

NEW

NATIONAL SCIENCE

YEAR 8

• Brian Shadwick •

Consulting editor
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Science Press

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Living Cells

Do you know what a cell is? Do you know about all the different types of cells in plants and animals? What does a cell look like? You will find the answers to these questions in this chapter as you explore the unseen wonders of the microscopic world.

You will examine how cells grow differently and make different tissues and that tissues make organs which work together in systems to run our bodies.

You will also practise skills in classifying things, researching information, using dichotomous keys and using the microscope.

1.1 Plant, animal and fungal cells

1.2 Structures within cells

1.3 Examining cells

1.4 Single-celled organisms

1.5 Cell division

Chapter 1 Test

1.1.1 A timeline for cells

1.1.2 Plant and animal cells

1.1.3 Fungal cells

1.2.1 Functions of cell parts

1.3.1 Different animal cells

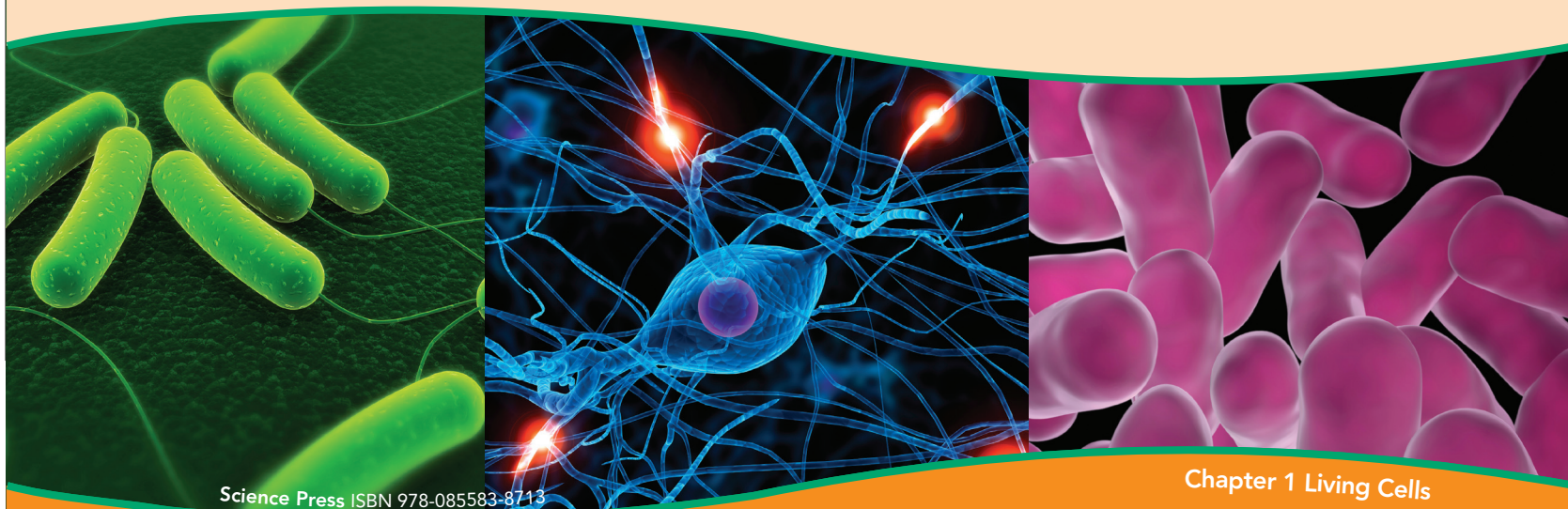
1.3.2 Different plant cells

1.3.3 Classifying cells

1.4.1 Unicellular and multicellular organisms

1.5.1 The phases of mitosis

1.5.2 The importance of mitosis



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Chapter 1 Living Cells

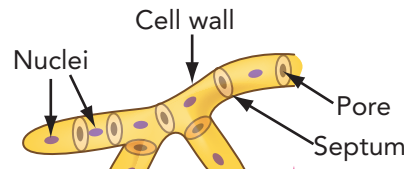
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1.1 Plant, animal and fungal cells

1.1.3 Fungal cells

Fungi are widespread around the world and include a wide range of organisms from unicellular yeast to large mushrooms and toadstools. Like plants, fungi have a cell wall, but their cell wall is made of chitin unlike plants which have a cell wall made of cellulose. Like animals, fungi are heterotrophs and cannot make their own food. However, unlike animals they do not 'eat' their food but release enzymes (chemicals that break down large complex particles into small particles) onto their food source. They can then absorb the small particles into their cells. **Parasitic fungi** live on other living organisms and cause disease, e.g. tinea or 'ringworm' is a skin disease in humans caused by a fungal infection. **Saprophytic fungi** live on dead plant and animal remains and are important decomposers in the food web.



Fungal hyphae.

Multicellular fungi such as mushrooms consist of thin threads called hyphae. The hyphae of some fungi have cross-walls, called septa that divide the thread into cells, while other fungi do not have septa and the cytoplasm is a continuous mass with hundreds of nuclei.

1.1.3.1 Label the structures in the animal cell, fungal cell and plant cell shown in the table below.

Animal cell	Fungal cell	Plant cell

1.1.3.2 Construct a table to compare an animal cell, a fungal cell and a plant cell.

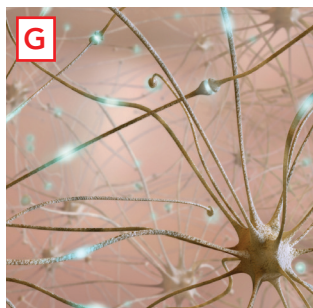
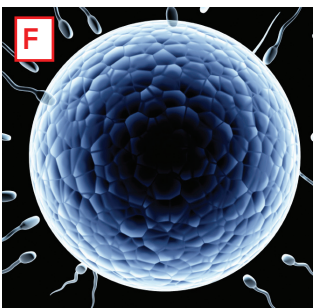
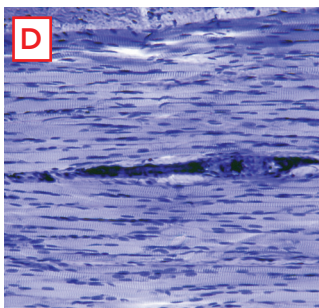
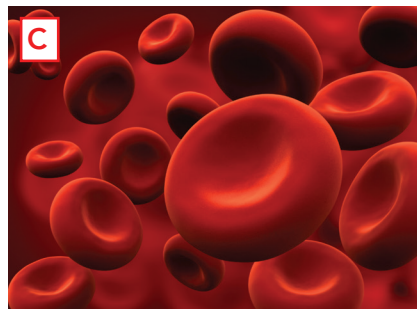
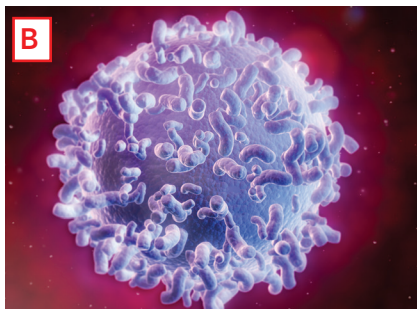
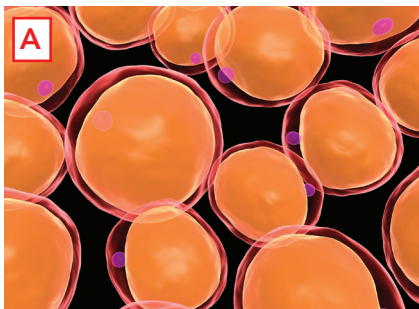
1.3 Examining cells

