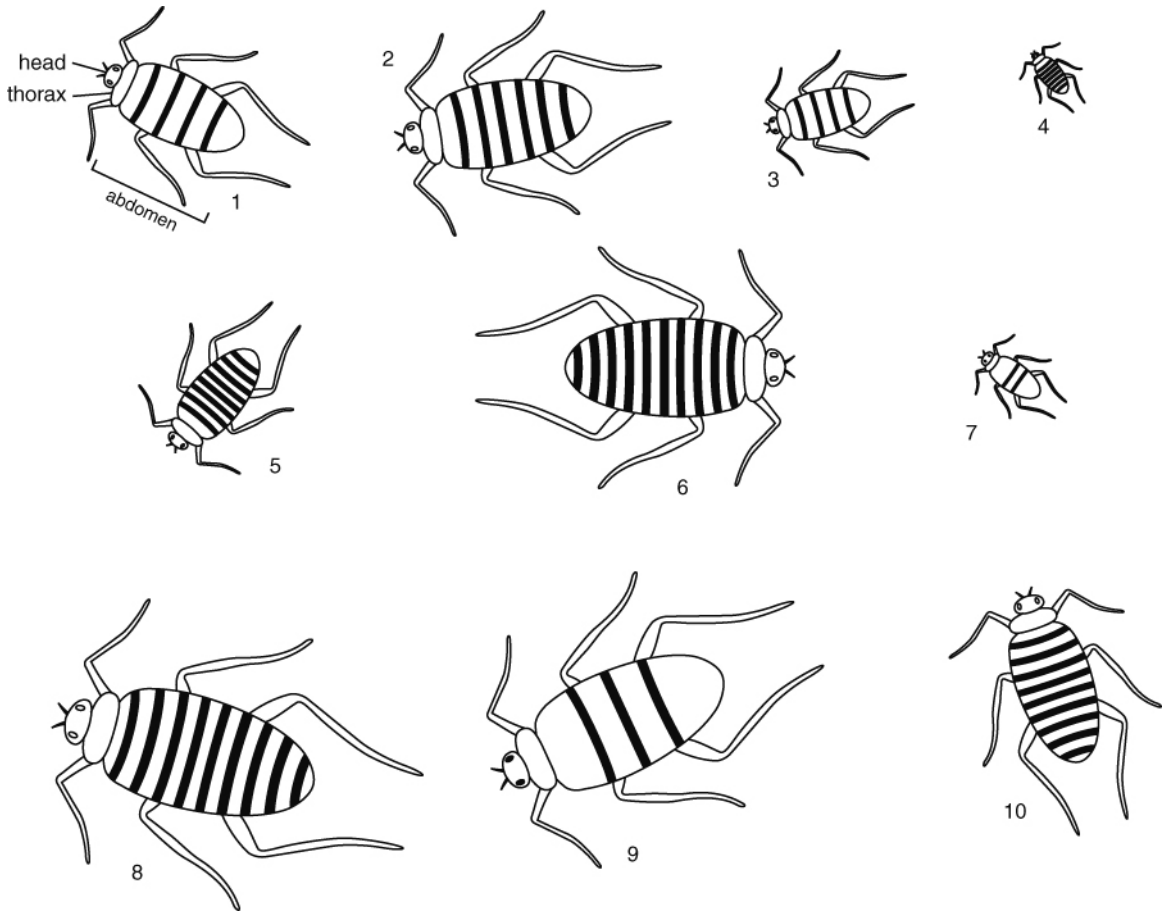


I can…

- make careful observations
- identify variations
- present data as a bar chart.

Continuous and discontinuous variation

Name _____ **Class** _____ **Date** _____



Look carefully at the insects above.

1 Which features of the insects vary?

2 State *one* feature of the insects that shows:

- **a** continuous variation
- **b** discontinuous variation.

3 **a** Measure the width of the head and the abdomen of each insect. Record your measurements in a table.

- **b** Use a way of displaying your measurements to find out whether there is a relationship (link) between insect head width and abdomen width. You will need to decide whether to draw a bar chart, a scatter graph or some other sort of chart or graph.
- **c** Is there a relationship? If there is, write down what it is.

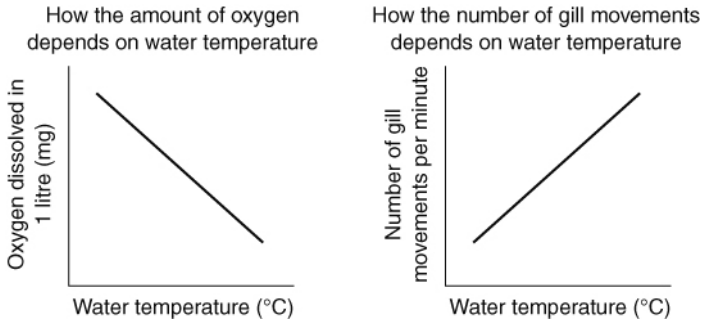
4 These insects are all the same species. What does this mean?

I can…

- make careful observations
- identify continuous and discontinuous variation
- recall what a species is
- present data in an appropriate chart or graph.

Gone fishing

Oxygen dissolves in water. Fish absorb this dissolved oxygen using gills. If you look carefully at a fish you can see the gills moving. Look at the graphs below.

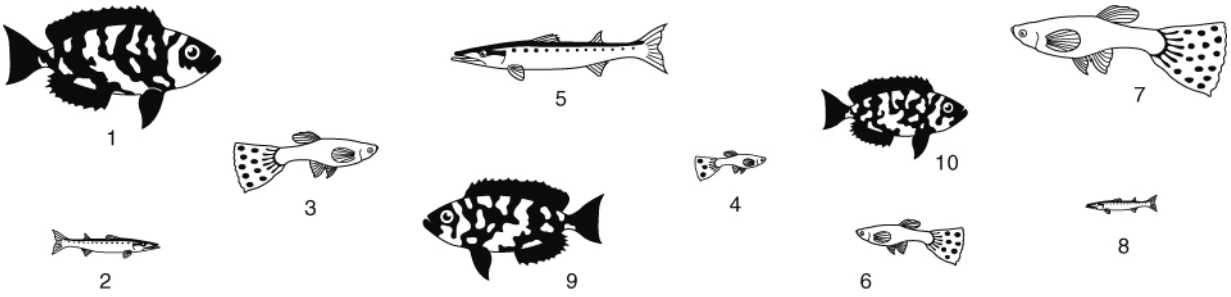


1 What relationship does each graph show? Start your sentences with 'The warmer the water, the ...'

2 **a** What is the relationship between the amount of oxygen dissolved and the number of gill movements per minute?

b Sketch a graph for this relationship.

Look at the pictures of the fish. Some of these fish are the same species, and others are different species.



3 Which fish are the same species?

4 What is a 'species'?

5 Describe *one* continuous variation between members of *one* species.

6 Describe *one* discontinuous variation between members of *one* species.

7 **a** Look at the fish that are similar to fish 3. Measure the overall lengths of the bodies and count the number of spots on the tails. Draw a suitable chart or graph in order to look for a relationship between these variables.

b Is there a relationship? If there is, write down what it is.

8 Very rarely, members of different species can breed. The offspring are called hybrids. Draw a picture of what a hybrid of fish 1 and fish 3 might look like.

9 What can hybrids not do that their parents can?

10 Name *one* other hybrid animal and say what its parents are.

I can…

- make careful observations
- identify continuous and discontinuous variation
- recall what a species is
- present data in an appropriate chart or graph
- recall what a hybrid is.

Table 1 shows the heights of a class of students. In Table 2, the heights have been divided into groups, 150–154 cm, 155–159 cm, etc.

Heights of Class 7X (cm)				
160	161	169	183	152
169	180	151	159	172
174	187	167	177	177
155	164	166	168	170
160				

Table 1

Heights groups (cm)	Number of students in each height group
150–154	
155–159	

Table 2

1 **a** Which type of variation do human heights show: continuous or discontinuous?

b Explain your reasoning for your answer to part **a**.

c Name *one* human feature that shows the other type of variation.

2 Make a copy of Table 2 and use the information in Table 1 to complete it.

3 Draw a bar chart to show this information. Label the axes.

4 **a** What shape is your chart overall?

b What sort of distribution does your chart show?

I can…

- identify continuous and discontinuous variation
- present grouped continuous data as a bar chart.

EXPLORING SCIENCE WORKING SCIENTIFICALLY 7 Da-9 Heights

Table 1 shows the heights of a class of students. In Table 2, the heights have been divided into groups, 150–154 cm, 155–159 cm, etc.

Heights of Class 7X (cm)				
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169	180	151	159	172
174	187	167	177	177
155	164	166	168	170
160				

Table 1

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b What sort of distribution does your chart show?

I can…

- identify continuous and discontinuous variation
- present grouped continuous data as a bar chart.

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Name _____ **Class** _____ **Date** _____

1 Tick *two* boxes for each habitat to describe the physical environmental factors.

a Desert habitat

☐ dry ☐ hot in the day ☐ not much light in the day ☐ wet

b Arctic habitat

☐ hot at night ☐ snowy ☐ cold ☐ wet

c Grass plains (savannah) habitat

☐ very cold ☐ lots of light in the day ☐ hot in the day ☐ wet

d Seashore habitat

☐ salty ☐ very cold ☐ dry ☐ windy

2 Complete these sentences using words from the box below.

Organisms have _____ so that they can survive the _____ factors in their _____. We say that the organisms are _____.

adapted	adaptations	environmental	habitats

3 A stickleback is a fish that lives in ponds. Write down *three* features that allow sticklebacks to survive in ponds.

i _____

ii _____

iii _____

4 **a** Polar bears and Arctic hares live in the Arctic. Why do they both have thick fur?

_____

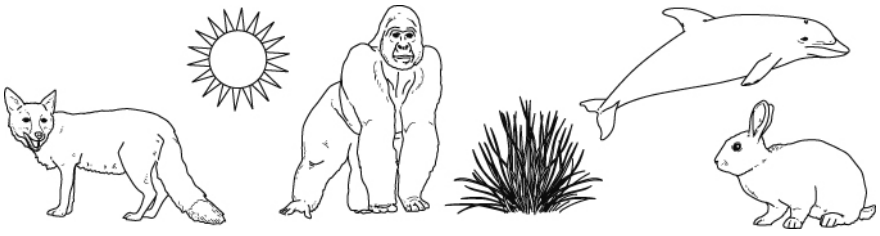
b Polar bears inherited their white fur. What does this mean?

_____

c How does their fur colour help these animals survive?

_____

5 Circle *all* the members in the same community as the rabbit.



I can…

- describe environments
- explain the adaptations of some organisms
- identify inherited features.

Your teacher may watch to see if you can:
- follow instructions carefully.

Aim

To find out whether duckweed plants can live in salty water as well as fresh water.

