

Living Things

Chapter 6

CONTEXT AREA

- Our Earth is teeming with life. No one knows how many different types of living things there are. New types are being discovered all the time. There are perhaps 10 million different types of living things.
- To learn more about living things, scientists have sorted them into groups. Each group is different, and they have names like birds and reptiles and insects. Some living things have not been studied very well, and they have not been placed in a group.
- What are the groups of living things? How are they organised? How can you find the group name? How are living things different to each other?
- Why is it important that there are so many different living things?

PRESCRIBED FOCUS AREAS

- 4.2 use examples to illustrate how models, theories and laws contribute to an understanding of phenomena
- 4.3 identifies areas of everyday life that have been affected by scientific developments

DOMAINS

KNOWLEDGE AND UNDERSTANDING

- 4.8 describes features of living things
- 4.8.2 classification to
- a classify living things according to structural features and identify that they have patterns of similarities and differences
 - b identify a range of plants and animals using simple keys
- 4.8.4 a identify that there is a wide range of multicellular organisms

SKILLS

- 4.16 accesses information from identified secondary sources

- 4.17 evaluates the relevance of data and information
- 4.18 with guidance, presents information to an audience to achieve a particular outcome

VALUES AND ATTITUDES

- 4.26 recognises the role of science in providing information about issues being considered and in increasing an understanding of the world around them
- 4.27 acknowledges their responsibility to conserve, protect and maintain the environment for the future



CONCEPTS

What is life?

Features of living things

Variety of life

Sorting into groups

Why people classify

Classifying insects

Using keys

Making a key

Using a key

Kingdoms of living things

Details of the five big groups of living things

The plant kingdom

The variety of plants

Importance of plants

The animal kingdom

The variety of animals

Importance of animals

The fly

Looking inside the body of this active animal

Vertebrates

Details of this group of animals

Biodiversity

How vertebrates are divided into groups

Why is biodiversity important?



6.1

What is life?

Life is the name given to all the living things we know. Living things come in many shapes and sizes. The world's largest animal, the blue whale, can weigh 118 tonnes. The tallest tree ever measured was more than 120 metres tall. The smallest living thing is too small to see with the best microscope in your school. Some bacteria live for only 20 minutes before dividing into two. The oldest living thing, a bristlecone pine, is 4600 years old. A coral reef, built by tiny coral animals, might be 1500 km long.

This chapter is about looking at the variety of living things. There are many unusual and strange living things. Here are just a few.



The axolotl's name means 'water monster'. It breathes through its feathery gills



Mushrooms are a type of fungus



Coral reefs are made of hard skeletons formed by millions of coral polyps. Coral is really two organisms living together – the coral polyp (an animal) and an algae (a microscopic water plant)



Common sea dragon

Features of living things

Living things can be very different to each other. Surprisingly, living things are more alike than they are different. What do living things have to do to be living? They need to:

- 1 Take in chemicals from outside them. Animals eat food, while plants make their own food from water, air and sunlight. Both plants and animals take in gases from the air.
- 2 Use food to make themselves grow. Our food is digested in our stomachs, then absorbed into our bodies. This process is called assimilation.
- 3 These processes make wastes. All living things need to dispose of their wastes.
- 4 Living things grow. Puppies and kittens grow into dogs and cats. Seeds grow into plants.
- 5 Respond to changes around them. Worms avoid salty soil. Most trees grow so that their leaves face the Sun.
- 6 Be able to reproduce their own kind. Crabs have baby crabs, and elephants have baby elephants.



Cow and calf

There are some non-living things that do some of these things. Robots respond and use energy, but they cannot grow or reproduce. Crystals growing in a solution use chemicals to grow, but are not living. A fire takes in chemicals, uses substances to make energy, can grow in size, produces waste, and reproduces (by sparks). Yet a fire is not a living thing.

There is one important addition to make to the list:

7 All life is made of cells, and each cell is controlled by the chemical called deoxyribonucleic acid, or DNA. DNA controls life.

Cells are the tiniest bits of life. They are in all living things. Some living things are made of only one cell. People are made of billions of cells which all work together as a team.

An organism is any living thing. Organisms include all the plants, animals and other living things which live with us on the Earth.

CHECKPOINT:

COPY AND COMPLETE

What does a _____ thing have to do to be _____?

- 1 Take in _____ from outside them.
 - 2 Use _____ to make them _____. This process is called _____.
 - 3 Dispose of their _____.
 - 4 Living things _____.
 - 5 Respond to _____ around them.
 - 6 Able to _____ their own kind.
 - 7 All life is made of _____, and each cell is _____ by the chemical called _____.
- Cells are the _____ bits of _____. Cells are in _____ things. Some living things are made of _____ cell.
- People are made of _____ of _____ which all work _____ as a team.
- An _____ is any living thing. Organisms include all the _____, _____ and all the other living things which _____ with us on the _____.

QUESTIONS

- 1 What is the meaning of the following words: assimilation, respond, reproduce, DNA, cells?
- 2 What is an organism? How are organisms connected to cells?
- 3 A fire has some of the features of a living thing. Looking at items 1 to 6 in the Copy and Complete section, which of these features could describe fire as a living thing? Explain them one at a time.



A caecilian looks like a worm

RESEARCH QUESTIONS

There are some strange living things. Research one living thing, and write a short description of it. A drawing or diagram is needed. Describe it on an A4 sheet of cardboard so it can be displayed in your room. Some ideas are: coelacanth, peripatus, giant squid, mountain ash, cunjevoi, sequoia, Wollemi pine, gastric brooding frog, caecilian, platypus, rattlesnake, lamprey, hydra, grass-tree.



After a fire, grass-trees grow back and send up huge flower-spikes



6.2

Sorting into groups

Biologists have sorted living things into groups. Sorting into groups is called classifying. Each group has a group name, and that group name tells us about it. Most people don't know what a frogmouth is. If you knew that it belonged to the group called birds, or belonged to the group of birds called owls, you would have a good idea what a frogmouth was. You would know that it had feathers on its body and laid eggs because all living things in the group called birds do this. You would know that it hunted at night and ate small animals because all birds in the group called owls do this. The owls are a subgroup of the bigger group called birds.

Classifying living things enables us to sort them into groups, and give each group a name. Even

the subgroups have names. The owls are part of the bigger group called birds. Birds are part of the bigger group called vertebrates, and vertebrates are part of the bigger group called animals.

When biologists first classified living things, they used the most important features. The colour of the animal, its size, and where they live is not as important as the type of skin covering, or the method of reproduction, or whether the animal has bones or not. People, emus and kangaroos all stand on two legs. They are classified into different groups because of differences in their skin covering and method of reproduction. These criteria are more important than how these animals stand up.

EXPERIMENT

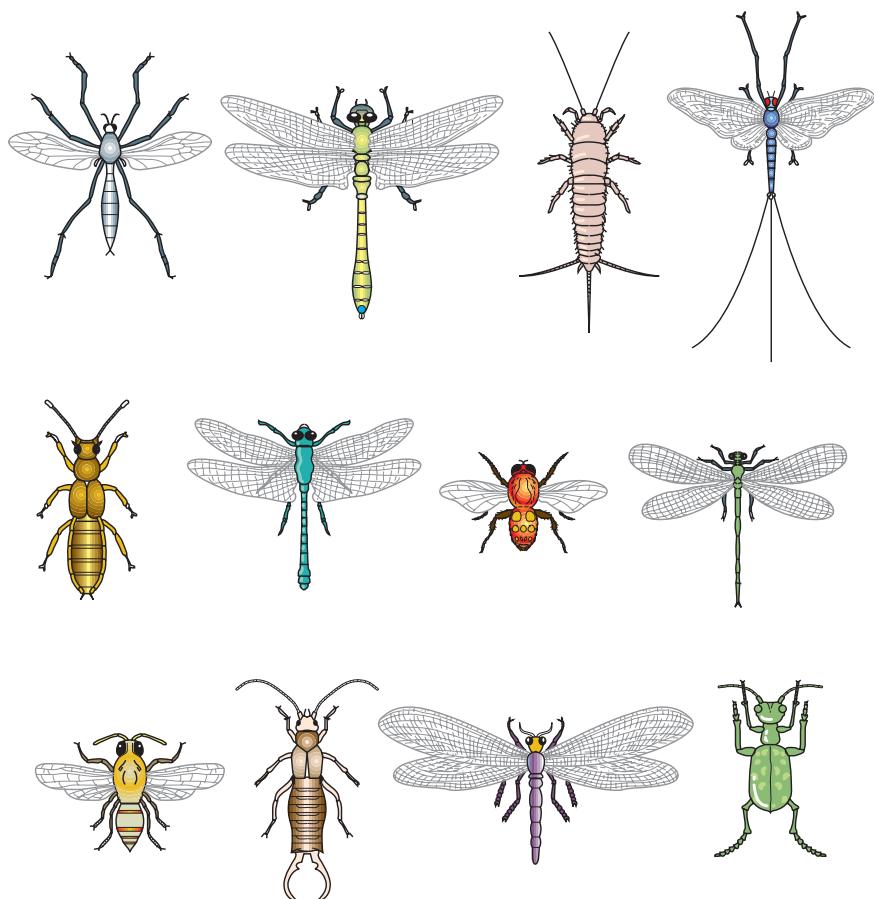
AIM: To make your own classification system

Your teacher will photocopy the drawing of insects at the back of this book. Cut them out and move them around on your desk.