1.3.1 Different animal cells

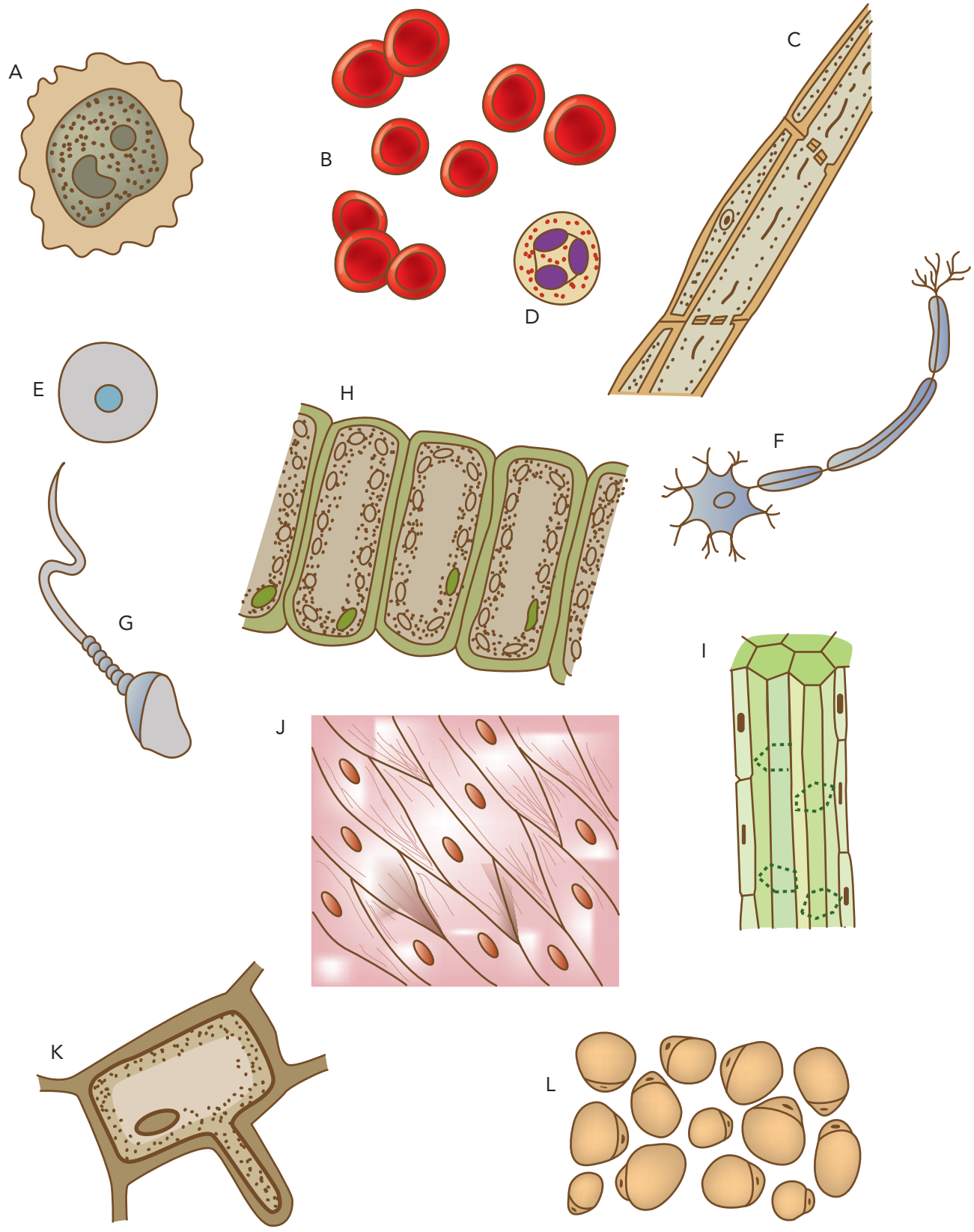
1.3.1.1 Match the phrases for animal cells.

There are many different types of cells in animals. Each type has a specific function. The phrases below describe several different types of animal cells and their functions. Your task is to match the phrases to form sentences which you write in the table on the next page, and draw (or paste a picture or photocopy) the appropriate cell next to each description.

Sentences for animal cells		
First part of sentence	Second part of sentence	Last part of sentence
1. Donut shaped red blood cells are made in bone	(a) responsible for carrying messages around the body from the brain	(A) reproductive cells.
2. White blood cells are more irregular in shape than red	(b) and a long tail, and are the	(B) store energy.
3. Skeletal muscle cells are long, pointed at each end and are	(c) spherical and are the female	(C) male reproductive cells.
4. Nerve cells which have several short and one long tendril are	(d) marrow in the centre of bones and are responsible for transporting oxygen to	(D) all body cells and waste carbon dioxide back to the lungs.
5. Spherically shaped fat cells	(e) blood cells and are	(E) and relax, they produce movement of body parts.
6. Sperm cells have a spear point shaped head	(f) insulate the body and	(F) to all body parts and from those body parts back to the brain.
7. Ova, or egg cells are also	(g) bound together into small bundles to form muscles. As they contract	(G) responsible for fighting disease.



Diagrams of various plant and animal cells

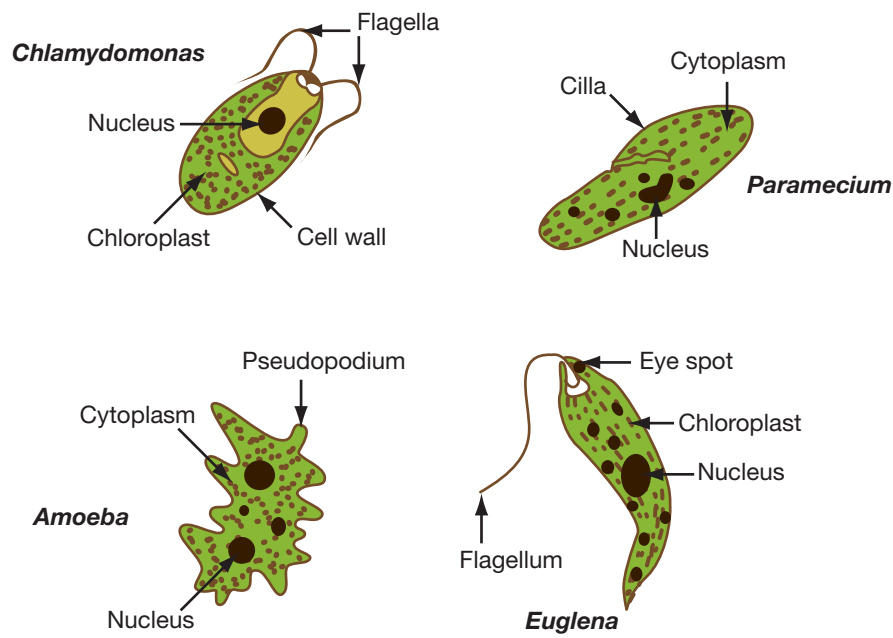


1.4 Single-celled organisms

1.4.1.2 What do each of the following words mean?

- (a) Autotrophic.
- (b) Heterotrophic.
- (c) Unicellular.

1.4.1.3 The diagrams show four single-celled organisms.



- (a) Which of these is/are autotrophic? Justify your answer.
-
-
-
- (b) According to this information, what do all four organisms have in common?
-
-