Prediction

1 **a** Write down whether you think duckweed plants can live in salty water.

b Why do you think this? Try to give scientific reasons if you can.

Method

Apparatus
- 3 large beakers
- about 60 duckweed plants
- tap water
- weak salt solution (3 g/litre)
- strong salt solution (30 g/litre)

⚠ Wash your hands after handling duckweed.

A Half fill the beakers – one with tap water, one with weak salt solution and one with strong salt solution.

B Place about 20 duckweed plants in each beaker.

C Place all the beakers in a warm, light place.

D Look at your beakers each day and record carefully what happens in each beaker. You may need to top up the beakers with water.

Recording your results

2 Describe carefully what happened to the duckweed plants in:

a the tap water

b the weak salt solution

c the strong salt solution.

Considering your results/Conclusion

3 Do your results agree with your prediction? If not, say what is different.

4 Plants that can cope with some salt are called ‘salt tolerant’. Do you think duckweed plants are salt tolerant, slightly salt tolerant or not at all salt tolerant? Explain your reasoning.

I can…
- make a prediction
- make careful observations
- record results clearly.

Name _____ **Class** _____ **Date** _____

Habitat name

_____

Members of the community of animals and plants

_____

_____

_____

_____

Environment

Mainly wet or dry? _____

Temperature: _____

Amount of light during the day: _____

Weather: _____

Problems for animals and plants living in the habitat: _____

_____

_____

_____

_____

Adaptations of animals and plants for survival

_____

_____

_____

_____

_____

_____

I can…

- recall examples of habitats and communities
- describe environments
- explain the adaptations of some organisms.

Adaptations for tree living


You are going to find out what adaptations grey squirrels and woodpeckers have for living in woodland habitats. You are going to use this information to make notes for a short presentation about these animals, called 'Adaptations for living in trees'.

Here are some subheadings for the sections of your presentation. First, write out the subheadings in the order that you will cover them in your talk. Then do your research, adding notes for each subheading.

Where do woodpeckers live?

Why do grey squirrels have the adaptations that they have?

What adaptations do grey squirrels and woodpeckers have that are the same or similar?

Why do woodpeckers have the adaptations that they have?

Where do grey squirrels live?

I can…

- make and organise notes for a presentation
- explain the adaptations of some organisms.

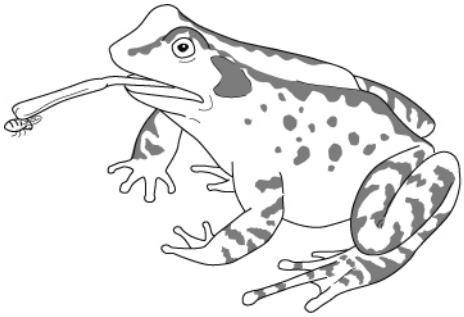
Here are some statements that students have found while researching the adaptations of grey squirrels and woodpeckers. Use the statements to make notes for your presentation.

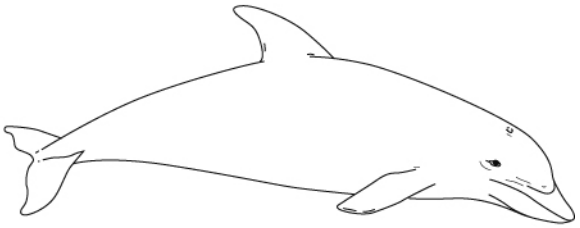
Woodpeckers peck holes in trees to build their nests and find insects to eat.	They have very long tongues to reach inside holes and get insects.	Their grey-brown colour does not show up against tree trunks.
They have spongy shock-absorbers in their heads.	They have sharp, curved toes (some pointing forwards and some pointing backwards) for clinging to trees.	They have sharp, chisel-shaped teeth for cutting into hard nuts.
They have long bushy tails for balance.	Grey squirrels build nests (called dreys) in trees.	When the sun goes down, they head back to their dreys for protection.
They have sticky tongues to trap insects.	They have eyes on the side of their heads so they can spot danger all around them.	They have a special third eyelid that moves across the eye each time they peck.
Their teeth grow all their lives because they are ground away quickly by eating hard nuts.	They have strong, long back legs for leaping.	Their beaks grow all their lives because they are worn away quickly by pecking at wood.
They have eyes on the side of their heads so they can spot danger all around them.	They have beaks shaped like chisels for cutting away hard wood.	They have sharp, curved claws for gripping tree trunks.
They spend the nights in their nests, protected from animals that might attack them.	Their nostrils are covered with fine feathers to stop wood chips getting in their beaks.	They bury nuts in the ground to use as a store of food in winter.

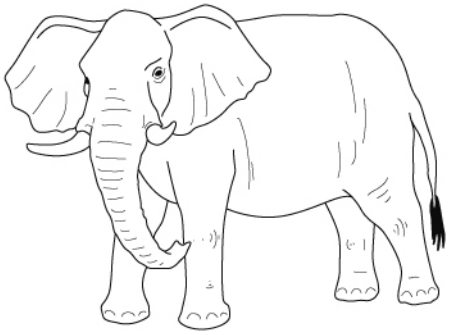
1 Throw a die and use the result to choose *one* of the animals below.

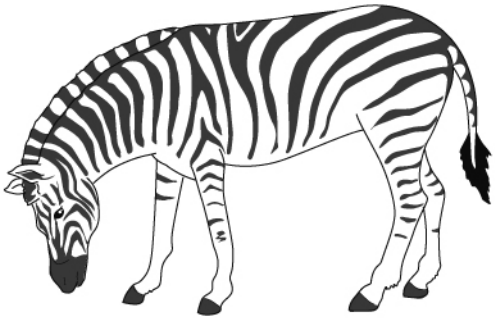
2 For your chosen animal, carry out some research and design a note card to give brief information about:

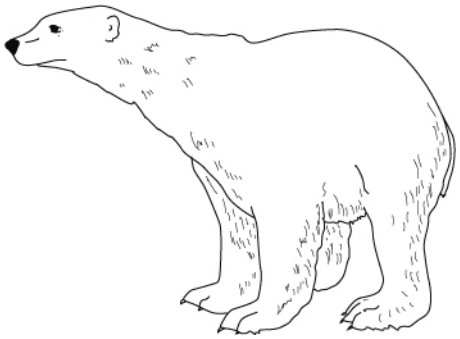
- the habitat it lives in
- what the environment of this habitat is like
- what adaptations this animal has for surviving in this habitat.

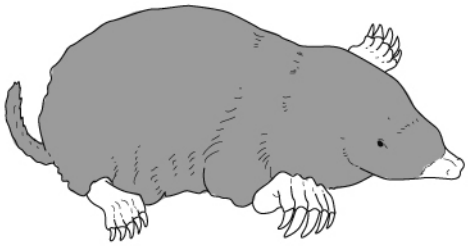












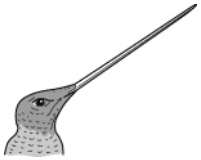
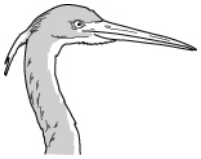
I can…

- make and organise notes
- explain the adaptations of some organisms
- describe environments.

Bird adaptations for feeding

Name _____ **Class** _____ **Date** _____

Different birds are adapted to feeding on different types of food by having beaks that are different shapes and sizes. Cut out the information boxes below. Organise them into groups of three – for example, a picture of a bird together with the name of its food and a description of its beak.

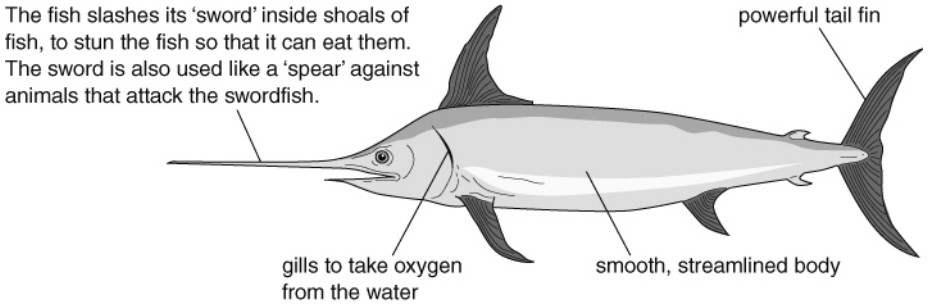
fish	**sparrow** 	A long thin beak allows the bird to dig for small animals.
flying insects	**eagle** 	A short, sharp and hooked beak is used to tear flesh.
fruit	**hummingbird** 	A very long, thin and delicate beak is used for probing the insides of flowers.
insects in wood	**parrot** 	A wide beak can be used like a sieve to strain tiny organisms out of the water.
meat	**duck** 	A wide, curved and sharp beak allows the bird to cut open its food and gnaw the inside.
nectar	**woodpecker** 	The beak is short, thick and strong to allow the bird to crush its food.
seeds	**curlew** 	The beak is wide and short, with bristles on it to help trap the bird's food.
small animals buried in mud	**heron** 	A long, sharp beak that can be used like a spear to stab animals to eat.
tiny water plants and animals	**nighthawk** 	The beak is shaped like a chisel and, like a chisel, it is used to chip away at wood.

I can…
- explain the adaptations of some organisms.

Name _____ **Class** _____ **Date** _____

1 Mammals are 'warm-blooded' and their body temperatures are kept constant and do not depend on their environment. Fish are 'cold-blooded' and the temperatures of their bodies change depending on how hot or cold their environments are.

Swordfish live in the ocean, and are often found at depths around 300 m where the water temperature can be very cold (as low as 3 °C) and it is very dark. At these temperatures the nervous systems of organisms work slowly and their eyes do not work very fast. Swordfish, though, have a muscle in their eyes that has a very special function: it produces heat and this keeps the temperature of a swordfish's eyes at about 20 °C. This allows the fish to see extremely well, even at cold temperatures.



a What habitat do swordfish live in? Circle the word in the passage above.

b In the passage, draw boxes around *two* physical environmental factors.

c Suggest *one* other physical environmental factor in this habitat.

_____

d Why is it important that swordfish have good eyesight in deep water?

_____

e In the passage, underline the adaptation of swordfish for living in deep water.

f Write down *two* adaptations that swordfish have for moving through water.

_____

_____

g Suggest another adaptation that swordfish have for living in water.

_____

h Whales are mammals. What adaptation do they have for having good eyesight in deep oceans?

_____

i Why do all swordfish have 'swords'? Use the word 'inherited' in your answer.