Working on your own, sort them into groups based on some aspect of their appearance. Write a reason for your classification.

Then join with a friend, and compare your classifications. Between you, can you think of other classifications? Then join with another pair to make a group of four, and compare your classifications again. Elect a spokesperson to report to the class on your classifications.

Is any one type of classification better than any other?



Classifying living things

All living things have been divided into five groups: animals, plants, fungi, monera and protista. These are called kingdoms, and they are the biggest groups of living things. They are explained in Activity 6.4.

Each of these kingdoms is divided into smaller groups. These groups are divided into smaller groups of living things which are even more alike. These groups are divided again. And divided again. In the end, the smallest groups of living things are very similar to each other. They are called species.

A species is a group of organisms that look similar to each other. When they breed, their offspring are fertile (in other words, they can also breed). Domestic cats belong to the one species because they can interbreed and have kittens. Within the domestic cat species there are many types, called breeds, such as Burmese, Siamese, Manx and Chinchilla.

Binomial names

Each living thing is given its own two-word name. This is called its binomial name, or scientific name. The two names are group names. The second word is the species name, and the first word is the name of the next bigger group called genus. The genus name starts with a capital letter. The second word is the species name and it does not have a capital letter. The binomial name for the household cat is *Felis domesticus*, and a dog is *Canis familiaris*, and a human is *Homo sapiens*. Notice that the binomial name is always written in italics (sloping letters).

There are over 500 000 organisms which have a binomial name. And no two names are the same. You would think that all the names would be long and hard to say. Some genus names are short, such as *Mus* for mouse, *Apis* for bee, and *Poa* for a type of grass. Others are familiar to us, such as *Gorilla*, *Eucalyptus*, *Asparagus*, and *Hippopotamus*.

CHECKPOINT:

COPY AND COMPLETE

Biologists have sorted _____ things into _____. Sorting into _____ is called _____. Each group has a _____, and that group _____ tells us about it.

All living things have been _____ into _____ groups: _____, _____, _____, _____ and _____. They are called _____, and they are the biggest _____ of _____ things.

Each of these _____ is divided into _____ groups. These _____ are divided into _____ groups of living _____ which are even more _____.

A species is a _____ of _____ that look _____ to each other. When they _____ their offspring are also _____ (in other words, they can also _____).

Each living thing is given its own _____ name. This is called its _____ name, or _____ name. The binomial name for a _____ is *Homo _____*.

QUESTIONS

- 1 What is classifying? Why do people classify things?
- 2 What is meant by 'binomial name'? What is the binomial name of a cat and dog?
- 3 What is the meaning of species and hybrid?
- 4 The binomial name of a lion is *Panthera leo*, and a tiger is *Panthera tigris*. Are a lion and tiger in the same species? Are these animals alike?
- 5 All household cats belong in the one species. Why is this?
- 6 What is the odd one out in each of the following lists?

- a cow, goat, sheep, shark
- b bean, egg, pea, spinach
- c tiger, lion, grasshopper, panther
- d fox, cat, budgerigar, dingo

- 7 What is the difference between a breed and a species in dogs?
- 8 Why is the binomial name used in scientific papers, instead of the common name?
- 9 Explain which two types of plants are most similar:
 - a *Acacia saligna*
 - b *Eucalyptus saligna*
 - c *Eucalyptus robusta*

6.3

Using keys

How would you find the name of a strange plant or animal you had not seen before? How would you find out which group it belongs to? You would use a key. A key is a chart or table which allows us to identify and name living things.

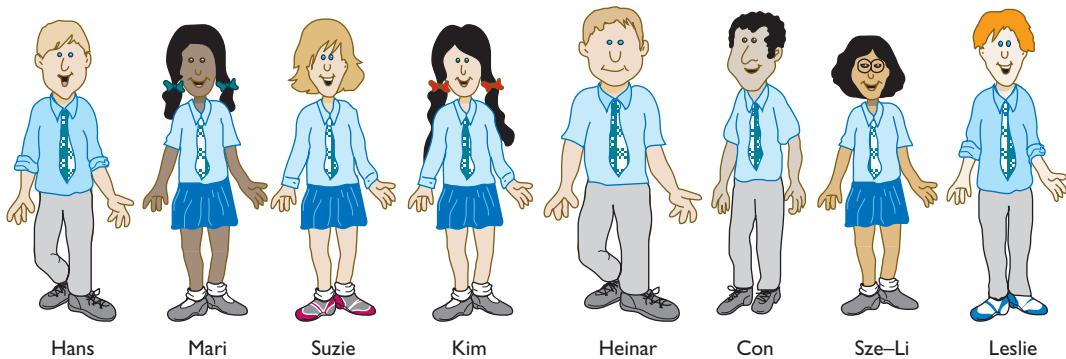
Learning about keys

It is the day of the school photographs. The students below are the school Mixed Indoor Hockey Team, and their photograph is shown below. The key lets you identify each of the team members. Mari, for example, is the girl with her hair tied in pony tails, and wearing a short sleeve blouse.

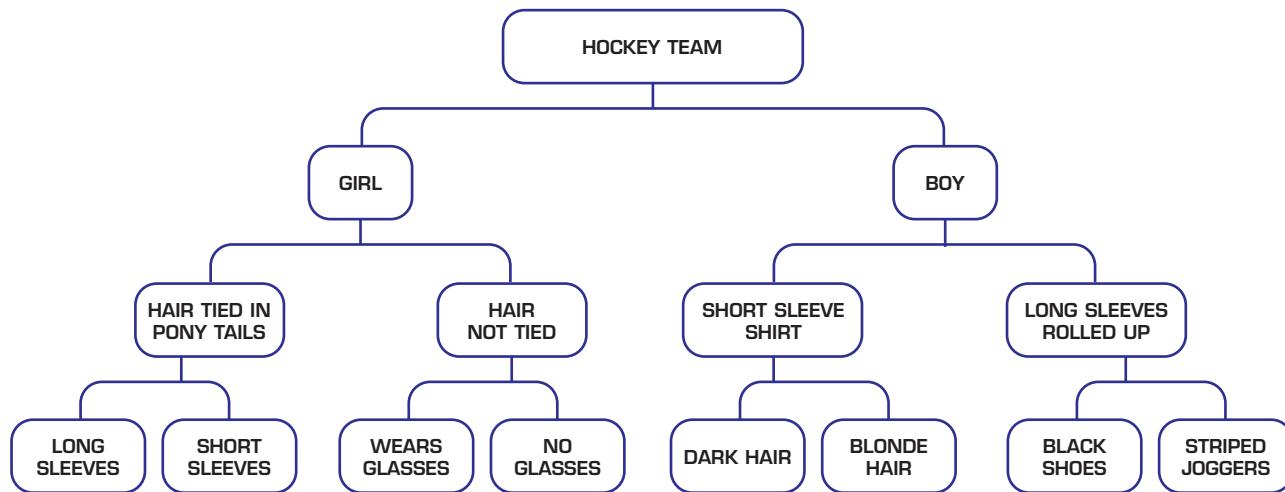
Can you identify the other team members from their drawings? There is Suzie, Leslie, Con, Heinar, Sze-Li, Kim and Hans. And of course Mari.

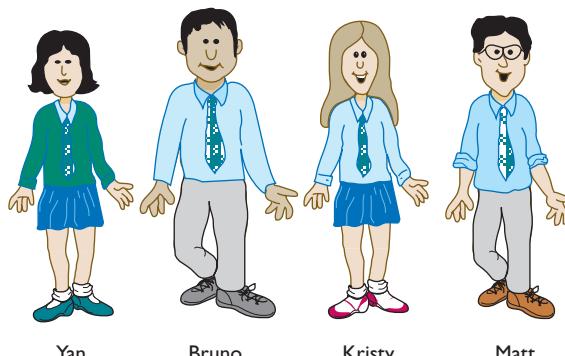
This key only works for these students. If the team changes, the key must change as well.

Look at the four new team members: Yan, Bruno, Kristy and Matt. Using the key, both girls appear to be named Suzie and both boys are named Hans. A larger and newer key is needed to include these four new team members.

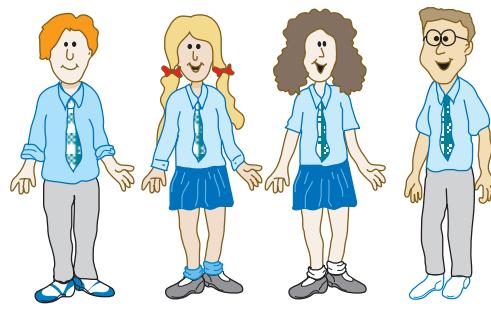


The hockey team





Some new players



More new players

EXPERIMENT**AIM: To make your own key**

When you are designing a key, use special or distinctive features. Being tall or short, or having dark blonde hair or light brown hair, could be confusing to other people using your key. Use features which everyone agrees on—sleeve length, ribbons in hair, colour of socks or shoes, glasses or no glasses, jumper or no jumper, and so on—to make a key for the students in your class.