1.5 Cell division

1.5.1 The phases of mitosis

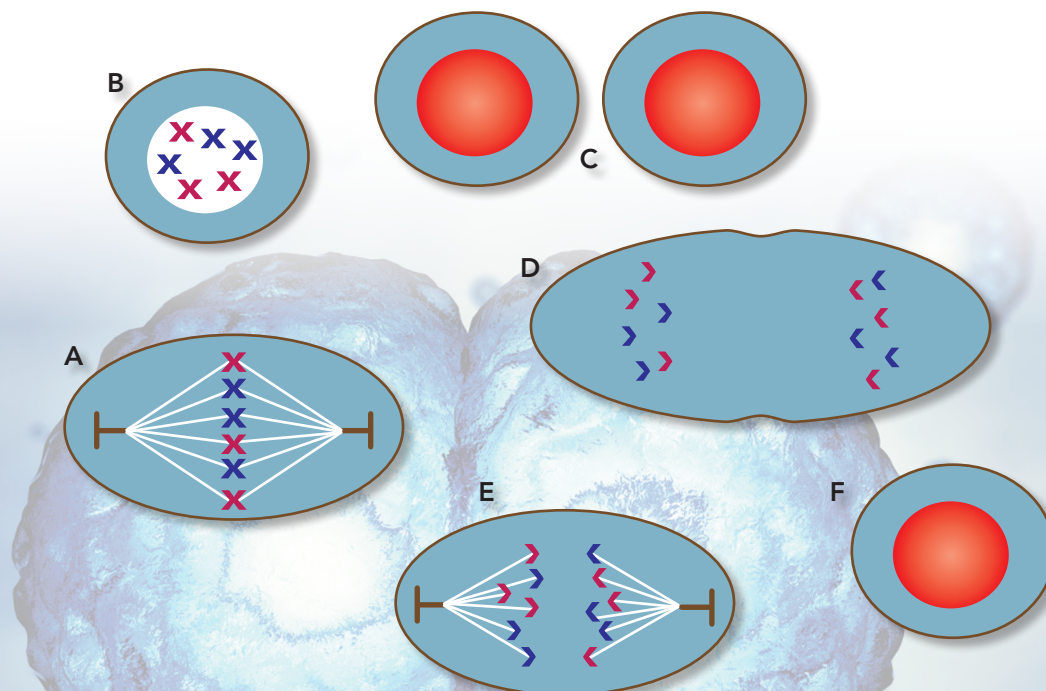
Mitosis is a type of cell division where the nucleus divides into two daughter nuclei. **Cytokinesis** is the division of the cytoplasm immediately following mitosis to form two separate daughter cells.

1.5.1.1 The sentences and diagrams below describe mitosis. However, they are not matched. Your task is to put the sentences in order, then copy the diagrams so that the correct diagram is next to each sentence. Write your work in the table on the next page.

The information refers to mitosis occurring in a human body cell, which starts with 46 chromosomes.

The phases (not necessarily correct order):

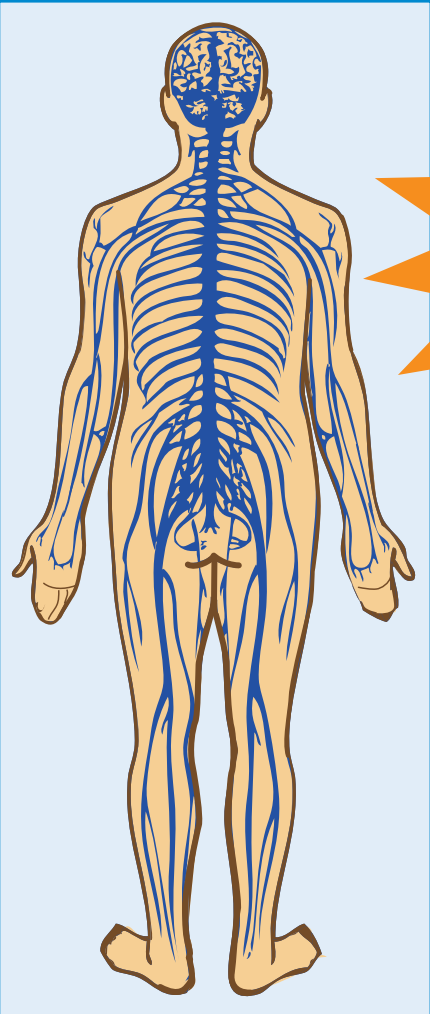
- (i) The daughter chromatids separate to move towards the opposite ends of the cell pulled by the spindle fibres which are contracting.
- (ii) This is the normal life stage for cells when the cell is not dividing. It is when the genetic information is being duplicated and cellular activity is high.
- (iii) The chromatids line up along the centre of the cell.
- (iv) The chromosomes become visible as two daughter chromatids which are connected to each other at a point known as the centromere.
- (v) Daughter chromosomes gather at the end of the cell, the spindle breaks down and there are now two daughter nuclei with identical chromosomes to each other.



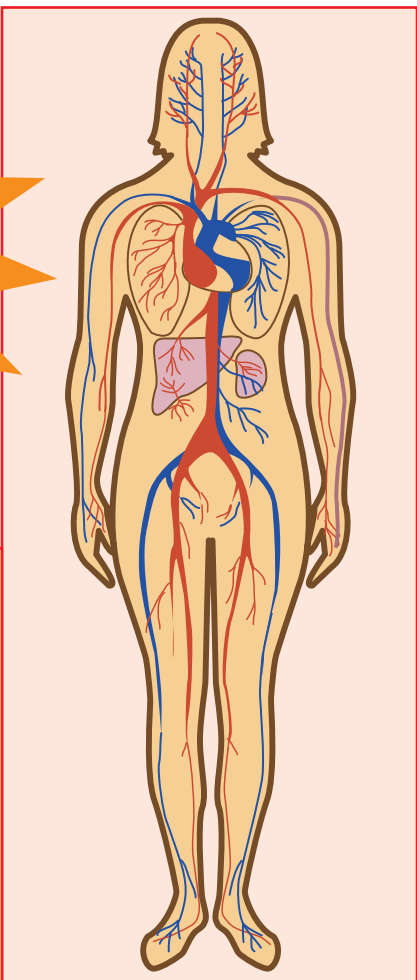
2.2 More organs and systems

2.2.1 Organs in some human body systems

2.2.1.1 The diagrams show six systems of the human body and some of the organs associated with them. Your task is to research and find out what the functions of each organ are as they relate to the specific system indicated (they may have additional functions).



Nervous system.



Circulatory system.

Nervous system and circulatory system.

Circulatory system – organs and their functions

Heart

Lungs

Nervous system – organs and their functions

Brain

Spinal cord

(Note that some references will include the eyes, ears, nose and tongue as special organs in the nervous system.)

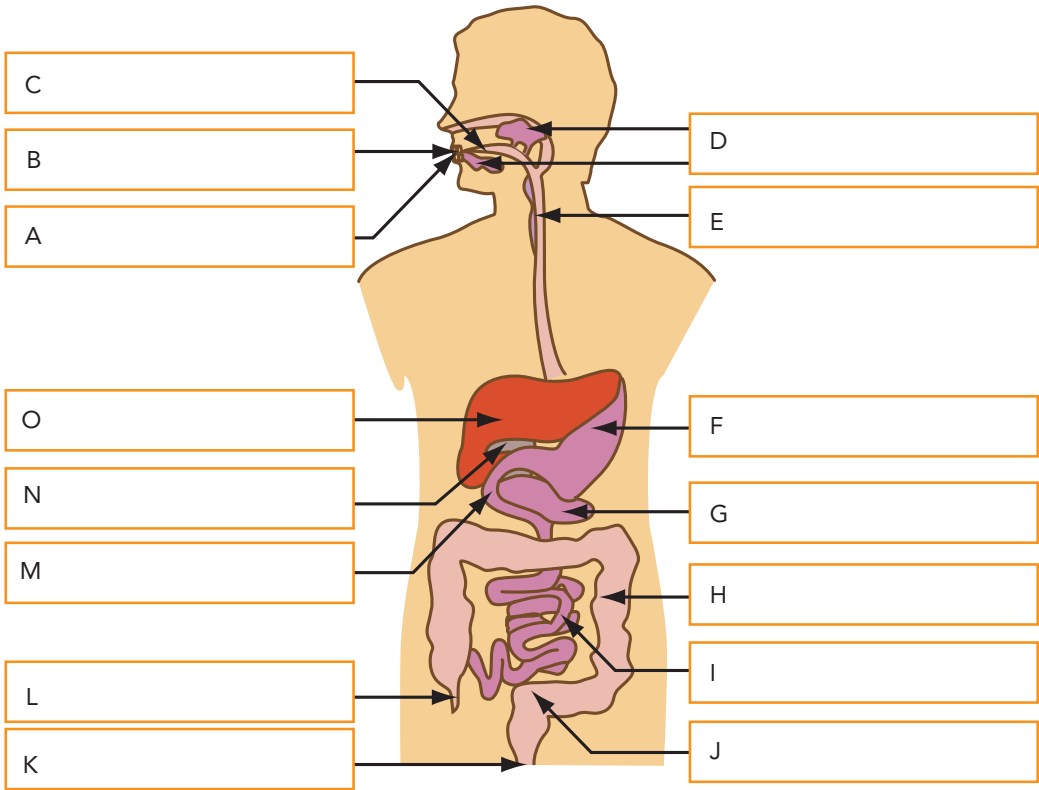
2.2 More organs and systems

2.2.2.2 Complete the tables.

Substance	What assists digestion?	Where does digestion start?	Where does main digestion occur?	Where does digestion finish?	How long does digestion take?	What are the end products?
Carbohydrate						
Proteins						
Fats						