_____

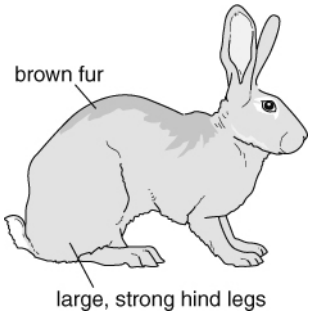
_____

I can…

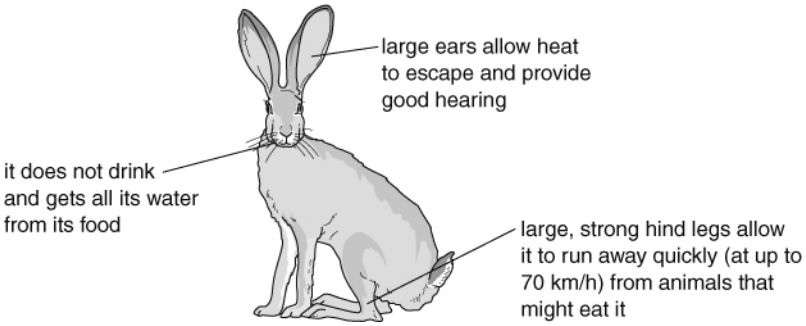
- describe environments
- explain the adaptations of some organisms
- identify inherited features.

Look at the drawings of the three hare species. One species lives in the UK.

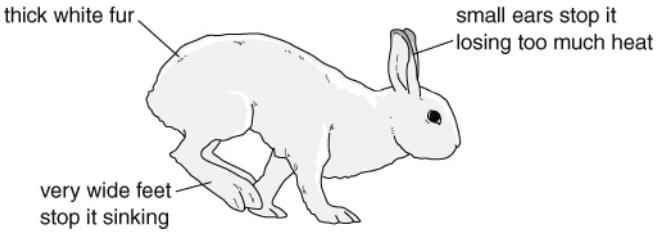
Hare A



Hare B



Hare C



1 Give *one* way in which there is variation between the three different species.

2 **a** Give *one* way in which the three hares vary between one another.

b How is this variation caused?

3 **a** Suggest the name of the habitat in which each species of hare might live. Give reasons for your choices.

b Suggest another member of the community for the habitat in which Hare **A** lives.

c Suggest *two* other parts of the ecosystem in which Hare **C** lives. (Remember that an ecosystem is the members of a community together with physical environmental factors.)

4 Draw a table to show the adaptations of each hare and how those adaptations help it to survive.

I can…

- describe environments, communities and ecosystems
- explain the cause of inherited features
- explain the adaptations of some organisms.

Searching for coelacanths

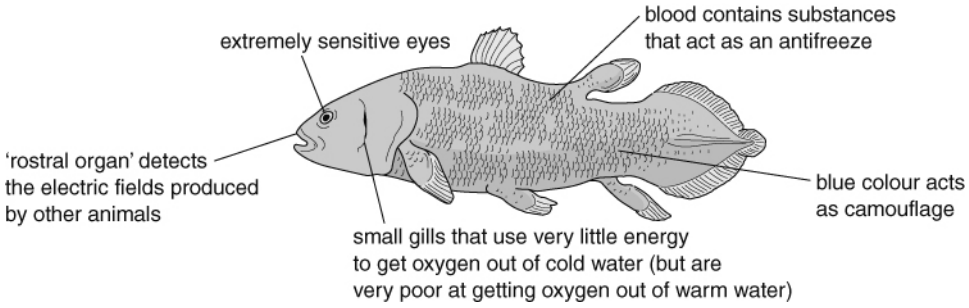
In the 1930s, Marjorie Courtenay-Latimer worked for a nature museum in East London, South Africa, collecting interesting specimens to put on display. She made friends with a local fisherman, Hendrik Goosen, who made a habit of inviting her aboard his boat whenever he returned to port, so she could examine the fish he'd caught (and take any that might be of interest).

On 22nd December 1938, she received a phone call from the dock manager to say that Hendrik's boat was about to dock. She was very busy preparing a display but thought that she should go and wish Hendrik a 'Merry Christmas'. So she took a taxi down to the dock to visit Hendrik's boat. She didn't have time to look at the fish but as she was about to leave she caught sight of a blue fin sticking up out of a pile of fish. "I picked away at the layers of slime to reveal the most beautiful fish I had ever seen," she later said. "It was five foot long, a pale mauvy blue with faint flecks of whitish spots; it had an iridescent silver-blue-green sheen all over. It was covered in hard scales, and it had four limb-like fins and a strange puppy dog tail."

She had no idea what it was but knew she must get it back to the museum as soon as possible. The taxi driver was not that keen on taking a 1.5 m long, stinky, slimy fish but eventually agreed. Back at the museum she couldn't find the fish in any reference books, so she decided to try to preserve the fish. She took it to the morgue … but they refused to keep it. The cold storage facility also refused to have it. So she wrapped it up in a sheet, which she borrowed from her mother, soaked in a liquid called formalin (which is used to preserve things). She made a quick sketch and then posted this to a university lecturer, J. L. B. Smith, to ask what it was. However, he was on holiday and as the fish started to rot, Marjorie was forced to get it gutted and stuffed.

When Dr Smith finally saw Marjorie's sketch, he knew exactly what it was: a coelacanth ('***see**-la-canth'*), a fish that was thought to have been extinct for 65 million years! Dr Smith spent the next 14 years searching for another coelacanth and finally found one for sale in a market on an island off the coast of Africa. The first live one was brought to the surface in 1998 but died within a few hours. The first time that divers found and filmed the fish in the wild was in 2000.

We now know that coelacanths live at depths of between 90 and 200 m. They rest in caves, away from sharks, during the day and come out to feed at night.



1 Describe the ecosystem in which coelacanths live.

2 Make a list of all the coelacanth's adaptations and explain how each one allows it to survive.

3 **a** The 'distribution' of an organism describes the places in which the organism lives in a habitat. Some organisms have an 'even distribution' and are found throughout a habitat. Others have an 'uneven' distribution and are only found in certain areas of a habitat. Is the distribution of coelacanths even or uneven? Explain your reasoning.

b Explain how the adaptations of a coelacanth control its distribution.

I can…

- describe environments, communities and ecosystems
- explain the adaptations of some organisms
- explain how adaptations limit distribution.

Name _____ **Class** _____ **Date** _____

1 Tick the boxes to show whether each feature is inherited or environmental variation.

Feature	Inherited	Environmental
Scar on the face		
Earring		
Eye colour		
Haircut		
Ear shape		

2 Fill in the missing words using the words from the box below.

daily	factors	nocturnal	seasonal

Changes in environmental _____ during a 24-hour period are called _____ changes. For example, most owls rest during the day and are active at night. These owls are _____. Changes during a year are called _____ changes.

3 Draw lines to link each organism with how it changes as the environment changes. Then draw lines from the changes to the correct reasons.

Organism	Change	Reason for change
oak tree	hibernates	to find food in the winter
dormouse	migrates	to match its surroundings
rabbit	loses its leaves in winter	so it does not have to eat when there is little food in winter
ptarmigan	comes out at night	so there are less animals around that would attack it
hedgehog	grows thicker fur	to help keep it warm in winter
swallow	changes its colour	to stop it losing water when the water in the ground is frozen

I can…

- describe how environmental variation can be caused
- explain the adaptations of some organisms for daily and seasonal changes.

Fertiliser and algae 1

Name _____ **Class** _____ **Date** _____

Your teacher may watch to see if you can:
- carefully add the right amounts of the different liquids.

Aim

You are going to investigate whether adding fertiliser to pond water makes algae grow better.

Introduction

Algae are tiny organisms that live in pond water. You can only see them using a microscope, but the more there are, the cloudier the water is.

Hypothesis

The growth of algae depends on the amount of fertiliser.

Prediction

1 a Read the method below. Which beaker do you think will become the most cloudy?

_____

b Why do you think this?

_____

Method

Apparatus
- 3 beakers
- liquid fertiliser
- measuring cylinder
- pond water
- pipette

⚠ Wash your hands after handling pond water.

A Take three beakers of the same size.

B Add the same amount of pond water to each beaker.

C Use the pipette to add 1 drop of fertiliser to one beaker, and 2 drops to another. Do not add any fertiliser to the third beaker.

D Leave your beakers in a well-lit area.

E Write down why this is a fair test. _____

_____

_____

Recording your results

2 For how long did you leave your experiment? _____

3 **a** Which beaker became the most cloudy? _____

b Which beaker became the least cloudy? _____

Considering your results/Conclusions

4 **a** Did your results match your prediction? _____

b Explain what has happened in the beaker that became the most cloudy.

_____

_____

_____

Evaluation

5 **a** What do you think would happen if you left your experiment for longer?

_____

b What do you think would happen if you tried another beaker containing 20 drops of fertiliser?

_____

6 **a** What could you do to make this experiment better?

_____

_____

_____

b Explain why your suggestion would make the experiment better.

_____

_____

_____

_____

_____

I can…

- carry out a fair investigation
- make a prediction using scientific ideas
- draw a conclusion
- evaluate a method.

Fertiliser and algae 2

Name _____ **Class** _____ **Date** _____

Your teacher may watch to see if you can:
- carefully add the right amounts of the different liquids.

Aim

You are going to investigate whether adding fertiliser to pond water makes algae grow better.

Introduction

Algae are tiny organisms that live in pond water. You can only see them using a microscope but the more there are, the cloudier the water is.

Hypothesis

The growth of algae depends on the amount of fertiliser.

Prediction

1 Read the method below and make a prediction about how the cloudiness of the water will be affected by the fertiliser.

Method

Apparatus
- 3–4 beakers
- pond water
- liquid fertiliser
- pipette
- measuring cylinder
- piece of white paper

⚠ Wash your hands after handling pond water.

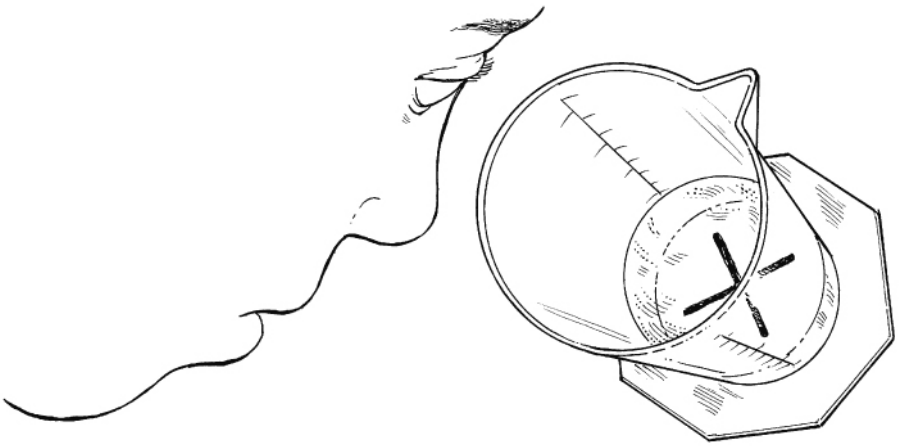
A Fill each beaker with the same amount of pond water.