Another team

The coach, Mr Harding, decides to form another team when four more students join. The second team consists of Yan, Bruno, Kristy, Matt, Nikos, Stacey, Rochelle and John. Draw a key to name each team member.

Your key may not be exactly the same as someone else's key. This is because you used different features when writing your key.

Another type of key is written in words. It follows the 'If...go to...' format. For example:

If a boy player, go to 2

If a girl player, go to 5

Sometimes these statements are shortened.

This is the type of key that you commonly see in reference books, field guides, and other publications that allow you to identify unknown species and objects. An example of this type of key is set out below.

Using a key

Key to the hockey team

- 1** Boy player — go to 2
Girl player — go to 5
- 2** Short sleeve shirt — go to 3
Long sleeves rolled up — go to 4
- 3** Dark hair = CON
Blonde hair = HEINAR
- 4** Black shoes = HANS
Striped joggers = LESLIE
- 5** Hair tied in pony tails — go to 6
Hair not tied — go to 7
- 6** Long sleeves = KIM
Short sleeves = MARI
- 7** Wears glasses = SZE-LI
No glasses = SUZIE

CHECKPOINT:**COPY AND COMPLETE**

A key is a _____ or _____ which allows us to _____ and _____ living things.

When you are designing a key, use _____ or _____ features.

Your key may not be exactly the same as someone else's _____. This is because you used different _____ when writing your key.

QUESTIONS

- 1** What is a key?
- 2** Which features are best to use in making your own key? Name some.

- 3** Draw a key showing items of laboratory equipment. Include these items of equipment: tripod stand, Bunsen burner, gauze mat, 50 mL beaker, 150 mL beaker, 100 mL measuring cylinder, 10 mL measuring cylinder, 500 mL beaker, 500 mL measuring cylinder, retort stand, clamp and boss head.

6.4

Kingdoms of living things



Kingdoms are the largest groups of living things. All the living things on Earth have been classified into five kingdoms. The classification is made on the type of cell, and how the organisms obtain their food. The five kingdoms are monera, protista, fungi, plants and animals.

monera Monera includes all the bacteria and cyanobacteria, because their cells are very simple. They are all microscopic in size. They are important because they cause diseases, but most people don't know that the benefits of bacteria far outweigh any bad points. Monerans are studied using powerful microscopes.

protista The Protista are microscopic organisms which have only one cell. Their cells are more advanced, being like our body cells and not the cells in bacteria. Protists can be seen with a light microscope like you may have in your school. You will need a more powerful microscope to get a clear view of them. Protists live in stagnant water and damp places. A few of them cause diseases.

fungi Some fungi look like small plants, but they are not. Plants make their own food. Fungi feed on dead things, and have an important role in recycling. Fungi reproduce differently to plants, and can live in the dark. Some native Australian animals eat only fungi.

plants Plants have the green chemical called chlorophyll in their leaves so they can make their own food. All plants need sunlight for the energy in their food. Plants are eaten by animals, and those animals might be eaten by other animals. So really, most of the food for all animals comes from plants.

animals Animals live by eating the food they need to stay alive. Animals live in many environments, and some are fast moving so they can catch their food.

Some organisms do not fit into one kingdom. They have characteristics of many groups. Biologists select the most important features and place the organism into the kingdom with those features.

Euglena ('you-gleen-ah') is a microscopic organism which can make its food like a plant and eat food like an animal. It moves like a microscopic animal. Since it is microscopic, some biologists consider it to be a protist. Euglena fits into three kingdoms—plant, animal and protist.

A lichen ('lie-ken') is not one organism, but two living together. A lichen is an alga (a simple plant) growing with a fungus. They rely on each other so much that if the alga dies, the fungus dies too. The alga makes the food, and the fungus provides a place to live and some of the nutrients. Is a lichen a plant, or fungus, or both?

A Bacteria cannot move by themselves

B Amoebas are single-celled organisms that can change shape as they move and feed

C Fungi feed on dead plants and animals. They reproduce from spores produced in the gills or pores underneath.

D Flowering plants reproduce by pollination of their flowers

A slime mould is an unusual fungus-like organism. It can move around like a protista. Like a fungus, it feeds on dead things. Its cells are merged together and not separated as in fungi. A slime mould could fit into the fungi kingdom or the protista kingdom.

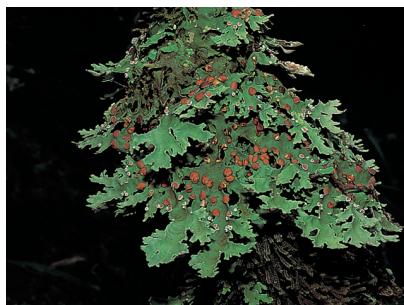
Some life has been found in volcanic springs of boiling hot water. Biologists have also found life at the deepest parts of the ocean. Some animals spend their entire life in caves or inside other living things. Some bacteria have been discovered in boiling volcanic springs, in the ocean depths, inside solid rock and high in the atmosphere. A few bacteria do not even use the same chemical processes as all the other life on Earth. The more that people study life and living things, the more fascinating and bizarre are the things that they are discovering.



Jellyfish live in salt water and kill their prey by stinging them. Some are dangerous to humans.



Euglena contains chlorophyll and moves by wiggling its tail, called a flagellum



A lichen is a fungus and an alga growing together



Slime moulds are protists, and they are not always slimy

CHECKPOINT:

COPY AND COMPLETE

All the living things on Earth have been divided into five _____. The five kingdoms are _____, _____, _____, _____, and _____.

Monera includes all the _____ and _____. They are all _____ in size.

_____ are microscopic organisms which have only ____ cell.

Some _____ look like small plants, but do not make their own _____. They feed on _____ things.

Plants can _____ their own _____.

Animals live by _____ the _____ they need to stay alive.

Some organisms do not fit into one kingdom. Three examples are _____, _____ and _____ mould.

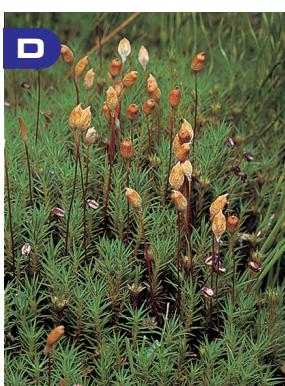
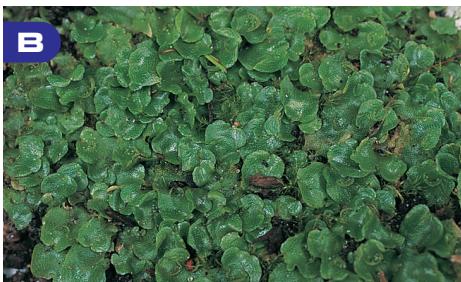
QUESTIONS

- 1 A green spider is classified as an animal, even though it is green like all plants. Why is a spider classified as an animal?
- 2 Bracket fungi grow on dead tree trunks. How do these fungi obtain their food?
- 3 Some seaweed is brown. When you put it in hot water, the brown colour dissolves into the water and the seaweed becomes bright green. Which kingdom does brown seaweed belong to, and why?
- 4 Monera and protista are both microscopic. Why are they placed in different kingdoms?
- 5 Biologists classify an alga as a plant, even though it might be microscopic like a protist. Why is an alga considered to be a plant?
- 6 Lichen is unusual because it contains a fungus and is green like a plant. Explain.
- 7 Coral was mentioned in Activity 6.1. How is coral like lichen?
- 8 Why is euglena an unusual living thing?
- 9 If explorers from Earth ever visit distant planets where there is no light, is it likely that they will find green plants like on Earth? Explain.
- 10 Is it true that plants are solar-powered? What about animals: are they solar-powered as well? Are humans solar-powered?
- 11 If you were looking for signs of life on another planet (such as Mars), which kingdom(s) of living things would you be most likely to find?



6.5

The plant kingdom



A Ferns produce spores from special sacs called sori on the underside of the leaves **B** Many liverworts are fleshy, like this rare *Treubia* species **C** Sugar cane, where most of our sugar comes from, is a type of grass **D** New moss plants grow from spores released when capsules dry out and split **E** Most palm trees grow in wet forests and rainforests, but some can survive in very dry areas if there is water nearby

Plants are living organisms which can make their own food. They contain a green chemical called chlorophyll. This enables them to use solar energy to make their food. Food has energy stored in it. Many plants move their leaves to face the Sun, and some have flowers that close at night. Plants do not have much movement when compared to animals.

The plant kingdom is divided into different groups. Each of the big groups is called a division. The five important divisions, and their characteristics, are shown in the chart.

Importance of plants

Plants are essential to our survival. They provide us with food, oxygen and other materials.

food All our food comes from plants, or from animals that have eaten plants. Some food plants are wheat, rice, corn, and fruits and vegetables. Some plants produce oil, such as sunflower, canola and olives. Grasses such as lucerne and rye are grown as food for farm animals.