Substance	Where produced	Role in digestion
Gastric juice		
	Mouth	
Bile		
Pancreatic juices		

2.2.2.3 Label the indicated parts of the human digestive system in the diagram below.



2.2 More organs and systems

2.2.3 Ethics and organ donation

Recent reports shows that for every 20 000 organ transplants performed each year, a further 85 000 people in need miss out, although the figures differ depending on the particular organ – kidney, lungs, heart, liver etc. Many people on waiting lists for transplants die before an organ becomes available.



A Who should receive a transplant organ?

Given the shortage of donor organs, some people have the unfortunate task of deciding who will live and who probably won't. Should they decide on the basis of the following?

- Who has the most urgent medical need?
- How important is each person to the community?
- How much effort has each person contributed to society in their lives?
- How much can they pay?
- How long have they been on the waiting list?
- How old are they?
- What sex are they?
- What race do they come from?
- Where do they live?
- Are they smokers or not?
- Do they have other diseases?
- Who is most likely to live longest if they receive a transplant?
- Is this their first organ transplant?
- Have they attempted suicide in the past?
- How many young children do they have?
- Are they prisoners on life sentences?



B Who should donate organs?

The shortage of organs reflects a limited number of donors. At the moment, organs can only be donated by people who have left consent that this can be done, or in some cases when families give consent after a person has died. Consider the following.

- Should the organs of all deceased people be used?
- Should it be considered a social responsibility for people to donate organs?
- Should people be allowed to sell organs (e.g. kidneys) to help pay their debts?
- Should there be more education programs to advise people of the need for donating their organs?
- Should religious groups be allowed to opt out of organ donation?
- Should families be paid to help cover funeral costs if they donate the deceased's organs?
- Should donations to charity be made in the deceased's name if organs are donated?
- Should organs from aborted fetuses be used?
- Should animal organs be used (e.g. pig livers work quite well in humans)?
- Should more research be done on artificial organs (e.g. mechanical hearts)?

2.4 Comparative anatomy

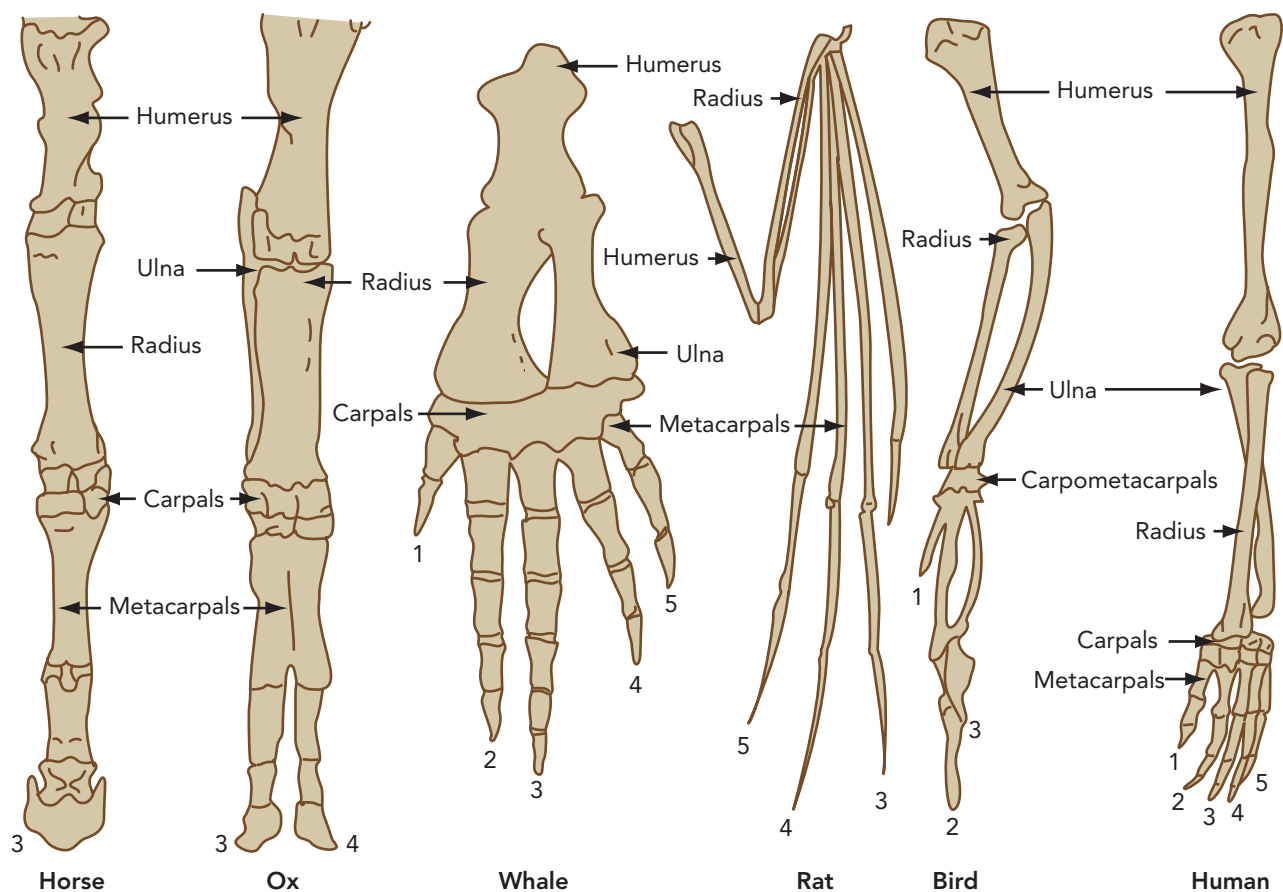
2.4.1 Comparing structures

Comparative anatomy compares the structures and functions of systems and organs in different animals (or plants).

Comparative anatomy has long served as evidence for evolution because many scientists believe that organisms which have similar characteristics share a common ancestor. Comparative anatomy also assists scientists in classifying organisms based on similar anatomical structures.

A common example of comparative anatomy is the similar bone structures in forelimbs of cats, whales, bats, and humans. All of these appendages consist of the same basic parts; yet, they serve completely different functions.

The diagrams show the forelimbs of six different animals (not to scale), adapted for different purposes.



2.4.1.1 What do the forelimbs of these six animals have in common?

.....

.....

5

Forms of Energy

This chapter briefly considers the various forms of energy then examines kinetic, potential and heat energy in more detail. You will also explore one of the most important laws in science – the law of conservation of energy – plus energy changes and the three forms of heat transfer: conduction, convection and radiation. The content is reinforced through practical work, emphasising data organisation and problem-solving.

Most technologies in our lives work on the fact that they can change energy from one form to another – toasters, light globes, radios, TVs, computers, hot water systems, ovens, grills, CD players – you name it, there are probably several energy changes involved in it.

You will be given opportunities in this chapter to practise your experimental design and procedure skills, both in looking at some basic energy situations and at some applications.