B Do not add any fertiliser to one beaker. Add a different number of drops of fertiliser to each of the other beakers. Record how many drops you add to each one.

C Place your beakers in a light, warm place.

D On the piece of white paper, draw an 'X' using a thick pencil or marker pen.

E After your algae have grown, put a measuring cylinder on top of your 'X'. Slowly fill the cylinder with water from one of your beakers, until the 'X' just disappears. Write down how much water was needed to make the 'X' disappear. Then repeat the measurement with water from your other beakers.



Recording your results

2 Why does the 'X' disappear as you add the pond water?

3 Draw a table to show how much of each pond water was needed to make the 'X' disappear.

4 Draw a graph or chart to display your results.

Considering your results/conclusions

5 What is the effect of adding fertiliser?

6 Do your results match your prediction? If not, explain how they are different.

Evaluation

7 What do you think would happen if you left your experiment for longer?

8 What do you think would happen if you added even more fertiliser?

9 **a** How could you improve this experiment?

b Explain why your idea in part **a** would improve the experiment.

10 Try to find out what substances are in the fertiliser that cause the effects you have seen.

I can…

- carry out a fair investigation
- make a prediction using scientific ideas
- present data using an appropriate chart or graph
- draw a conclusion
- evaluate a method.

Beech leaves

Name _____ **Class** _____ **Date** _____

Your teacher may watch to see if you can:
- take samples of leaves carefully
- work out an area using squared paper.

Aim

You are going to investigate whether the leaves on a beech tree all have about the same area.

Introduction

Plants use their leaves for photosynthesis. The chloroplasts in the cells trap sunlight and use it to power photosynthesis, which makes food for the plant. Plants that grow in the shade often have bigger leaves than plants that grow in the sun, so that they can absorb as much light as possible.

You are going to survey a tree, called a beech. There are many different species of beech tree that can grow in the UK. The drawings below show four of them.

1 Do you think the variation between these different species is inherited or environmental?

Hypothesis

The size of a beech leaf depends on the amount of sun it receives.

Prediction

2 Make a prediction. Do you think there will be a difference between beech leaves that are inside the tree and those which are on the outside? Explain your reasoning.

Method

Apparatus
- a beech tree!

⚠ Wash your hands after handling leaves.

A In your group, form a ring around the tree so that all of you are equally spaced out.

B Walk directly towards the tree trunk and pick one leaf from outside of the tree. Do not pick one of the young leaves from the end of a branch because they may not have finished growing. Pick the fourth leaf down a branch but make sure that it's a leaf that is in the sun.

C Now walk further towards the tree trunk and pick another leaf from inside the tree, from somewhere that is shady. Again, pick the fourth leaf down on a branch.

D Use the grid below to estimate the area of your leaves. Put each leaf on the grid and draw around it. Then count the number of squares that your leaf covered at least half of. Do not count squares that your leaf did not cover at least half of.

Recording your results

E Record the areas of both your leaves and pool your results with the rest of the class.

F Calculate the mean area of leaves grown in shady conditions compared with those grown in sunny conditions.

Considering your results/Conclusions

3 **a** Is there a difference between the two sorts of leaves?

b If there is a difference, is it inherited variation or environmental variation?

4 Do your results match your prediction? If not, explain how they are different.

5 Try to explain your results using scientific knowledge.

Evaluation

6 How would measuring more leaves help you to be more sure of your conclusion?

I can…

- make a prediction using scientific ideas
- draw a conclusion
- evaluate a method.

Name _____ **Class** _____ **Date** _____

The table shows some physical environmental factors that change. Tick the correct columns to show whether these factors change daily or only change with the seasons (some factors may have ticks in both columns). Then fill in the last column to show what humans do to cope with these changes.

Change	Daily change	Seasonal change	Example of how people cope with the change
length of daylight			
temperature out of doors			
amount of rain			
amount of snow			
wind			
height of tide			

I can…

- describe some daily and seasonal changes.

Name _____ **Class** _____ **Date** _____

1 Look at these pictures.

in summer in winter

a Complete the table to show how physical environmental factors change.

Physical factor	How it changes from summer to winter
temperature	
light	

b How is a rabbit adapted to winter?

_____

c Name another animal that has adaptations to survive winter.

_____

d How is this animal adapted to survive winter?

_____

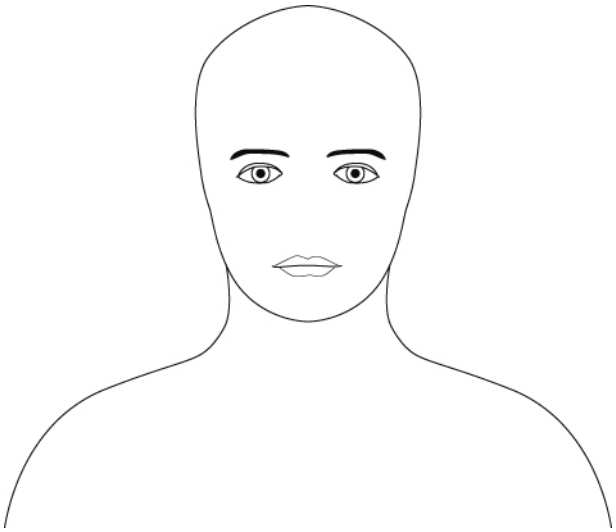
2 **a** Plants often drop their leaves in autumn. Name *one* plant that does this. _____

b Name *one* change in the environment that may cause this. _____

c Is this an example of a daily change or a seasonal change? _____

3 **a** Draw in the following features on the outline body:

naturally curly hair, a scar on the face, small nose, an earring, trendy clothes, lobes at the bottom of the ears



b Which are examples of environmental variation? Label them on your drawing.

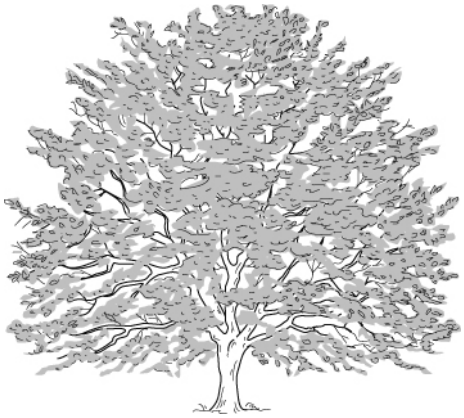
c What environmental factor causes someone to wear trendy clothes?

_____

I can…

- describe how environmental variation can be caused
- explain the adaptations of some organisms for daily and seasonal changes.

1 Look at these hawthorn trees.



a State *one* example of environmental variation between the trees.

b Suggest what physical environmental factor caused the variation.

c Hawthorn trees are deciduous. What does this mean?

d Explain why being deciduous helps the trees.

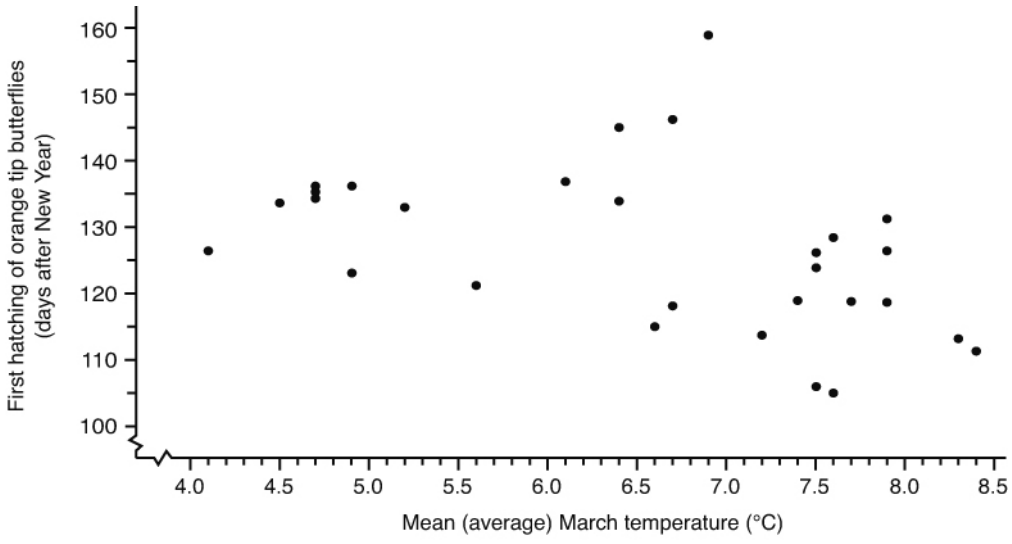
2 Caterpillars turn into butterflies inside cocoons. The warmer it is, the faster they turn into butterflies and the sooner they hatch from their cocoons.

a State *one* physical environmental factor that changes from winter to spring.

b How does it change?

c How do butterflies react to this change?

d From the graph, state the relationship between the mean March temperature and the time the butterflies hatch.

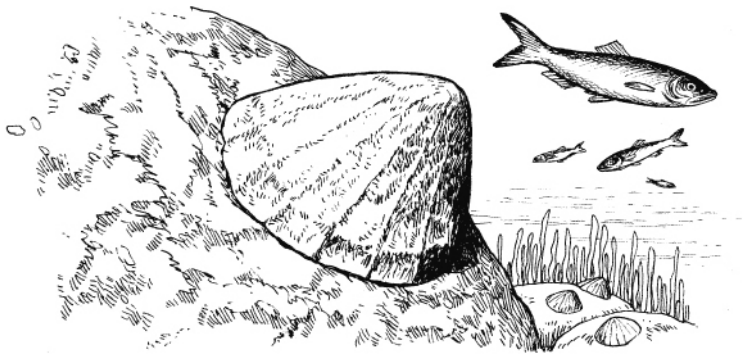


Hatching of orange tip butterflies compared with the mean March temperature.
Data collected by Anne Phillips, Walsall. Supplied by UK Phenology Network.

e How might global warming affect the time when these butterflies hatch?

f Explain your answer to part **e**.