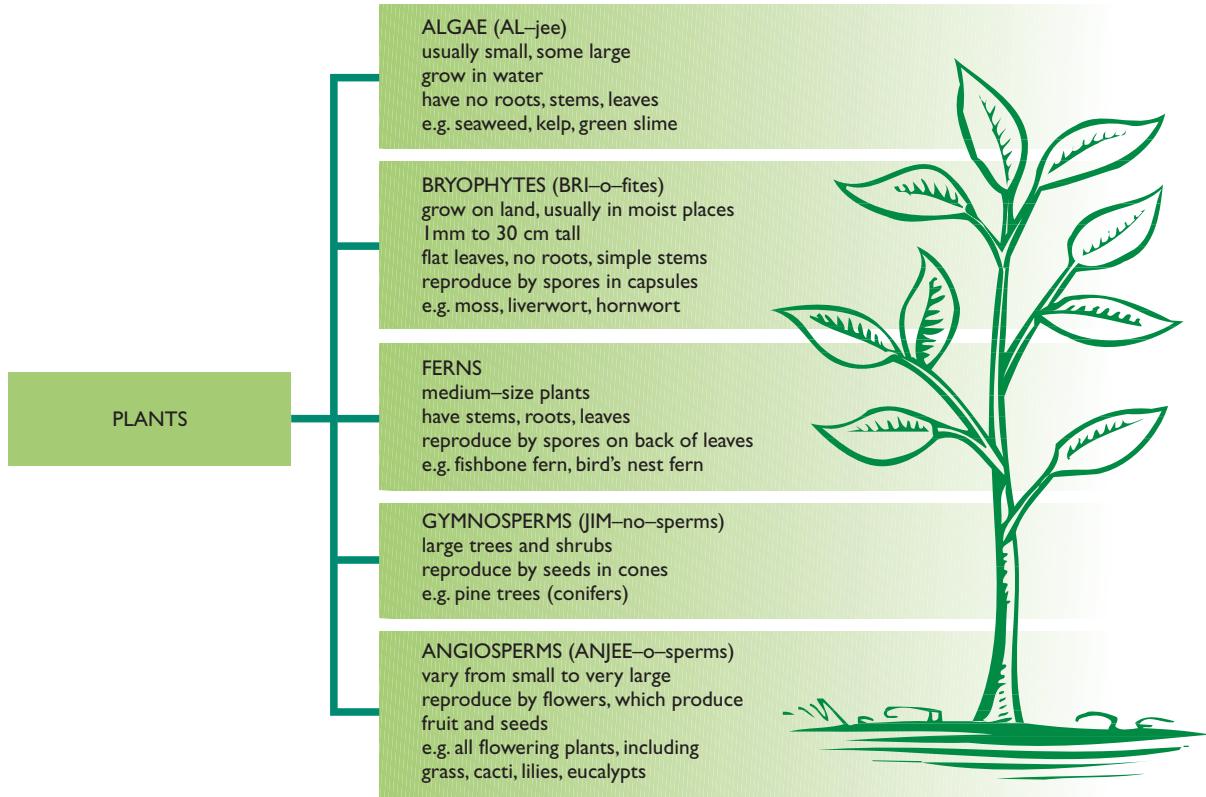
oxygen As plants make their food, they also make oxygen. This is the oxygen that people and all animals breathe.

fibres Many plants provide fibres for making clothes. The best example is cotton. The leftover parts of the cotton, containing oil and protein, are used as animal feed. Another plant fibre is jute, which is made into ropes and hessian fabric.

medicine Some medicinal compounds come from plants. The painkiller morphine is extracted from poppies. Digitoxin, used to treat heart disease, comes from a common garden plant, the foxglove. The insecticide pyrethrin comes from chrysanthemum flowers. Alginates in brown seaweed are used as thickeners in toothpaste and ice cream.

timber Trees provide all the timber we use. In many parts of the world, wood is used as a fuel for cooking. We use wood to make houses and furniture. Timber is also used to make paper and cardboard.

relaxation and sport Urban parks, forests and national parks all provide recreation facilities. Grass is grown on most ovals and playing fields.



The classification of plants

CHECKPOINT:

COPY AND COMPLETE

Plants are living _____ which can make their own food. They contain a green chemical called _____. This enables them to use ____ energy to make their _____. Food has energy stored in it. Plants do not have much _____ when compared to animals.

The plant kingdom is classified into different _____. Each of the big groups is called a _____. Plants are essential to our survival. They provide us with ____, ____ and other _____.

QUESTIONS

- 1 List ten plants that we eat.
 - 2 Name two grasses that are grown for animals to eat.
 - 3 What is one plant grown to make clothes?
 - 4 What is the difference between these plants:
 - a gymnosperms and angiosperms
 - b fern and moss
 - 5 Which division do these household plants belong to?
 - a fruit tree
 - b palm tree
 - c green weed in fish tank
 - d maidenhair fern
 - e rose bush
- f** bird nest fern
g moss on the path
h flowers in the garden
i vegetables
j pine tree
k grass and lawn
- 6 Is it true that plants don't move? Give examples to explain.
 - 7 How do mosses (bryophytes), ferns, conifers and flowering plants reproduce?
 - 8 Check with your teacher: Are there any gymnosperms, ferns or bryophytes growing in your school grounds? If there are, examine them and note the environment that they are living in.

6.6

The animal kingdom

Animals are living organisms which need to eat food in order to survive. Animals move around looking for their food, and this is when we see them. Spiders and ants in the kitchen at home are looking for food.

The animal kingdom is classified into groups. Each group is called a phylum (plural = phyla). Some important phyla, and their characteristics, are shown below.

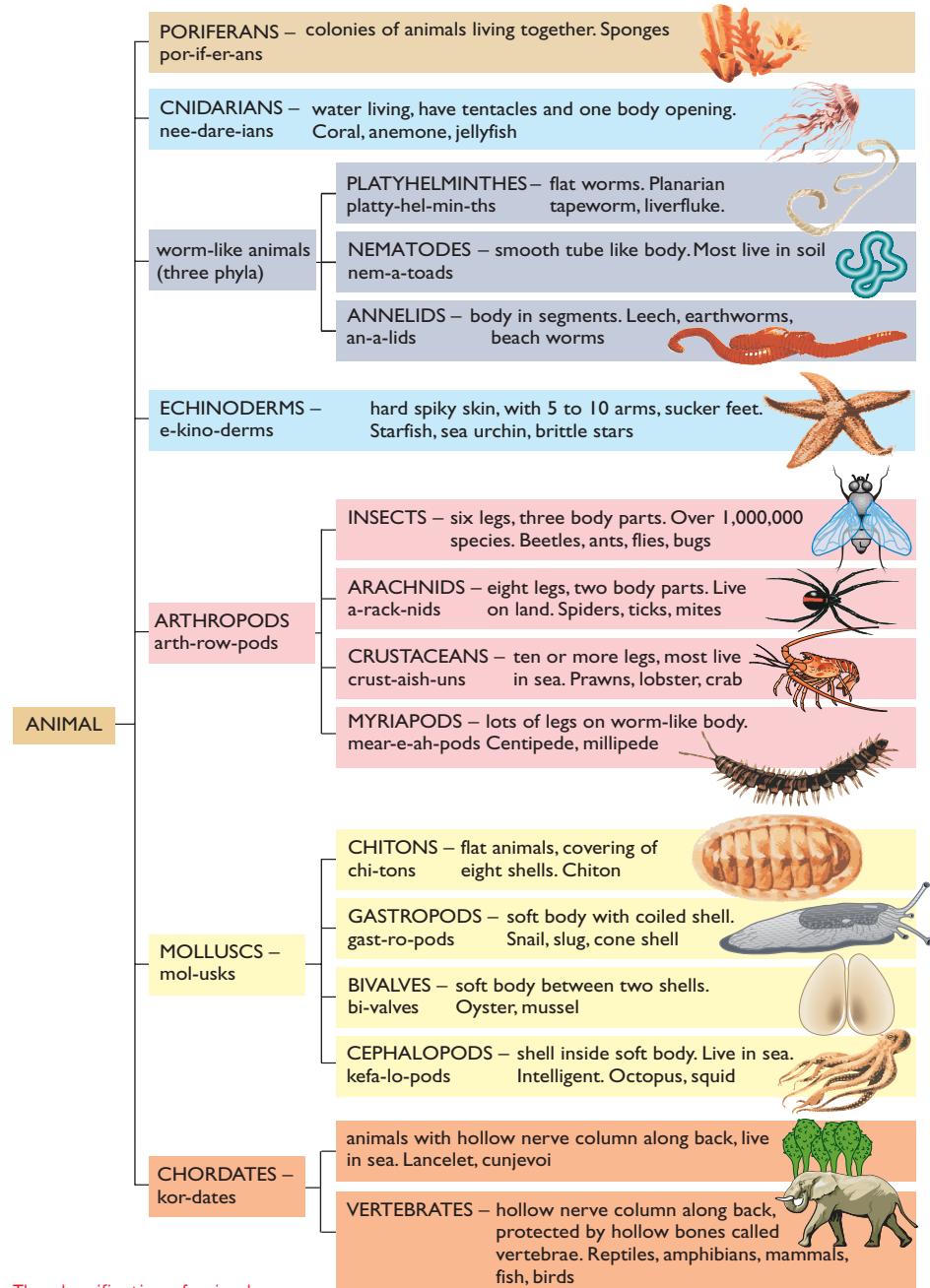
Importance of animals

Animals are used in every aspect of our daily lives. They supply us with food, and many people keep animals as pets.

food Common food animals are cattle, sheep and pigs. Different animals are eaten in different parts of the world. Other food animals are poultry, and seafoods like fish, oysters and prawns. Dairy products such as milk, cheese, yoghurt and ice cream come from cows. Cheese is made using fungi, yoghurt is made using bacteria and beer is made using yeast. Eggs are laid by poultry.

fibres Animals provide us with fibres for making our clothes. Wool comes from sheep, and silk is made by the caterpillar of the silk worm moth. Goats and similar animals produce mohair and cashmere fibres.

medicines Some medicines are obtained from animals. Chemicals that can be used to treat cancer have been found in sharks, and ingredients for sun block creams with an SPF of 15+ are obtained from coral. Animals are also used to make vaccines against diseases and poisonous snake bites.