5.1	Different forms of energy	5.1.1	Ideas we have for energy
		5.1.2	Forms of energy
		5.1.3	Which is which?
5.2	Kinetic energy	5.2.1	More about kinetic energy
5.3	Potential energy	5.3.1	More about potential energy
		5.3.2	Bouncy bouncy
		5.3.3	Bubble, bubble, froth and trouble
5.4	Energy changes	5.4.1	We need to change energy
		5.4.2	The source of all our energy
		5.4.3	Rube Goldberg machines
5.5	Electricity – flowing energy	5.5.1	We use it all the time
		5.5.2	What is electricity?
5.6	Electric circuits	5.6.1	Circuit components
		5.6.2	Conductors, resistors and insulators
5.7	Indigenous fire starting	5.7.1	Starting fires

Chapter 5 Test



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Chapter 5 Forms of Energy

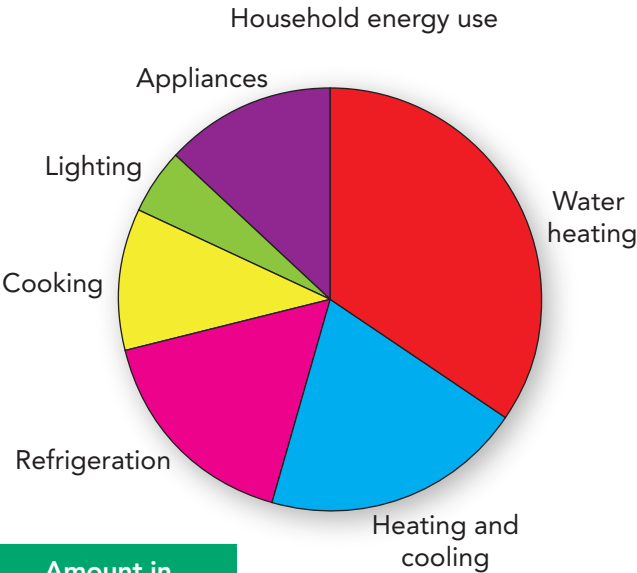
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5.4.1.3 The pie chart shows where energy is used in an average household.

- (a) What uses the most energy in an average household?
.....
- (b) What uses the least energy?
.....
- (c) Complete the table to show the information from the pie chart expressed as percentages (to the nearest whole number).

Where energy is used	Amount in average home (%)



- (d) List five things this information suggests we could do in order to save energy.
.....
.....
.....
.....
.....
- (e) If each household could reduce their energy bill by 10%, the saving would be enormous. How could this help a family?
.....
.....
.....
.....
.....

5.7 Indigenous fire starting

5.7.1 Starting fires

While we see fire as a threat to crops, homes and our safety, Indigenous peoples see it to increase the productivity of their environment. Within years of white settlement in Australia, and the prevention of Indigenous peoples from burning forest undergrowth, lands which were clear and grassed, and river valleys which were unobstructed and visible for kilometres were overgrown with long grasses and weeds, and fuel for bushfires abounded.

Fire management by Indigenous peoples worked on five principles:

- (a) Lands were burnt on a rotating pattern with the area and intensity controlled. This allowed plants and animals to survive in non-burnt areas while the burnt areas regenerated. It also allowed Indigenous hunters to conceal themselves in adjacent land to hunt more efficiently when prey came to graze on the regenerating undergrowth.
- (b) When the land was burnt depended on the type of country, the time of the year and the condition of the undergrowth.
- (c) Weather conditions were crucial; fires being lit only in cooler conditions and when rainfall was likely to minimise fire getting out of control.
- (d) Neighbouring clans were advised of burning plans so precautions could be taken.
- (e) Fires were avoided in the growing seasons of food or sacred plants.

An advantage of Indigenous fire management was that the absence of weeds and undergrowth ensured a good food supply for animals and promoted the growth of native plants and maintained the ecological health of the land.

Watch a video on Indigenous fire starting. A good example is produced by Ray Mears for BBC Studios.

Obviously, Indigenous peoples would have used heat energy in the form of fire in their land management strategies, for cooking and keeping warm.

They also had knowledge of other forms of energy, although not using the names we use today. For example, they knew that (potential) energy could be put into bows that they then release to fire arrows (kinetic energy).



Controlled burning.

6

Rocks and Minerals

Understanding the structure of the Earth and the balance that exists between its water, rocks, air and the life forms that live on and in it will help you understand why it is so important to maintain that balance.

A significant proportion of Australia's overseas income comes from the minerals we extract from the ground. Being a mining geologist can be a rewarding occupation, both in terms of enjoyment and financially.

The mountains, valleys, river plains, canyons, waterfalls, lakes, caves and all the other beautiful features of the Earth's surface are caused by erosion and underground forces – physical, biological and chemical – that shape the Earth.

6.1 Formation of rocks

6.1.1 How rocks are formed

6.1.2 Sedimentary rocks

6.1.3 Igneous rocks

6.1.4 Metamorphic rocks

6.1.5 Structure of the Earth

6.2 Identifying rocks

6.2.1 The rock cycle

6.2.2 Recognising sedimentary rocks

6.2.3 Fossils

6.2.4 Inferences from fossils

6.2.5 Inferences from rock layers

6.2.6 Recognising igneous rocks

6.2.7 Recognising metamorphic rocks

6.2.8 Structures and landforms

6.3 Indigenous use of rocks

6.3.1 All rocks have merit

Chapter 6 Test



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Chapter 6 Rocks and Minerals



How much do you remember or already know?

1. What is a volcano?
2. What is magma?
3. What is lava?
4. What are fossils?
5. What is the difference between boulders, cobbles and pebbles?
6. What is erosion?
7. What is a cycle in nature?
8. What are rocks made up of?
9. What is a mineral?
10. What do we mean by the 'properties' of rocks?
11. Name one sedimentary rock.
12. Name one igneous rock.
13. Name one metamorphic rock.
14. How do sedimentary rocks form?
15. How do igneous rocks form?
16. How do metamorphic rocks form?
17. Why do some rocks have large crystals and some have small crystals?
18. Would you expect to find fossils in igneous rocks?
19. Why or why not?
20. Marble is a metamorphic rock. Name one use for marble.
21. Granite is an igneous rock. Name one use for granite.
22. Sandstone is a sedimentary rock. Name a use for sandstone.
23. What makes rocks useful?
24. How old is the Earth thought to be?
25. What branch of science studies rocks?
26. What branch of science studies minerals?
27. What branch of science studies fossils?
28. What do we call a scientist who studies the Earth's crust?
29. What might a geophysicist do?
30. What might a geochemist study?

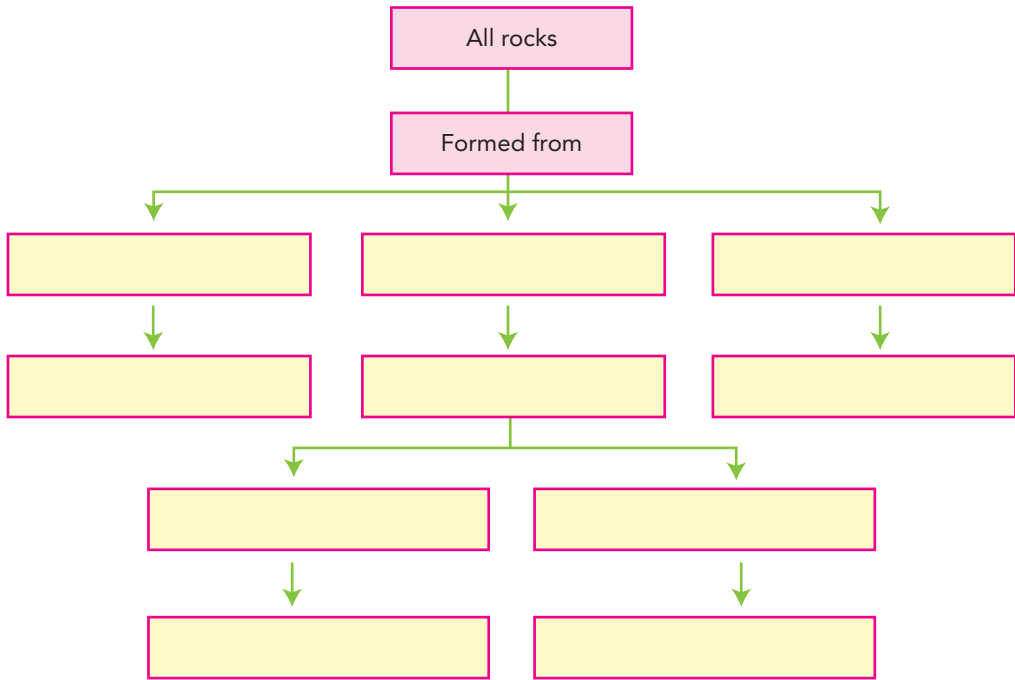


6.1 Formation of rocks

6.1.1.2 Each paragraph in the passage on the previous page has a main idea and another idea. Summarise these ideas in brief points in the table.