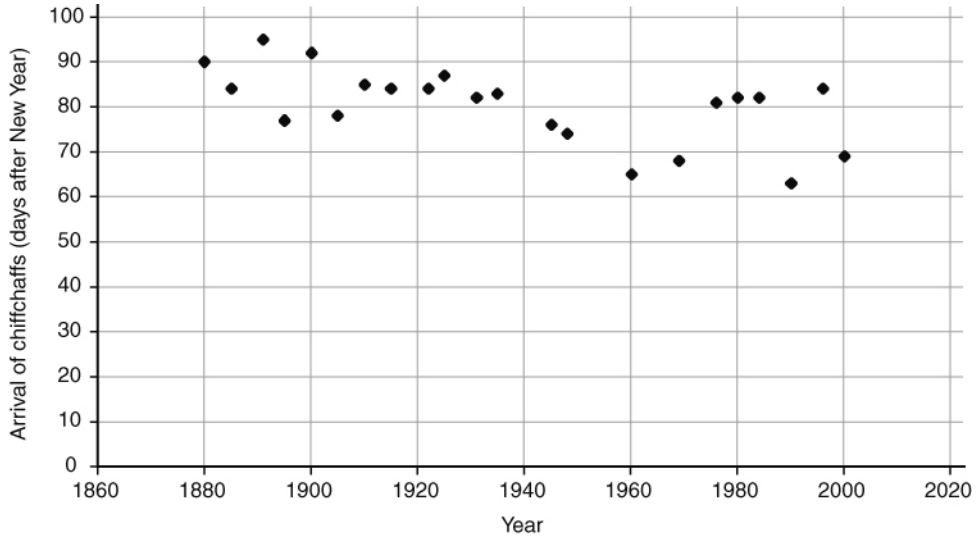
3 The drawing shows a limpet. Limpets live on rocks near the edge of the sea.



a What problems does a limpet face when the tide goes out?

b How is a limpet adapted to cope with these problems?

4 Chiffchaffs are birds that travel from North Africa to the cooler UK in time for summer. This scatter graph shows their time of arrival over the years.



Yearly arrival of chiffchaffs in Hertfordshire.

Data from Hertfordshire Natural History Society.

a What is this yearly travelling of animals called?

b Suggest why chiffchaffs make this journey.

c What does the graph tell you about the time of the chiffchaffs' arrival over the last century?

d Why do you think this has happened? Explain your answer to part **c** in as much detail as you can. You may be able to make more than one suggestion.

I can…

- use scatter graphs to find relationships
- describe how environmental variation can be caused
- explain the adaptations of some organisms for daily and seasonal changes.

Animals are usually born with the ability to do certain things. Young birds open their beaks and chirp when they hear a parent bird approaching the nest. This behaviour does not have to be learned. It is said to be 'innate'.

As animals get older they learn things. Young chicks innately peck at things on the ground. They soon learn that some of the things that they try to eat do not taste very nice. They learn to recognise these things and avoid them in the future. This is called 'learned' behaviour. Learning helps animals adapt to new situations as they occur. It is often not possible to change innate behaviour.

There are different types of learning, but all learning is caused by environmental factors. Some learning is caused by trial and error. When a scarecrow is put in a field, birds avoid it. Soon, however, they learn that it is not dangerous and ignore it. Other learning is taught by parents. For example, young lions learn how to hunt by watching their parents.

Although we often think of birds 'learning to fly', experiments have shown that birds brought up in isolation from other birds have been able to fly without ever having seen another bird fly. Also, scientists have found that migratory birds brought up in isolation not only learn to fly but also start to migrate at the right time of year and in the right direction. Hibernation is also innate.

1 There can be differences in the innate behaviour of two members of the same species. Is this inherited variation or environmental variation? Explain your reasoning.

2 Which statements describe learning that has to be taught?

a saying the alphabet

b birds ignoring a scarecrow

c liking the taste of Brussels sprouts

d speaking a new language

e mice finding food in a maze

3 Write down whether each of the statements below describes innate or learned behaviour.

a chick pecking at the ground

b baby crying

c answering these questions

d swallowing food

e riding a bicycle

4 Give *one* reason why it is important for animals to learn things.

5 **a** Why do birds migrate?

b Suggest a benefit of migratory behaviour being innate.

c Suggest a drawback. Think about what would happen if a permanent change in the environment in some birds' winter feeding grounds meant that there was very little food.

6 **a** Suggest an innate behaviour that humans have to help them when it is cold.

b Suggest a learned behaviour that humans use to help them when it is cold.

I can…

- obtain relevant information from a text
- recall that behaviour can have inherited and environmental causes.

Name _____ **Class** _____ **Date** _____

1 Look at the resources in the box. Circle any that are needed by both plants and animals.

fertiliser	food	light	water

2 On Easter Island before 1600, some trees were eaten by insects, which were eaten by birds. Some of the birds were eaten by people. Here is a food chain that shows this:

trees → insects → birds → humans

a Name *one* predator from this food chain. _____

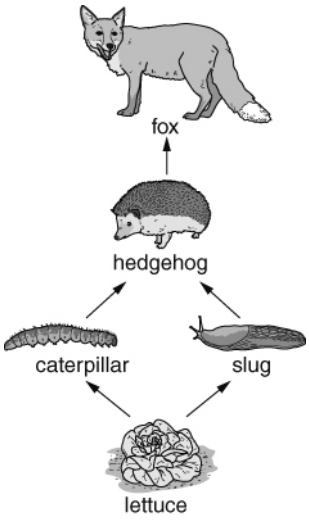
b What is that predator's prey? _____

c When the trees were cut down, why might the birds have had less to eat?

_____

d Why else do birds need trees? _____

3 Look at the food web.



a Complete this table by ticking the names of the organisms.

	lettuce	slug	caterpillar	hedgehog	fox
producer					
consumer					
herbivore					
carnivore					
top predator					

b What do slugs eat? _____

c Which *two* organisms are in competition with each other?

_____

d What are they in competition for?

_____

I can…

- interpret food chains and webs
- describe how organisms compete
- describe ways in which organisms affect their habitats and communities.

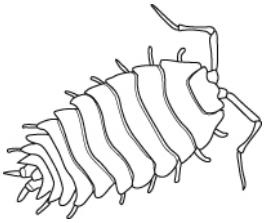
Your teacher may watch to see if you can:
- look for and handle woodlice carefully, without injuring them.

Aim

To discover the sorts of places where woodlice are most likely to be found.

Introduction

Woodlice are small animals that eat plants that are rotting.



Hypothesis

The presence of woodlice in an area depends on there being resources available for them.

Prediction

1 **a** Read the method below and then make a prediction. In what sort of places are you most likely to find woodlice?

b Why do you think this?

Method

Apparatus
- small soft paintbrush
- containers

⚠ Wash your hands when you have finished the investigation.

A Choose *two* different areas to look for woodlice in. You might choose two different piles of leaves, one dry and one wet. You could take some leaves from the top of a pile and others from the bottom, or you might measure out two squares on different types of ground. Your teacher may give you some other suggestions.

B If you are using leaves, you should collect the same volume of leaves from each place and count the woodlice in each. If you are looking for woodlice on the ground, you should make sure that the two squares are the same size. Only use a paintbrush to move woodlice. This will make sure that you do not harm them. Your teacher may show you how to do this.

Recording your results

2 What were the differences in the physical environmental factors between the two areas?

3 Make a neat table to show your results.

Considering your results/conclusions

4 How did you make sure this test was fair?

5 Draw a bar chart of your results.

6 Using your results, write down what sort of conditions woodlice like to live in.

7 Do your results agree with your prediction?

8 Why do you think woodlice like to live in the conditions you have identified?

I can…
- present data as a table and as a bar chart
- draw a conclusion.

This game is a model for how the populations of mice and owls change. Work in pairs. One person is going to look after some owls and the other is going to look after some field mice.

Preparation

Field mice: If you are looking after the field mice you need the map on Worksheet 7Dd-4. Draw 25 pencil crosses in the map squares to show where the field mice are (only one mouse is allowed in a square). Place your crosses randomly and do not show this to your partner.

Owls: If you are looking after the owls you need to draw a table like this:

Year	Number of field mice killed	Number of field mice killed per owl	Number of field mice left at end of year	Number of field mice for the start of next year	Number of owls for the start of next year
Start	–	–	–	25	2
1					
2					

Playing

There are two owls. The person with the owls has to guess where the field mice are by calling out the grid reference of a square on the map. If a mouse is in that square it is eaten and the pencil cross is rubbed out. Each 'year', *each* owl gets 10 turns to do this. So at the start of the game, the owls get to choose 20 squares. Every time a mouse is killed, a tally mark can be made in the 'number of field mice killed' column of the table.

Once the owls have called out all their squares for a 'year', work out the numbers of field mice killed per owl (total number of mice killed divided by number of owls). Owls and mice reproduce and die each year. At the end of each round ('year') of the game, adjust the numbers of owls and mice.

For the owls:

If the number of mice caught per owl is five or above you gain an owl.

If the number of mice caught per owl is below five you lose an owl.

For the field mice:

You gain one mouse for every five that you have left.

For each new mouse you get, add a pencil cross onto the map.

Continue playing until you have covered at least 10 years.

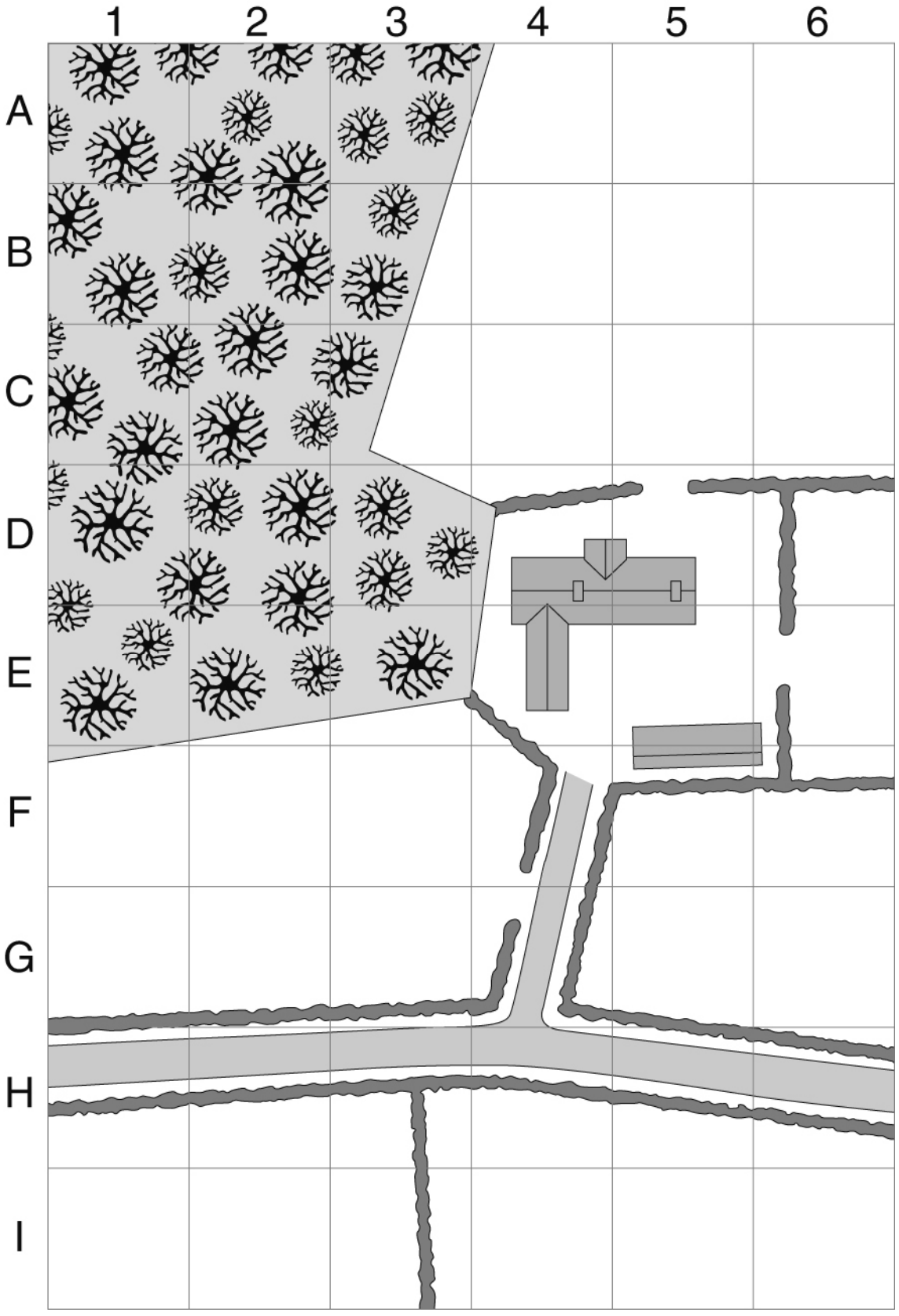
1 a Plot the figures from the table on a line graph. Show the numbers of field mice and owls on your same graph.

b What pattern do you notice?

c Explain why you see this pattern.