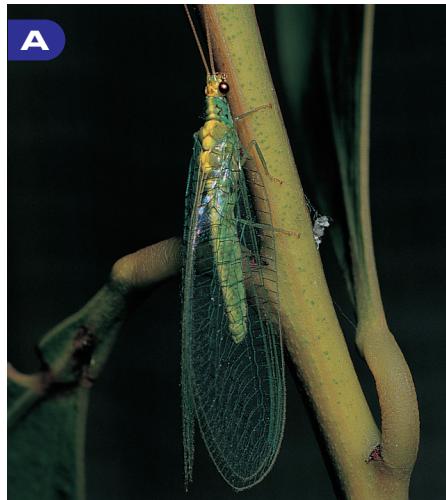


The classification of animals

Companions and helpers

Many people keep animals as companions (pets), especially cats, dogs and birds. Different breeds of dogs are used as guide dogs, guard dogs, police dogs and sniffer dogs.

Animals can be divided into groups. Animals with backbones are called vertebrates. They are grouped into the phylum Chordata ('cor-DA-ta'). Animals without backbones are called invertebrates. Invertebrate animals include every phylum except Chordata. Most (but not all) chordates are vertebrates.



- A** The lacewing is a delicate insect with see-through wings **B** Scorpions are arachnids. In Australia they are not very poisonous **C** The octopus is a mollusc with a shell inside its soft body **D** Snails are gastropods. They have a soft body with a coiled shell **E** Sharks are fish, with a skeleton of cartilage; most of them are shy and do not attack humans

CHECKPOINT:

COPY AND COMPLETE

Animals are living _____ which need to eat _____ in order to survive. Animals _____ around looking for their _____.

The animal kingdom is classified into _____. Some important _____ are the arthropods, with four groups called _____, _____, _____, and _____. The molluscs have four groups, the _____, _____, _____, and _____. The phylum _____ has an important group called vertebrates.

Animals are used in every aspect of our daily lives. They supply us with _____, _____, _____ and _____.

QUESTIONS

- 1 Name ten foods which come from animals.
- 2 Which animals are grown for their fibres? Which are used to make clothes and blankets?
- 3 What uses are made of the different breeds of dogs?
- 4 What is one important difference between these animals?
 - a insect and spider
 - b chiton and snail
 - c nematode, platyhelminth and annelid

- 5 What is one important similarity and one important difference between these animals?
 - a spider and octopus
 - b gastropod and bivalve
- 6 What is the difference between a vertebrate and an invertebrate? List ten vertebrates and ten invertebrates.
- 7 Check with your teacher: Does your school have a collection of preserved animals? They may be embedded in plastic or preserved in a special liquid. If so, examine them and work out which phylum (and class) they belong to.

6.7

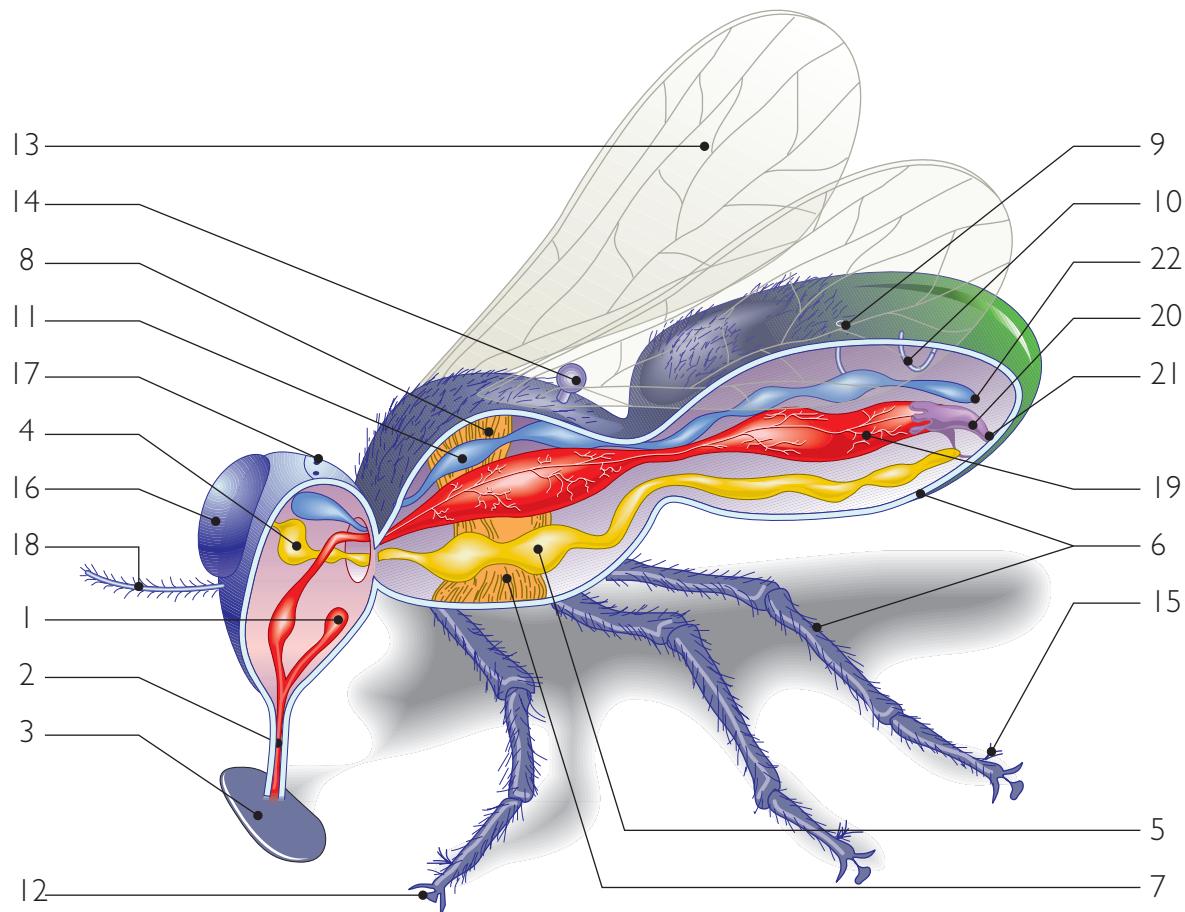
The fly

The house fly is found in most places on Earth. It is a very active insect, and it is commonly seen. Flies are a major cause of the spread of disease. This is because bacteria stick to them, and flies like to be near people and their food. Flies have many features which make them unusual to us. These differences are shown on the diagram.

Flies do not have a mouth or teeth. They vomit liquids onto their food (1), and then use their proboscis to suck up the mush (2). The end of the proboscis is shaped like the nozzle of a vacuum cleaner (3). Some of the vomit may be left behind on the food. Flies cannot think or remember, because their brain (4) is only the place where nerves join. The nerves run down the underside

of their body (5). Their outside skeleton, called an exoskeleton (6), is like a suit of armour around them. It cannot grow with the rest of the body. So flies have to make new exoskeletons as they grow. Nerves and muscles inside the skeleton control the movement of their legs (7) and wings (8). There are tiny holes (9) in the skeleton which lead to tubes (10). These help circulate air inside their body. Their blood is pumped with a simple vibrating heart (11). The blood is not contained in arteries and veins, but moves all through their body.

Flies have some special features that humans do not have. They can taste their food as they walk on it and can walk up smooth walls by



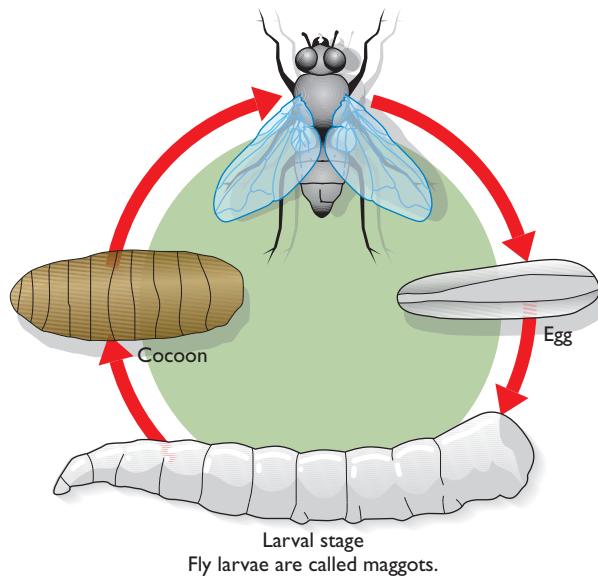
The parts of a fly

making a sticky chemical with pads (12) on their feet. To fly, flies need only two wings (13), which are stiffened by veins containing blood and air. Their second pair of wings are reduced to stumps (14). These stumps act like stabilisers to keep the fly balanced in flight. Flies are very clean animals, and they groom themselves regularly with special combs on their feet (15). Grooming removes dust and smaller animals which live on them, but not bacteria or fungi.