Para	Main and other idea in each paragraph	
1	Main	
	Other	
2	Main	
	Other	
3	Main	
	Other	
4	Main	
	Other	
5	Main	
	Other	

6.1.1.3 Use the information in the passage to complete the following classification diagram.





6.1 Formation of rocks

6.1.3.2 Complete the table.

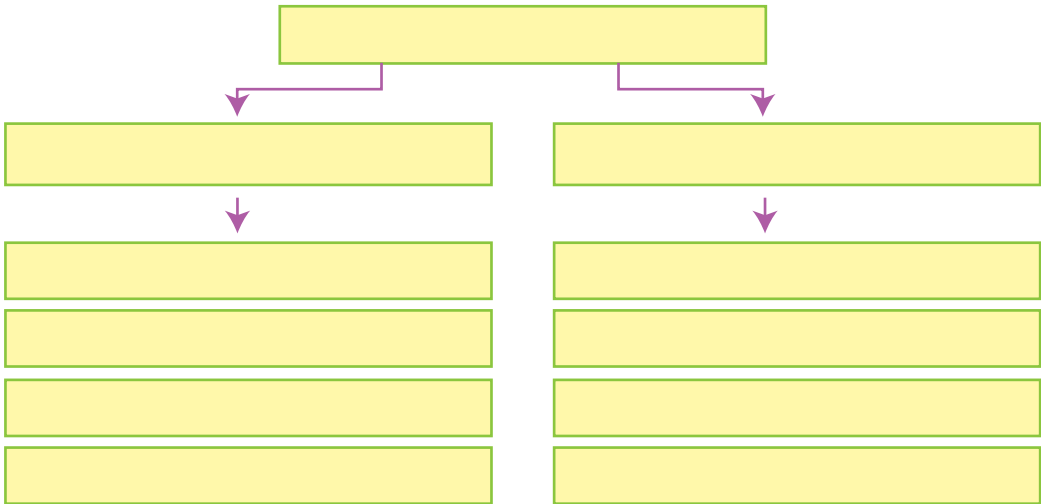
Noun	Adjective	Verb
Solid		
		Intrude
	Extrusive	
Crystal		
		Melt



6.1.3.3 Complete the table to give the opposite of each word.

Word	Opposite
Volcanic	
Intrusive	
Slowly	
Cool	
Recrystallise	
Molten	

6.1.3.4 Complete the diagram to summarise the classification of igneous rocks from the passage.



6.1.3.5 Volcanic and plutonic rocks can be easily distinguished from each other just by looking at them, even if you do not know what the rock actually is.

- (a) How can they be distinguished?
- (b) Why do they have this difference?

6.1 Formation of rocks

6.1.4 Metamorphic rocks

Read the passage below then answer the questions that follow.

The Earth's crust is constantly moving. Deep inside the Earth it is very hot. This heat and the forces which accompany Earth movements can change rocks. They melt and recrystallise or they are squeezed and deformed. Rocks which are changed like this are called metamorphic rocks.

Marble is a metamorphic rock. It is formed when the sedimentary rock, limestone, is partly melted and recrystallised. Marble comes in many colours, often with misty bands of other colours through it. Pure white marble from Carrara in Italy, is highly valued for use in carvings, tabletops and vases.

Metamorphic rocks are made, either by contact metamorphism or by regional metamorphism.

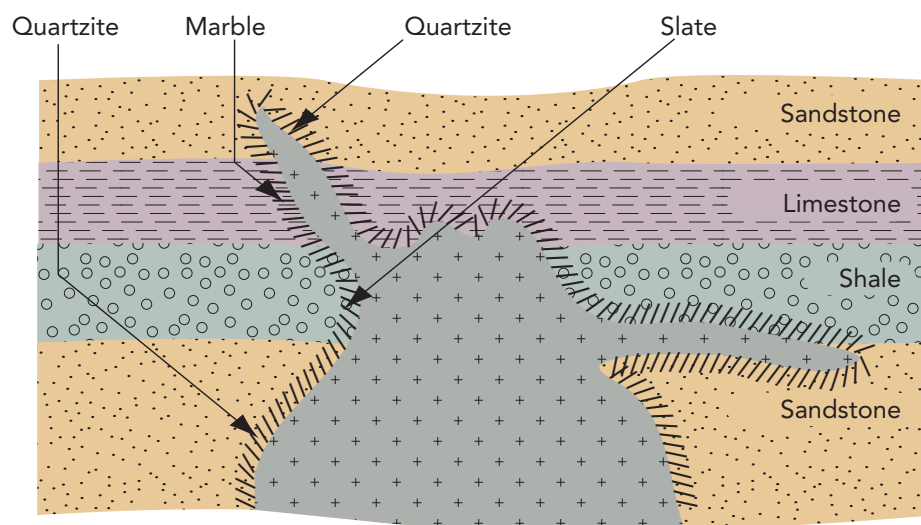
Contact metamorphism occurs when molten magma is forced into cracks in rocks in the crust. The heat from the magma can recrystallise the rocks it intrudes. Sandstone can be changed into **quartzite** in this way.

Regional metamorphism takes place over a much larger area. It occurs during movements in the crust of the Earth. In regional metamorphism, rocks are changed by both heat and the strong forces in the crust.

Granite, an igneous rock changes to the metamorphic rock **gneiss** when it is subjected to high pressures which deform the mineral crystals. The metamorphic rock **slate**, formed from metamorphism of shale can be further metamorphosed into **schist** in the same way.



Marble.

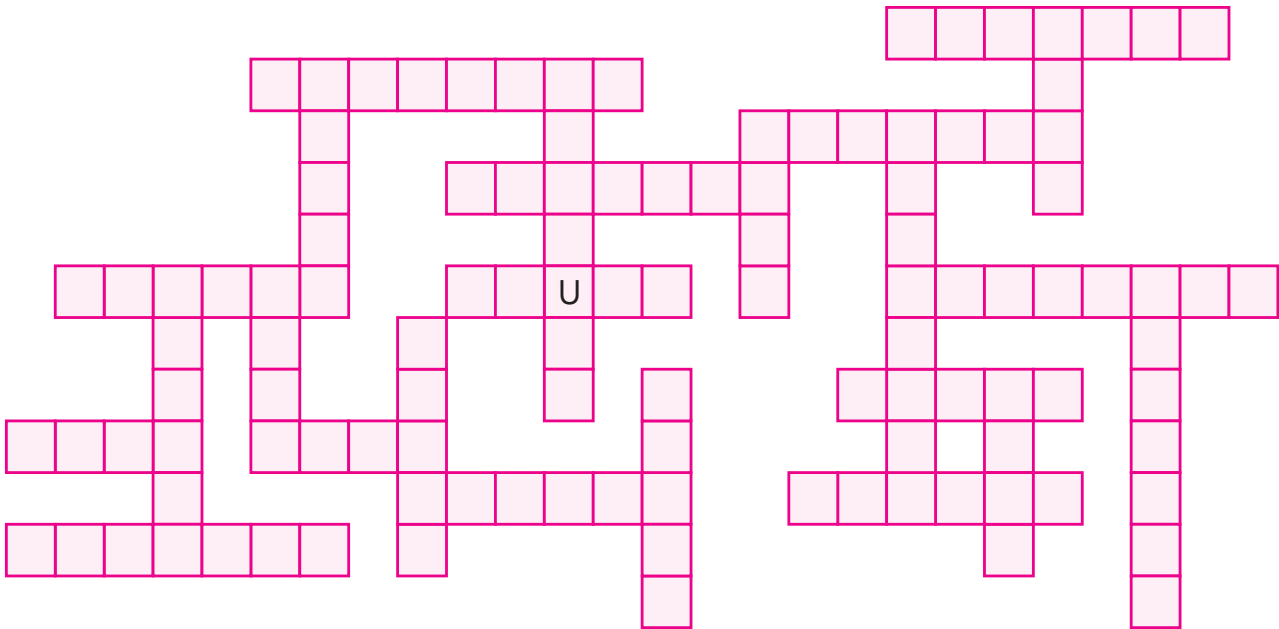


Metamorphic zone around intrusions.