I can…

- use a model to show how changes in one population can affect another.



Building a food web

Many people have allotments where they can grow vegetables. A scientist studied an area of allotments near Newcastle-upon-Tyne and found these food chains:

peach tree → peach-potato aphid → swallow → sparrowhawk

potato plant → blister beetle → mole → badger

hosta plant → snail → thrush → cat

peach tree → peach-potato aphid → spider → blue tit → cat

potato plant → snail → badger

lettuce → rabbit → fox

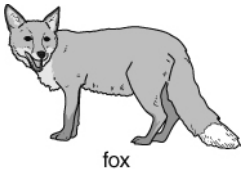
lettuce → peach-potato aphid → hoverfly larva → blue tit → sparrowhawk

potato plant → badger

1 Cut out the drawings below and arrange them to make a food web.

2 Write *one or more* of these words underneath each drawing:

carnivore	herbivore	omnivore	consumer	producer	top predator


fox


swallow


cat


potato plant


hoverfly larva


blue tit


hosta plant


mole


spider


peach-potato aphid


lettuce


snail


sparrowhawk


peach tree


thrush


rabbit


blister beetle


badger

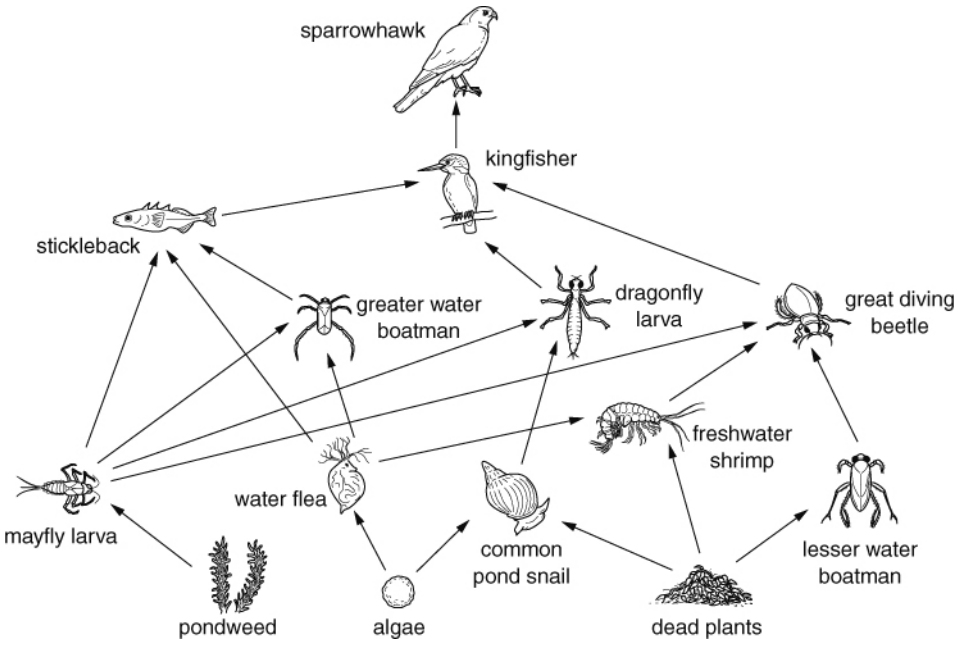
I can…

- interpret food chains and webs.

River food web

Name _____ **Class** _____ **Date** _____

Look at this food web from a river.



1 **a** Write out the longest food chain you can find in the food web.

b Label the organisms in your food chain to show whether they are carnivores, herbivores, omnivores, consumers, producers and/or top predators. You can use more than one term for each organism.

2 What are the prey for great diving beetles? _____

3 Apart from food, suggest something else needed by the following organisms in their habitats:

a common pond snail _____

b pond weed _____

4 **a** A greater water boatman is in competition with which organism? _____

b Why are they in competition? _____

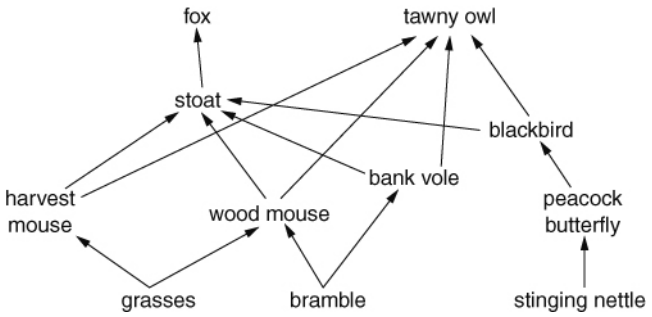
5 If all the pondweed died, suggest what effect this would have on the populations of mayfly larvae and lesser water boatman.

_____

I can…

- interpret food chains and webs
- describe how organisms compete for resources.

1 Look at this food web from farmland.



a Plants need light to grow. Suggest *two* other resources that they need from their habitat.

b Bramble plants and stinging nettles can grow in the shade. Grass plants need to grow in full sunshine. Suggest *one* place where you might find each plant growing on a farm, giving reasons for your choices.

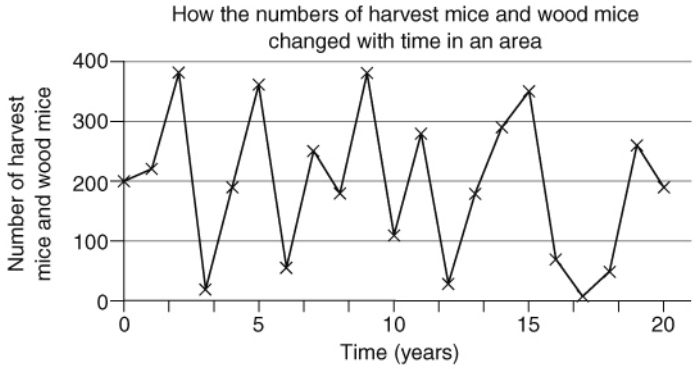
c How are stoats and tawny owls in competition with one another?

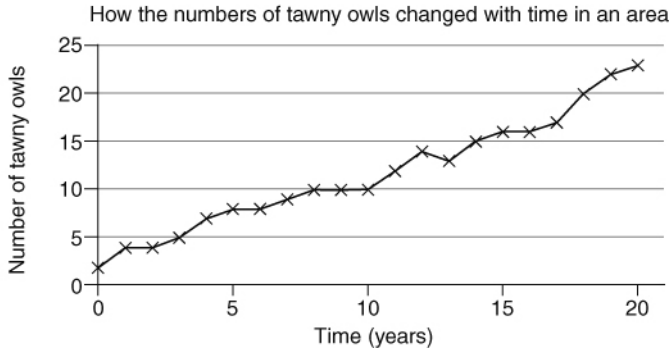
d Suggest *one* way in which stoats are in competition with bank voles, dormice, wood mice and foxes.

e If all the stinging nettles were cut down, what would happen to the population of blackbirds? Explain your reasoning.

f Suggest why the number of harvest mice might decrease if the farmer removed all the brambles. Explain your reasoning.

The graphs below show the populations of wood mice, harvest mice and tawny owls in the farmland habitat.

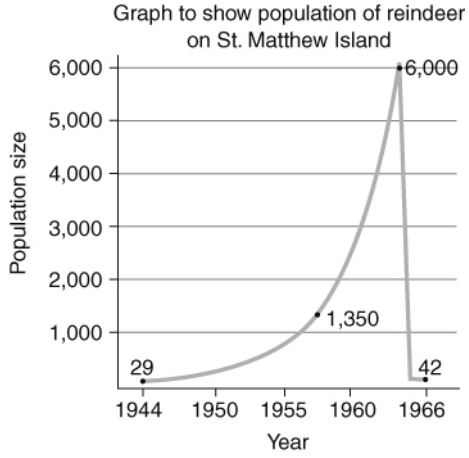


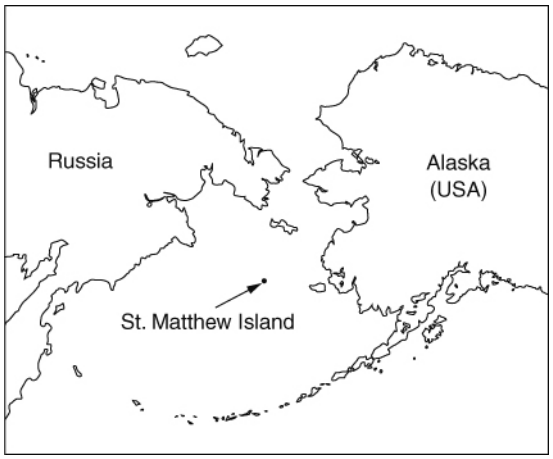


g Why would you expect the numbers of both wood mice and harvest mice to go up and down in the same way?

h What do the graphs tell you about the diet of tawny owls in this area?

2 Lichens are producers and provide the main food for reindeer, particularly in winter. In 1944 a radio station was set up on an island in the Arctic Circle, called St Matthew Island. The island was rich in lichens. In case food supplies could not be delivered to the island, 29 reindeer were brought to the island so that the workers would have food. The radio station was soon abandoned but the reindeer were left on the island. The population of reindeer quickly grew. However, in 1966 it was found that the reindeer were now eating sedge grass and the animals were underweight. After a very cold winter in 1963–1964, the population dropped to 42 (41 females and one infertile male). By the 1980s, there were no longer any reindeer on the island.





a Suggest how changes in the reindeer population affected the lichen population on St Matthew Island from 1944 until 1966.

b Suggest why the populations of reindeer in both Russia and Alaska were not as badly affected by the winter in 1963–1964 as the population on St Matthew Island.

c Explain why the reindeer were in competition with one another.

d The reindeer on St Matthew Island eventually died out after 1966. This was a result of which resource running out?

e Draw a food web for St Matthew Island when the radio station was still in operation.