Flies are aware of their environment through two large, complex eyes (16). There are three smaller eyes on top (17), which can only distinguish between light and dark. The antennae (18) are sensitive to vibrations in air. Flies do not have ears, and cannot make sounds. Flies cannot detect heat, and they cannot regulate their body temperature.

A fly's stomach and intestine (19) are in its abdomen (the rear part of the body). Its food is partly digested when it sucks it up. A simple kidney (20) absorbs waste products from the blood, and these are excreted to the outside (21). Also in the abdomen are the organs for reproduction. The eggs develop inside the female's body (22).

Flies have a complex life cycle. The female lays small white eggs. Within twelve hours soft white legless larvae emerge. These caterpillars are called maggots. The maggots grow and crawl out of their small shells and make larger ones for themselves. After the maggots have finished growing, the larvae



The life cycle of fly

shrink into a brownish shell. The transformation to a fly takes place in this time.

Flies reproduce every week or so. And they have 100 offspring at a time. The parents do not care for the young at all. The maggots eat different food to their parents, and do not compete with them for shelter or space. By the time the juveniles have matured, the parents would have been blown away to a different locality, died of old age, been killed by an angry human, or eaten by another animal such as a lizard.

CHECKPOINT:

QUESTIONS

- 1 A house fly has the binomial name *Musca domestica*. What is its genus name and species name?
- 2 This Activity described some of the similarities and differences between people and house flies. Copy the table below, and use the information about flies, and your knowledge of people, to fill it in. Make the table ten lines long, to allow for Question 3.

Feature	<i>House fly</i>	Person
size
location of skeleton
senses present
breathing
movement

- 3 Find another five differences between people and flies, and write them in the table above.
- 4 How do people know what a fly looks like inside?
- 5 The outside skeleton of a fly cannot grow. The same is true of all arthropods. How do arthropods grow?
- 6 What is an advantage of having babies that eat different foods to their parents?
- 7 Flies have 100 offspring each week. Assuming that no flies die before breeding, and that each fly only breeds once, how many offspring could one fly produce in 4 weeks?



6.8

Vertebrates

Vertebrates are the group of animals which have a backbone. The backbone or spine is made of series of bones, each of which is called a vertebra. Each vertebra is like a short pipe, and the spinal cord of nerve cells is protected by them.

Bones hold up the body and allow the muscles to work. Vertebrates have an advanced heart and blood system, with large gills or lungs. As a result, vertebrates can grow to a larger size than invertebrate animals. Vertebrates also have a well-developed nervous system. They are aware of their environment and can respond quickly to danger.

Vertebrates have bodies which enable them to live in many areas. They are found all over the earth, from the polar regions to the equator, and from the deserts to mid ocean. Their arms and legs may have toes, hooves, flippers, fins or wings.

Vertebrates are divided into five groups. The groups are based on the skin covering and method of reproduction. There are other similarities within each group, and differences between the groups. The five groups are fish, amphibians, reptiles, birds and mammals.

Fish

There are two types of fish: those with a skeleton of cartilage (sharks and rays) and those with a skeleton of bone. Both groups have a streamlined shape and are covered with scales. Some fish lay eggs, and other fish give birth to live young.

Amphibians

Amphibians include frogs, salamanders and toads. Most have four limbs and moist skin with no covering on their skin. On land they breathe using lungs, and in the water they breathe through their skin.

Amphibians lay their eggs in water. The eggs hatch into tadpoles, which swim with tails and breathe with gills. Tadpoles have many features of fish.

Reptiles

Lizards, crocodiles, snakes, geckos and tortoises are reptiles. Reptiles have tough, dry, scaly skin. They breathe with lungs. Reptiles lay eggs with tough, leathery shells.

Reptiles (like fish and amphibians) have a variable body temperature. This is called poikilothermic, or cold-blooded. On a hot day their body will be warmer than on a cold day. Fish and amphibians are also poikilothermic.

Birds

Birds are the feathered vertebrates. All birds have wings, although some cannot fly. Birds lay eggs which have a brittle, limy shell. Birds can maintain a constant high body temperature which means that their body functioning is more efficient. Animals that can maintain a high body temperature are called warm blooded, or homoiothermic.

Mammals

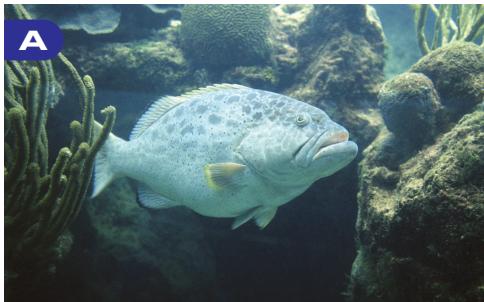
Mammals are the group of vertebrates which have hair or fur growing on their skin. There are other similarities—they are all homoiothermic, breathe air with lungs, have well-developed brains, have internal fertilisation, and give birth to live young which they suckle on milk produced by the mother's mammary glands. All mammals care for their young, and some teach them how to hunt and survive.

There are three groups of mammals. The first is the monotremes, which are platypuses and echidnas. Monotremes lay eggs with leathery shells. The young lick milk from their mother's fur.

The second group of mammals is the marsupials. They give birth to a tiny undeveloped animal which crawls through the fur to the mother's pouch. Here it attaches to a nipple and uses the nourishment in milk to grow and develop. Examples of marsupials are kangaroos, the koala, possums, wombats and quolls.

The third group of mammals is the placentals. Placental mammals have a uterus or womb where the young grow and develop. An organ called a placenta transfers nourishment and oxygen from the mother to the developing infant. Placental mammals are born in a well-developed state. For example, new-born antelopes can run within 20 minutes of being born.

Examples of placental mammals are whales and dolphins, bats, rats and mice, cattle and sheep, cats and dogs, monkeys and people.

**A** Grouper in a coral reef**B** A Red-eyed tree frog**C** Snakes are reptiles and must lie in the sun to keep warm and active**D** Birds can maintain a high body temperature which makes their bodies function more efficiently

CHECKPOINT:

COPY AND COMPLETE

Vertebrates are the _____ of _____ which have a _____. The backbone or _____ is made of _____. of bones.

Bones hold up the _____ and allow the _____ to work. _____ have an advanced _____ and _____ system, with large _____ or _____. Vertebrates have a well-developed _____ system. They are _____ of their _____ and can _____ quickly to _____.

Vertebrates have _____ which enable them to _____ in many _____.

Vertebrates are divided into _____ groups. The five groups are _____, _____, _____, _____ and _____.

QUESTIONS

- 1 What is the difference between a vertebra and a vertebrate?
- 2 Why are arthropods upside down and inside out compared to vertebrates?
- 3 What are the main features of each of these groups?

a fish	b amphibian	c reptile	d bird
e monotreme	f marsupial	g placental	
- 4 Use the information in this Activity to complete the table below.

Group	Body covering	Body regulation	Reproduction	Examples
<i>fish</i>				
<i>amphibians</i>				
<i>reptiles</i>				
<i>birds</i>				
<i>mammals</i>				

- 5 Compare the method of birth for each group of animals.



6.9

Biodiversity

There are about 10 million different species of life on Earth. Each species has its own features and its own place in the global environment.

Life in a forest

Some people think of a forest as a lot of trees growing near each other. But a forest is made of many different types of organisms living in balance with each other. The plants flower and fruit at different times of the year. This provides a variety of food and shelter for animals all year round. The plant-eating animals feed at different heights in the forest and at different times of the day and night. By eating fruit they help spread seeds. Different trees provide different nesting sites for animals such as birds and possums. Some species of plants rely on just one animal for their pollination and survival.

The plant-eating animals are eaten by meat-eating animals. Parasites live on and in animals, fungi decompose animal droppings, and other organisms decompose animals' bodies when they die. Fungi and microscopic life decay dead leaves, and recycle their nutrients to the soil to be reused by the plants. There are millions of species of insects and soil organisms. There are plants and animals which live their whole life high in the tree tops. All these living things are in balance, and there is not much opportunity for any of

them to increase so much that they become a pest.

A forest is home to a variety of life. The variety of life is called biodiversity. This biodiversity is essential for the life of the forest. Biodiversity is essential to a healthy environment, and for the well-being of our planet.

The opposite to the biodiversity of a natural forest is a monoculture. This is where only one species is grown, and all others are poisoned. An example is a wheat field. Only wheat grows there; weeds, birds and insects are enemies of the wheat. The wheat is grown for our food. A monoculture will soon become filled with weeds and pest animals if it is not maintained by people.