6.1 Formation of rocks

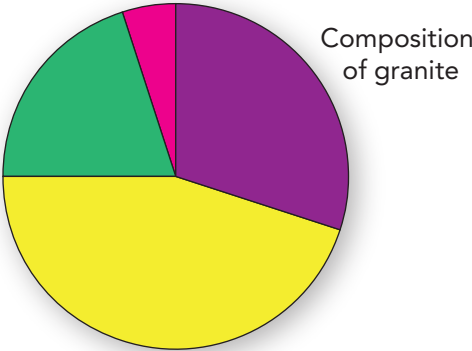
6.1.4.3 Below the crossword blanks are all the igneous jumbled terms that fit into it. Unjumble them then fit them into the blanks. One letter has been given as a clue.



Jumbled	Unjumbled	Jumbled	Unjumbled	Jumbled	Unjumbled
LEMT		QUILDI		COOLVAN	
RUDETEX		WOLF		DRUNE	
TRAINEG		LAMSL		RUDETIN	
LOCO		GAMAM		LABAST	
THEA		NEVT		GRALE	
FACERUS		NEGIOUS		ICEMUP	
PLUNTICO		SLYDOIFI		TRACYLSS	
AVAL		PRUTE		TENLOM	

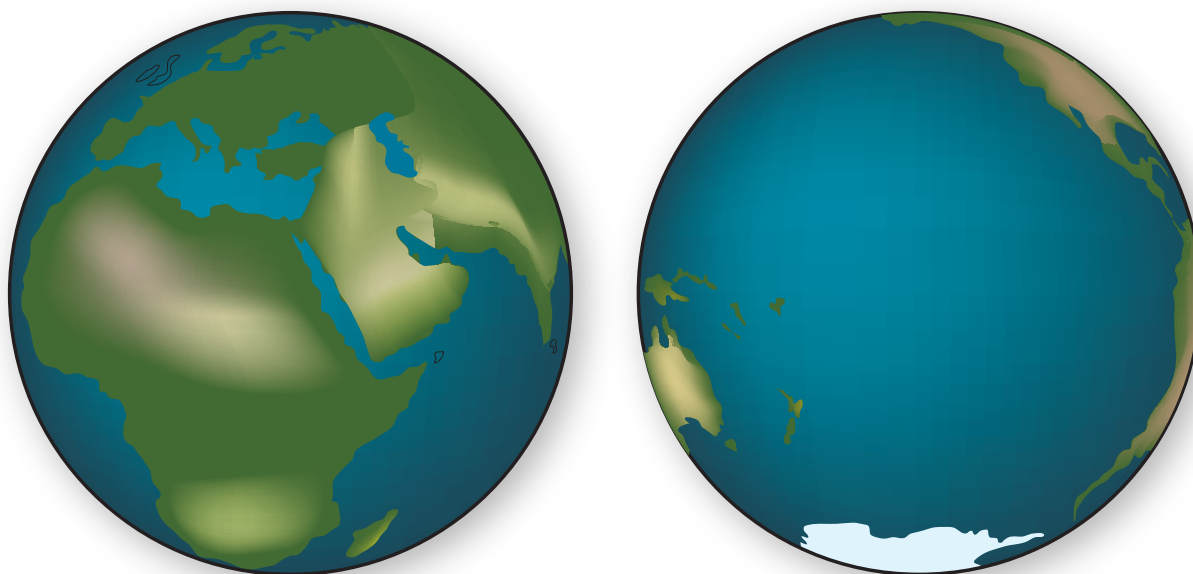
6.1.4.4 The pie chart shows the mineral composition of a type of granite. What is the mineral composition expressed as percentages?

Mineral	Amount (%)
Quartz	
Orthoclase	
Plagioclase	
Mica	



6.1.5 Structure of the Earth

The illustrations below suggest two totally different Earths. If approached from space we could image Earth as mostly land or mostly water, depending on what was facing us. The illustration on the left suggests that the Earth is 70% land and 30% water, while that on the right suggests it is at least 70% water!



The Earth actually has a surface area of about 508 million km², of which 360 million km² (about 71%), the **hydrosphere**, is water. The other 148 million km² is land. About 97% of the Earth's water is salt water in the oceans and seas. The other 3% is fresh water, of which about 77% is stored as ice at the poles, another 22% is absorbed into the ground, and only 1% is fresh water in lakes and rivers and moisture in soil and the air.

From observations of drillholes, earthquakes and volcanoes, scientists conclude that the Earth is not a solid sphere, but has several layers. (Note that resources vary significantly in their estimates of the thickness of these layers.)

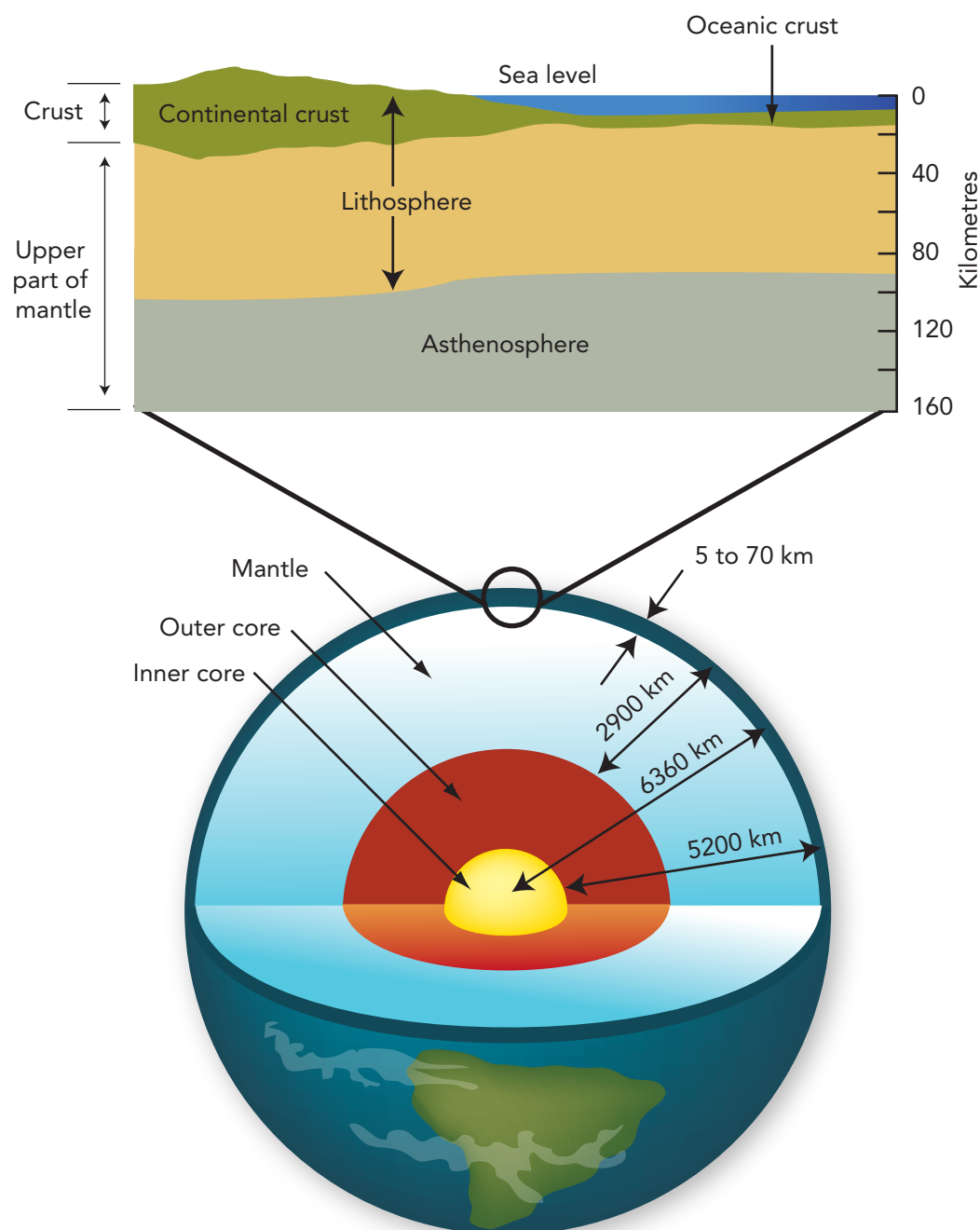
- The **crust**, averaging only 15 km thick (ranging from about 6 km under the ocean depths to about 70 km under continents) has been likened to the skin of an apple. The crust makes up only about 1.5% of the Earth and it is thickest under continents and thinnest under oceans. Its average density is 2.9 g/cm³ and its temperature varies from 20°C at the surface to about 500°C near the mantle. The crust and the upper, almost solid portion of the 2900 km thick mantle together make up the **lithosphere** – the outer, solid layer of the Earth. The lithosphere averages about 70 km thick.
- Under the lithosphere is the **asthenosphere**, ranging from 100 to 200 km thick under the continents. The asthenosphere is a zone in which 1% to 2% of the rock is molten, and it acts as a low friction zone on which the lithosphere floats and moves.