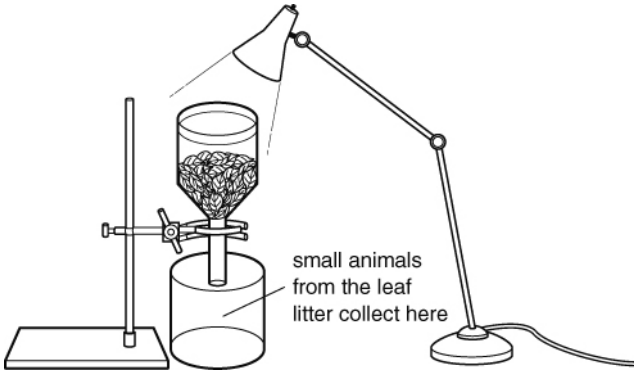
I can…

- describe ways in which organisms affect their habitats and communities
- describe how organisms compete
- interpret and use a food web to make predictions.

Leaf litter food web

Some rotting dead leaves were collected from a wood. The leaf litter was placed in the apparatus shown below (called a Tullgren funnel). The lamp was turned on and the apparatus was left for 24 hours. The organisms were then identified and counted. The results are shown in the table.

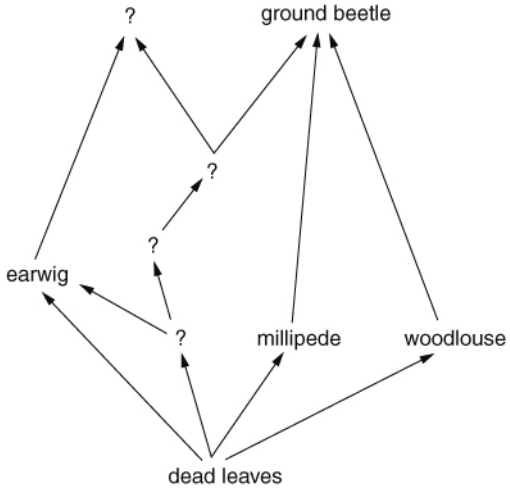
Name of organism	Number found
armadillo mite	102
centipede	2
ground beetle	2
hunting mite	36
spider	10



1 **a** Why do you think that the animals collect in the beaker?

b Suggest why this behaviour of the animals helps them to survive.

2 Think about how the numbers of the organisms change, as you move from the start to the end of a food chain. Copy and complete this food web, using the animals in the table.



3 All the hunting mites suddenly die.

a Suggest what effect this will have on the population of armadillo mites. Explain your reasoning.

b Suggest what effect this will have on the population of spiders. Explain your reasoning.

c Which do you think would be more affected by the death of the hunting mites: ground beetles or centipedes? Explain your reasoning.

4 Explain how *two* named carnivores in your food web are competing with each other.

5 A food web is a model to show the feeding relationships (what eats what) in a habitat.

a Suggest *one* way in which a food web is a better model of feeding relationships than a food chain.

b Suggest *one* reason why a food web is a poor model of the feeding relationships in a habitat.

I can…

- describe ways in which organisms affect their habitats and communities
- interpret and use a food web to make predictions
- describe how organisms compete
- evaluate food webs as a model.

Name _____ **Class** _____ **Date** _____

1 What do pesticides kill? Tick the *best* answer.

- ☐ all small animals
- ☐ animals that harm things that humans want to use
- ☐ bees
- ☐ slugs and other small animals that damage garden plants

2 What do the arrows in a food chain show? Tick the *best* answer.

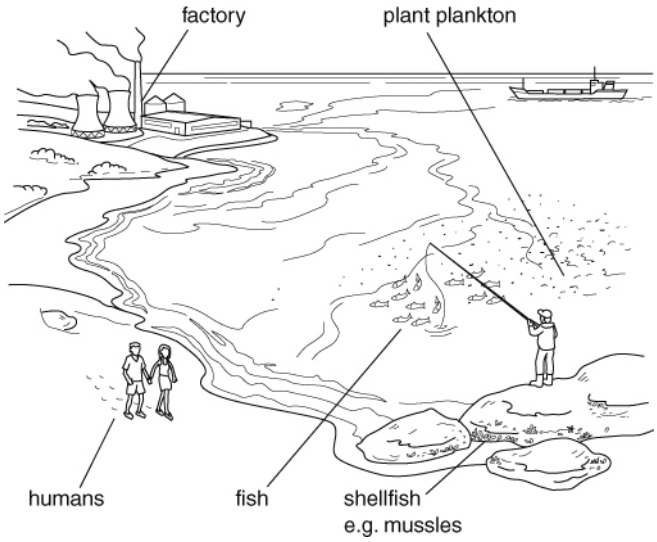
- ☐ which way the organisms go
- ☐ what eats what
- ☐ what different organisms eat
- ☐ increasing size of organisms
- ☐ the direction in which energy flows in the food chain

3 Write down *one* way that an animal loses some of the energy it gets from a plant.

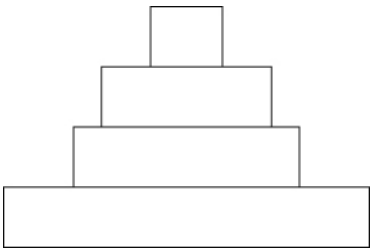
_____

4 The drawing shows Minamata Bay in Japan.

a Draw a food chain below using all the organisms labelled in the picture.



b Write the names of the organisms from your food chain on the pyramid of numbers on the right.



c In the 1950s a plastics factory was putting poisonous mercury into the sea. Which of the following explains why 70 people living around the bay died? Tick the correct box.

- ☐ The mercury was not destroyed inside the fish and people ate lots of fish and so ate lots of mercury.
- ☐ People drank the sea water and so lots of mercury got into their bodies.
- ☐ The mercury soaked into people's bodies when they went swimming in the sea.

I can…

- describe how energy is lost in food chains
- recall what pesticides do
- interpret pyramids of numbers.

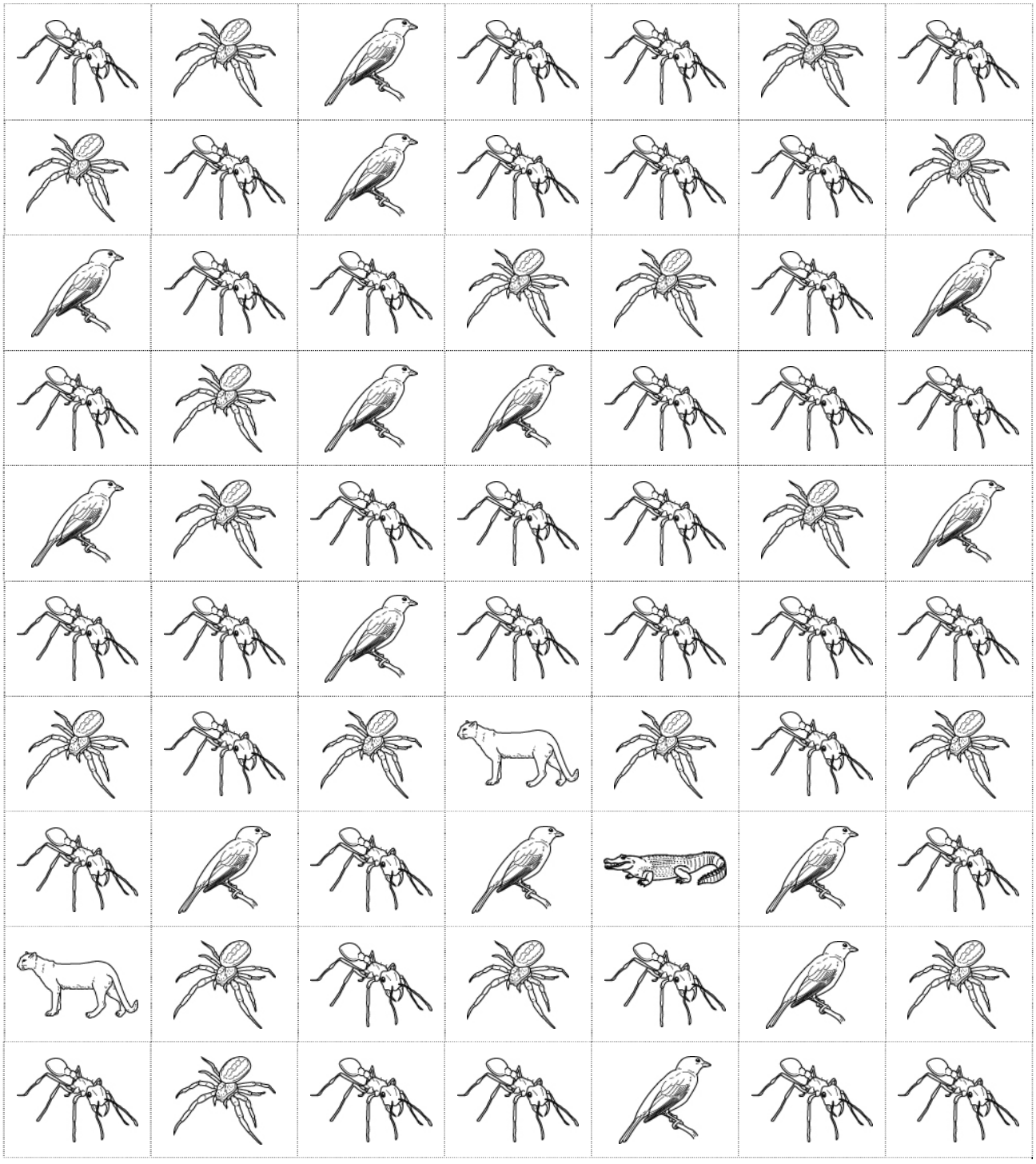
Working out food chains

During a trip to an area of the Amazon rainforest, scientists found black caiman (a type of crocodile), blue-grey tanager birds, janguarundi (cats), orb-weaver spiders and leaf-cutter ants that were busy stripping the leaves from a Brazil nut tree. Drawings of their findings are shown below.

Use the information to sketch a pyramid of numbers and a food chain for the organisms. Write a brief paragraph to explain why you have put the organisms in the order that you have.

I can…

- describe how energy is lost in food chains
- draw pyramids of numbers.



Pesticides and birds

The cut-out cards below give some information about the effects of DDT on wild bird populations. Cut out the cards and put together the evidence in the correct order to explain what happened to the birds.

I can…

- explain how human use of chemicals in agriculture can damage food webs.