The biosphere

The biosphere is all those parts of the Earth's surface where living things are found. It extends up to about 9000 m high, where mites and spring-tails eat the pollen and seeds carried by the wind. Life is thickest on the moist land near sea level, and in the region of sea which is lit by the sun. Life extends into the deepest parts of the ocean. Animals live in the darkness and extreme pressure of the ocean depths and eat the bodies of animals and plants which have drifted down from the surface.



Wheat fields are almost all wheat; the only other plants are small weeds. Wheat is a grass that dies after it has produced its seeds

Left: Rainforests are home to a variety of life

CHECKPOINT:

Extinction

When a species dies out, it is said to be extinct. There are no more members of that species alive. Species which are nearly extinct are said to be endangered. Some species are protected, which means that there are laws which state you cannot kill or interfere with these living things. Some species of animals have been bred in zoos and

reserves, then released back into the wild. This is called a captive breeding program.

Some famous extinct animals, and when they became extinct, are the dodo (1690), the passenger pigeon (1914) and the Tasmanian tiger, also called the thylacine (1936). Across the world, about 10 000 species become extinct every year.

COPY AND COMPLETE

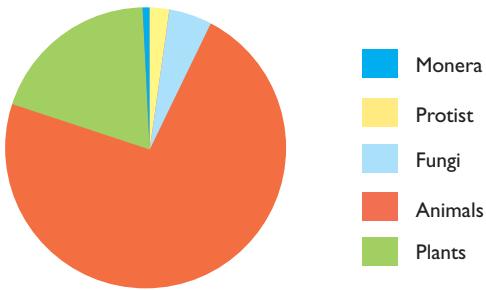
A forest is home to a _____ of life. The variety of life is called _____. This biodiversity is _____ for the _____ of the forest.

The opposite to the _____ of a natural forest is a _____. This is where only _____ is grown. An example is a _____ field. Only wheat _____ there; weeds, birds and insects are _____ of the wheat.

When a species dies out, it is said to be _____. There are no more members of that _____ alive. Species which are nearly extinct are said to be _____. Some species are _____, which means that there are _____ which state you cannot _____ or _____ with these living things. Some species of animals have been bred in _____ and _____, then released back into the wild. This is called a _____ breeding _____.

QUESTIONS

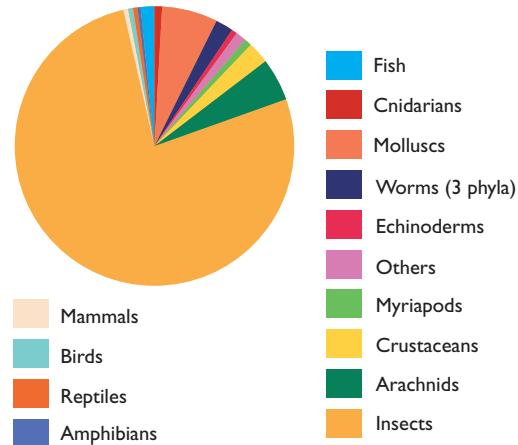
- 1 How many species are believed to be on Earth? How many are becoming extinct each year?
- 2 List some animals which have become extinct.
- 3 This question refers to the pie chart shown below.



The number of species of different kingdoms of living things

- a Which are the two largest kingdoms of living things?
- b Biologists guess that only one-tenth of all the species of fungi have been discovered. How would the pie chart change when they are all discovered?
- c Why are species of animals easier to discover than species of protists, monera and fungi?
- 4 For many years people have killed white pointer sharks whenever they catch one. They believe that they kill people. The population of sharks is now greatly reduced. These sharks are now endangered and are protected. How will this stop their extinction? What else should be done to ensure that white pointer sharks do not become extinct?

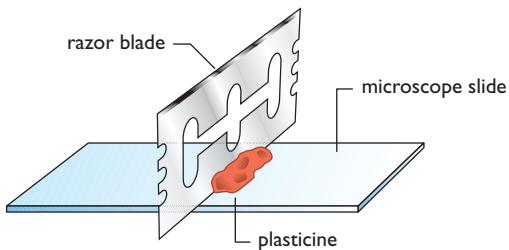
- 5 This question refers to the pie chart showing the numbers of species in the animal kingdom.
 - a Which are the most numerous group of animals?
 - b Are there more vertebrate species than invertebrate species?
 - c Rank, in order, the five groups of animals with the most species, from largest number to smallest number.
 - d Compared with all the animal species, are there many species of mammals?



The number of species of different kinds of animals

AIM: To develop and plan activities and projects with living things

- How do snails move? Collect some snails in a glass jar, and put some cling wrap over the top. Watch as the snails move around. Snails can also crawl over the edge of razor blades without getting cut. Set up a trial like that shown in the drawing. Remember that razor blades are very sharp. Hold them only on the flat surfaces.



Can a snail crawl over a razor blade?

- Look in a garden for insects like a praying mantis, grasshopper, beetle or butterfly. Do not collect bees or wasps, as they can give you a bad sting. Observe these animals in a ventilated observation box before releasing them back to their environment.
- If you have a mulberry tree near your school, you can keep a generation of silk worms. These moths make a cocoon out of silk. They eat the leaves from mulberry trees.
- Visit a local pet shop and see which animals they supply as pets. Do not collect wild rats and mice, as they carry diseases and will bite you. White rats and mice from a pet shop are very friendly and clean. Do not collect native animals, such as tadpoles, frogs and lizards. It is illegal to keep them in captivity without a special permit.
- Start an aquarium. Goldfish are the easiest to keep, but ask advice before you start. Sudden changes in temperature or type of water can kill them.
- A terrarium is an aquarium without water. It is home to land based animals. A terrarium is ideal for keeping slaters (wood lice), earthworms, crickets and beetles. Put in a piece of rotting timber to act as food and shelter. A terrarium can be made from a large glass jar or a disused fish tank.
- Check the biodiversity of your school playground. You will need to identify as many different plants and animals as you can. Knowing their names is not important, but having a description or diagram of them is important. For plants, a drawing or rubbing of a leaf is ideal. For animals, a labelled diagram is best. Remember to include a scale to show the relative size.

- On walls and shrubs you might see the cocoons of insects. Some of these will hatch out if you keep them in a cool ventilated place.
- There is often a large variation in the colour or patterns of animals of the same species, such as starfish and molluscs. Collect some sea shells or garden snail shells (but make sure there are no living animals inside them). Is every shell different, or are some the same?



A cocoon protects the larva from predators while it is changing into a moth



Although these starfish have different colours, they are all the same species

- Birds build their nests in areas away from people and other animals. Do you know where there are any bird nests? But be careful: do not disturb the birds, and do not touch the nest. Wild birds often carry parasites, such as lice.



Swallows don't mind building their nests on houses and other buildings

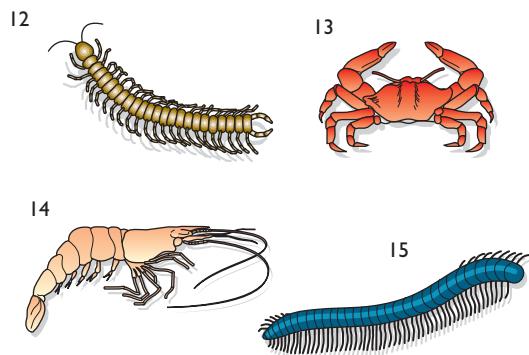
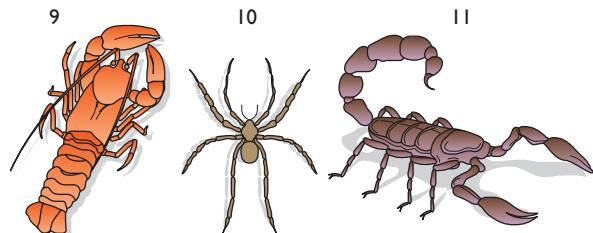
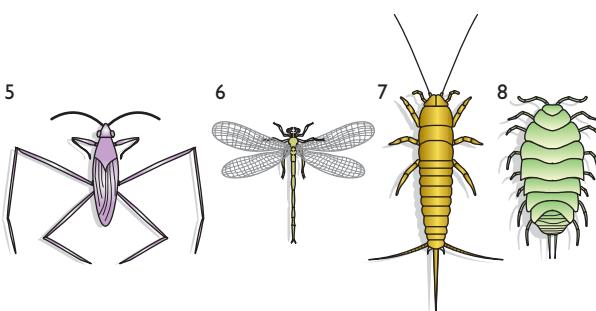
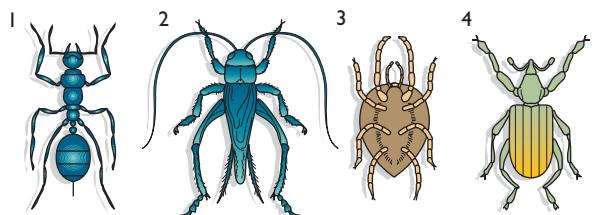
- Mice make interesting pets. They are readily obtainable at pet shops. They need to be cared for like any other mammal, like a pet cat, dog, rabbit or guinea pig.