6.1 Formation of rocks

The **mantle**, about 82% of the Earth, varies in texture from the near solid rock in the lower lithosphere to the hot, almost fluid or 'plastic' rock in the asthenosphere, to the molten rock near the core. Its average density is 3.6 g/cm^3 . The molten material from volcanoes comes from the mantle. The temperature of the mantle varies between 500°C and 3000°C .

Deeper inside the Earth is the 2300 km thick outer core – hot, permanently molten material at temperatures between 3000°C and 4000°C . The **core** (outer and inner) is thought to be composed mainly of the metals iron and nickel and is about 7000 km in diameter. Its average density is about 6 g/cm^3 . The inner core, density 9.5 g/cm^3 despite its 5000°C temperature, is thought to be kept solid by the enormous gravitational pressures from the material above it.

Internal structure of the Earth



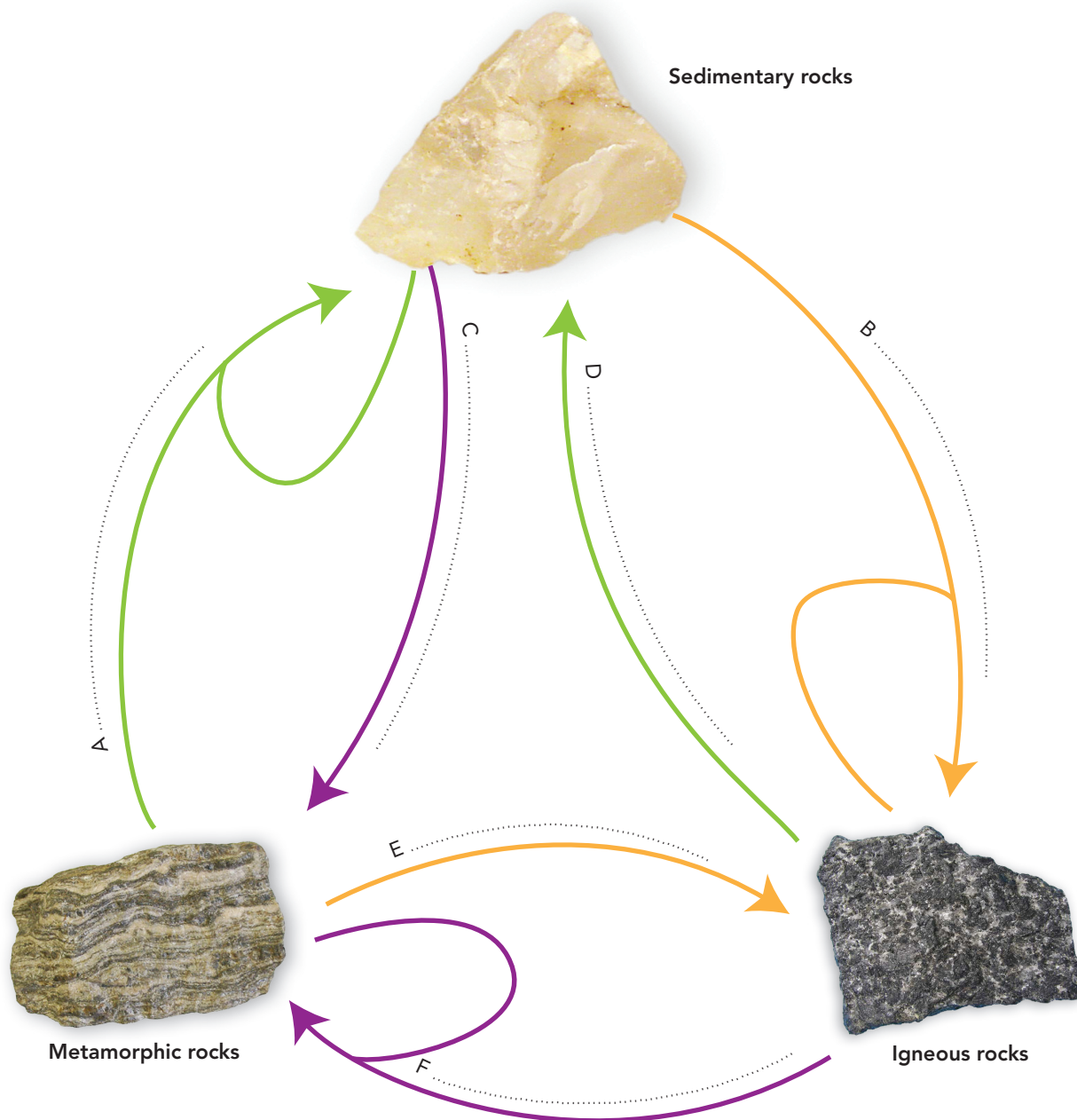
6.2 Identifying rocks

6.2.1.1 The diagram below shows a simple rock cycle. Your task, with your friends, is to discuss where the following labels go (print them neatly inside the arrows), and then add them to the cycle to complete it. Note that each label will need to be used more than once.

Label 1 Weathering, erosion, deposition, compaction

Label 2 Melting then cooling

Label 3 High temperature and pressure



6.2.2 Recognising sedimentary rocks

Recognising rocks is not easy. Even if you know all the characteristics of rocks, it still takes lots of practice and experience to tell some of them from others.

Some are obvious, like conglomerate and breccia with their different sized rounded or angular fragments cemented together, but others, like shale, sandstone and mudstone can sometimes look almost the same if you don't have an expert eye.



6.2.2.1 In this activity you will ideally have a real sample of each rock to look at as well as the photographs on the next page. You should also have a magnifying glass.

Your task is to describe the properties of each rock – things that will help you recognise other samples of these rocks later. You could also compare the properties with some of the others.

For example, you might describe both sandstone and shale as 'gritty' feeling, but comment that the sandstone is 'more gritty' than the shale (because shale's sediment particles are smaller).

Do this activity with your friends to share ideas and to get other input into your descriptions. Write your descriptions in the spaces on the next page.