DDT can alter the behaviour of birds, sometimes preventing them from building proper nests.

DDT can cause birds to lay eggs with thinner shells. As a result more eggs are likely to be broken.

The populations of many wild birds have decreased over the last 30 years.

DDT is absorbed by tiny organisms in the water called plankton.

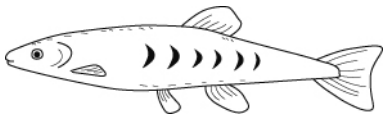
In large amounts DDT can be poisonous to birds.

DDT may cause wild birds to become infertile (unable to reproduce).

Any pesticide in the plankton gets into the fish.

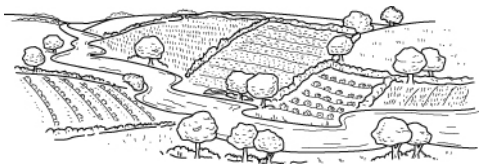
DDT builds up inside the fish.

Fish eat many plankton organisms.



Concentration of DDT: 1.2%

Some of the pesticide is washed into lakes and rivers.



Concentration of DDT: 0.00005%

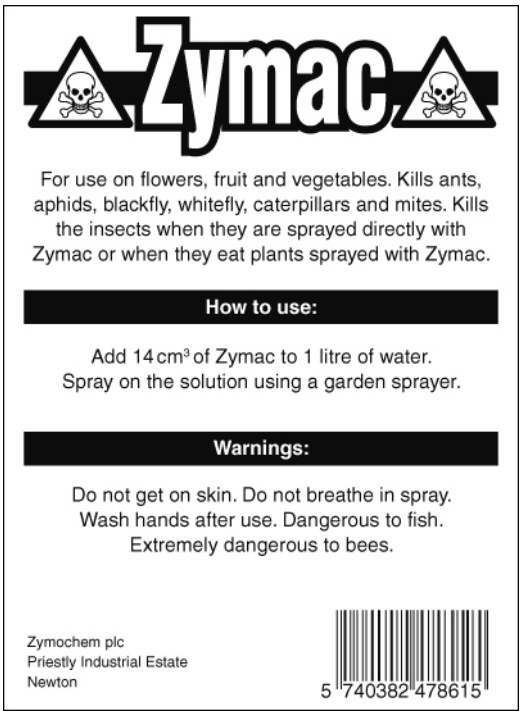
Many wild birds, such as osprey and heron, eat fish.

Concentration of DDT: heron 3.5%, osprey 14%

A pesticide (DDT) is sprayed over fields of crops to kill insect pests.

Name _____ **Class** _____ **Date** _____

The picture shows the back of a packet of pesticide. A pesticide is a chemical that kills pests. Pests are organisms that harm plants that we want to grow.



1 Why do farmers and gardeners use pesticides?

2 What does Zymac kill?

3 Using pesticides can harm other organisms that people do not want to harm. What other organisms can Zymac harm?

4 What safety precautions should a gardener take when using Zymac?

5 Look at the following food chains.

X: lettuce → rabbit → fox

Y: rose bush → aphid → ladybird

Z: pondweed → tadpole → stickleback

a What do the arrows in a food chain show? Use the word ‘energy’ in your answer.

b As you go up a food chain, the numbers of organisms get fewer and fewer. Why is this?

c For each organism in each food chain, say how it is affected by spraying Zymac. Give a reason for each answer.

I can…

- describe how energy is lost in food chains
- explain how human use of chemical substances can damage food webs.

There were many adverts at the end of the 1940s that looked like this:

Wonderful DDT now for homes!

For the last few years farmers have been using an amazing new pesticide to combat those troublesome insects that eat our food. And you can too!

Now the incredible insect-killing powers of DDT come to you in a handy spray.

It's completely safe – and good for use all around your home and garden!

Use it on your children's hair – yes it's safe!

Use it when growing flowers, tomatoes and potatoes!

Use it on pets!

1 What is a pesticide?

2 Suggest the name of one pest that DDT was used for.

3 Some food crops today are grown 'organically'. This means that they are grown without the use of most manufactured pesticides. Suggest one advantage and one drawback of organic farming.

4 How would DDT have been 'good' for the organisms mentioned in the advert?

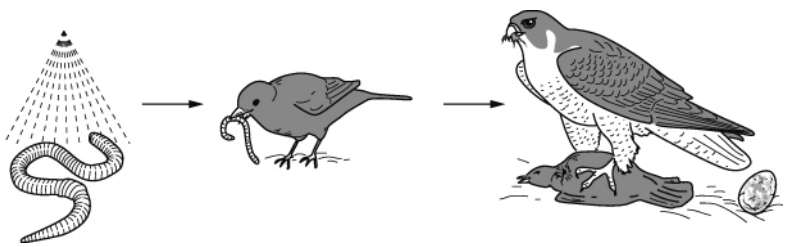
5 When DDT was first sold, some scientists said that the fact that it was 'persistent' (does not break down in nature) was a good thing. Why do you think they thought this? (*Hint*: Think about how long a crop grows for and what would be the effect of a pesticide that broke down too easily.)

6 Suggest one advantage and one drawback of using persistent pesticides such as DDT, which we know about today.

7 Design an advert explaining why people should not use DDT today. You could use the drawing below as part of your advert.

I can…

- explain how human use of chemical substances can damage food webs.



1 Here is a food chain ending with a heron:

algae → water flea → stickleback → trout → heron

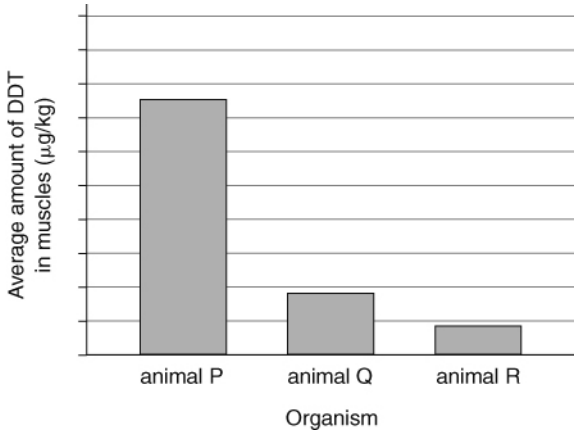
a What do the arrows in a food chain show?

b Sketch a pyramid of numbers for this food chain.

c Explain why your pyramid of numbers is this shape.

d Using your pyramid of numbers to help you, explain why herons used to die from the effects of the persistent pesticide DDT but trout did not.

2 The bar chart shows the amounts of pesticide found in the muscles of three woodland animals in a particular area.



a Of the three animals shown on the bar chart, which is most likely to be:

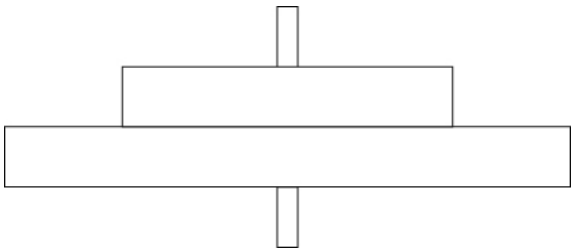
i a top predator

ii a herbivore?

b Sketch a pyramid of numbers for these organisms with 'leaves' as your producer.

3 DDT is a pesticide that has never been used in Antarctica. However, the chemical is found in the muscles of penguins. Explain why you think this is.

4 Look at the pyramid of numbers below and suggest why it is not a pyramid shape.

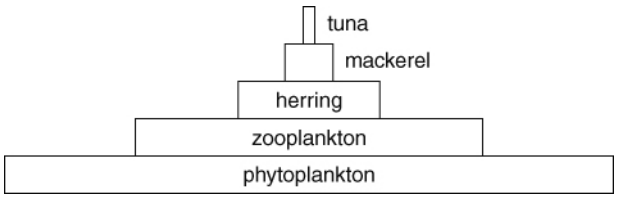


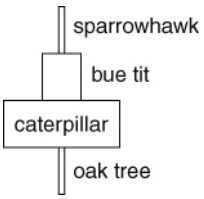
I can…

- explain how human use of chemical substances can damage food webs
- describe how energy is lost in food chains
- draw pyramids of numbers.

Each level on a pyramid of numbers is called a trophic level. Animals that are on the same level in two different pyramids of numbers are said to be at the same trophic level. The lowest trophic level is that of 'producers'. The next one up is the first level of consumers. They are called primary consumers. Above them come secondary consumers and above them are tertiary consumers. As you go up through the trophic levels, the amount of energy available is less and less. This means that each trophic level usually supports fewer and fewer organisms.

Pyramids of numbers do not take into account the *size* of the organisms. A better way of showing this is to use a pyramid of biomass. This shows the actual *mass* of material at each trophic level. A sample is taken and the masses of the different organisms are measured. This often involves drying the organisms in an oven to get rid of all the water. How wet or dry the weather is can affect how much water is found inside an organism. This would affect the biomass and might make the measurement inaccurate. So biomass is a measure of the *dry* mass of material at each trophic level.





1 Only about 10% of the chemical energy in an organism's food is used for growth. What happens to the remainder?

2 Draw food chains for the two pyramids of numbers above.

3 Draw a table to show the trophic levels of all the organisms in the two pyramids of numbers above.

4 Explain the shapes of the two pyramids of numbers above.

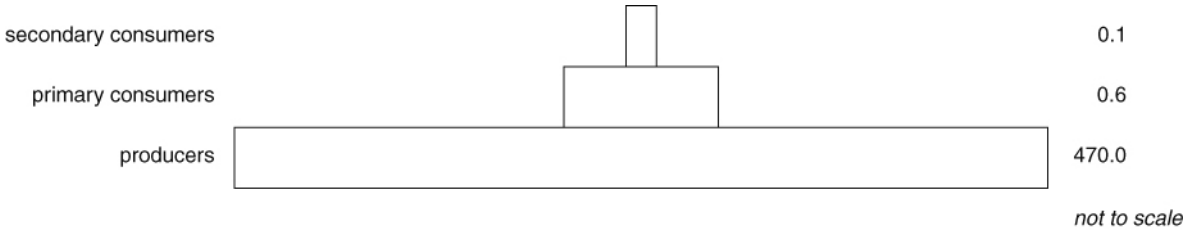
5 **a** What does the word 'biomass' mean?

b Sketch pyramids of biomass for each of the pyramid of numbers above. You do not need to add any figures, just draw the shapes.

6 To work out a pyramid of biomass, the dry masses of the organisms are used. Why?

7 The biomass of an oak tree changes during the course of a year. Why is this?

8 The diagram below shows a pyramid of biomass for a field. The units are g/m^2. Describe what this pyramid tells you in as much detail as you can.



9 Describe the advantages and disadvantages of using pyramids of biomass compared with pyramids of numbers.

I can…

- describe energy transfers using food chains, pyramids of number and pyramids of biomass
- identify trophic levels.