Review and Research

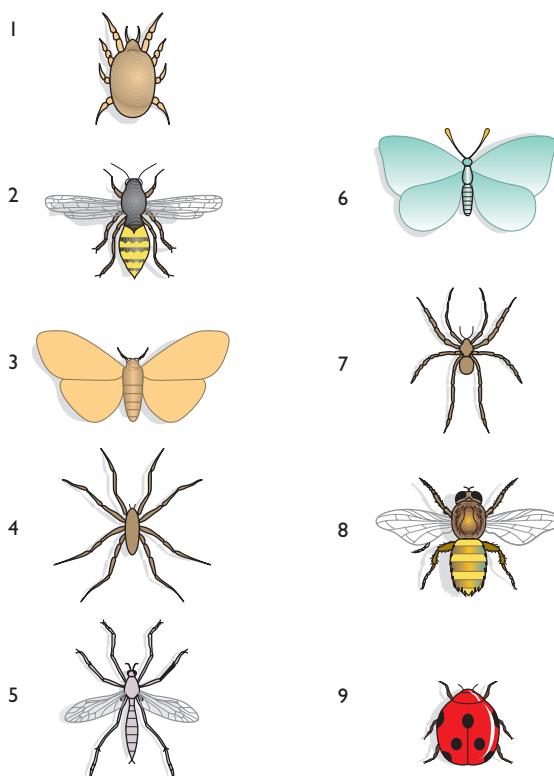
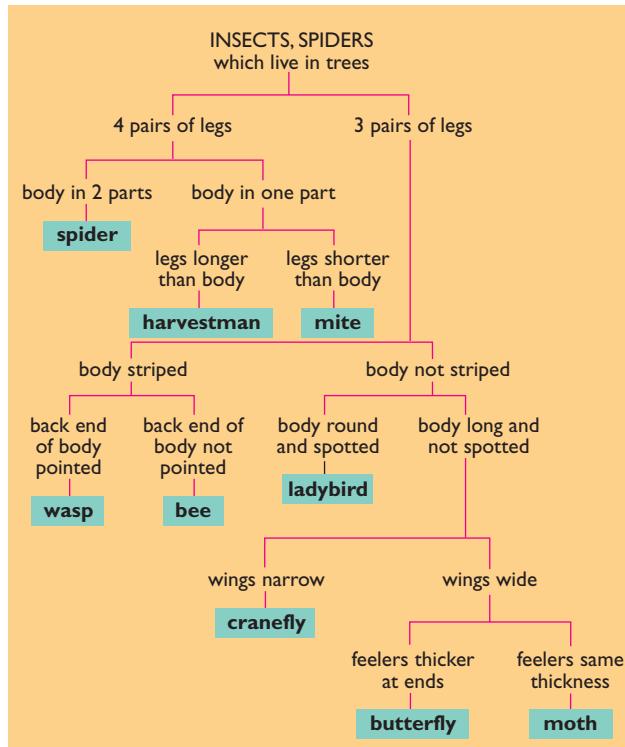
Review questions

- 1 Use the chart to classify each of the arthropods drawn below.

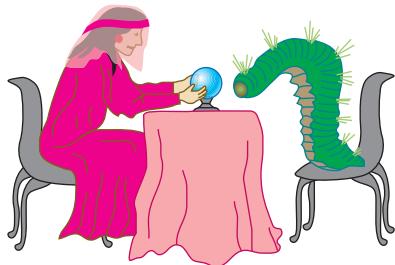
CLASSIFICATION OF ARTHROPODS	
3 pairs of legs, body has 3 parts	Insects
4 pairs of legs, body has 2 parts	Arachnid
5–8 pairs of legs, with other smaller limbs	Crustaceans
Many pairs of legs, long thin body	Myriapod



- 2 Below is a key for the identification of insects and spiders which live in trees. Use the key to name the animals shown.

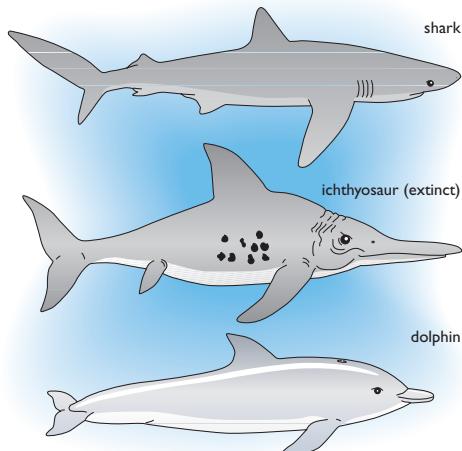


- 3 To tell people where you live, you give them your address. It includes country, state, suburb or town, street name, house number and your name. How is this like the classification system from phylum to species?
- 4 These are the binomial names of some organisms. Which (if any) are in the same genus? Which (if any) are in the same species? *Pita incisa*, *Pita regia*, *Incisa regia*.
- 5 The cartoon shows a fortune teller predicting the future of a caterpillar. If you knew about insects, its future would be obvious. Explain its future.



'I SEE MONTHS OF DARKNESS, THEN A SUDDEN CHANGE OF LIFESTYLE, WITH OPPORTUNITIES FOR TRAVEL!'

- 6 The drawing shows three animals which look similar. They are classified into three different groups. The shark belongs to the fish group, the ichthyosaur ('ICK-thee-o-saw') to the reptile group, and the dolphin to the mammal group. Why are they classified into different groups?



Research questions

- 1 Some organisms have misleading names. What type of plant or animal are the following?
- a silverfish b dog fish
 c blue bottle d sea mouse
 e monkey puzzle f earwig

- 2 There have been many famous people in the study of biology. Select one of the following people and present a story of that person as a poster.

- Jean Henri Fabre
- Henry Bates
- Jan Ingenhousz
- Carl von Linné (Linnaeus)
- Jacques-Yves Cousteau
- Joy and George Adamson
- Jane Goodall
- Joseph Banks
- Henry Bates
- Konrad Lorenz

- 3 This photograph shows a circle of toadstools (like mushrooms) and is called a fairy ring. How does a fairy ring grow? What does this tell us about fungi?



A fairy ring

Videos

The lives of some famous biologists have been made into movies. Watch a video or DVD that describes the life of a biologist. *Born Free* is the story of a lioness bred in captivity and released into the wild. *Gorillas in the Mist* is the story of the study of gorillas in the jungle of Africa.

Word check

assimilation	hybrid	monotreme
binomial	invertebrate	moss
biodiversity	key	placental
characteristics	kingdom	Protista
dichotomous	lichen	respond
endangered	mammal	species
extinct	marsupial	vertebrate
fibre	Monera	

Concept map

Draw a concept map of the classification system described in this chapter.

Living things puzzle page

The answers to this puzzle are not found in this book. You will have to look up the answers in reference books or CD-ROMs, and check your answers by asking knowledgeable adults.

1 Which of these materials are derived directly from living plants?

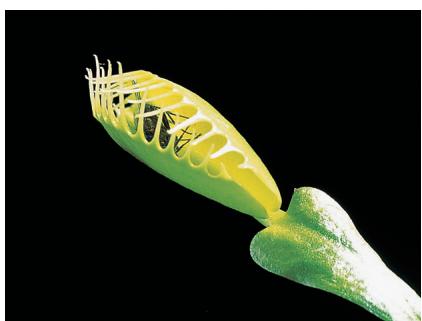
- paper
- steel
- canvas
- wood
- fruit
- plastic
- vegetables
- chipboard
- petrol
- cooking oil
- water
- housing timber
- oxygen
- aluminium
- leather
- cotton
- wool
- meat

2 Many products we use and eat are processed from plants. Which plants provide us with the following foods?

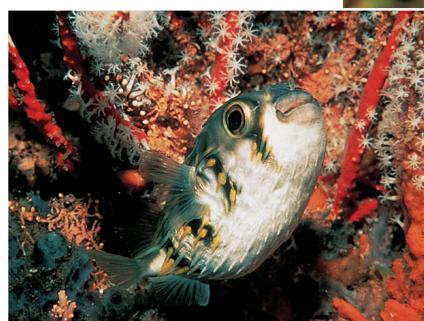
- chips and crisps
- porridge
- flour
- bread
- beer
- wine
- soy milk
- sugar
- ginger
- garlic
- peppermint
- tea
- coffee
- chocolate
- rubber
- tea tree oil
- olive oil
- peanut butter
- margarine
- starch
- icing sugar

3 What are unusual or useful about these plants and animals?

- aloe vera
- pitcher plant
- jojoba
- chameleon
- gulper eel
- sundew
- mimosa
- Venus fly trap
- puffer or toad fish
- archer fish



The Venus flytrap feeds on insects or small animals that it traps



A porcupine fish can inflate itself with air or water to frighten its enemies

4 Which of these materials are derived from animals?

- milk
- eggs
- nylon
- fur
- sea shells
- leather
- cheese
- plastic
- oxygen
- meat
- wood chips
- ice cream
- aluminium
- cling wrap
- soap
- wool
- cooking oil
- dripping
- lanolin
- paper

5 Many products we use and eat are processed from animals. Which animals provide us with the following foods?

- ice cream
- butter
- eggs
- yoghurt
- bacon
- flake
- salami
- scallops
- caviar
- escargot
- calamari

6 What are the following, and where do they come from? You may need to look them up in a reference book.

- ambergris
- penicillin
- spermaceti
- atropine
- pyrethrum
- amylopectin
- citronella



A chameleon can change its colour to match its environment