Cambridge Checkpoint Lower Secondary Science Student Book 9 (2022) Answers

Introducing science

Student's Book answers

A scientist grows up (SB page vii)

1 Sound is made by vibrations. The tree falling will make a sound because it will make vibrations as it falls through the air to hit the ground. Even if the tree was a long way away and no-one saw or heard it, a recording device such as a microphone would record the falling vibrations as sound.
2 Suggestions might include setting up a sound recording device near a tree that is in danger of falling (think about safety!). Listen to the sound recording once the tree has fallen. Alternatively, set up some simple equipment (for example, a ruler ready to fall – or make it fall over by pushing or pulling it) and record this to see what sounds are made.
3 Accept any reasonable suggestions; for example, observation, curiosity, questioning, etc.

Stories about scientists (SB page xii)

4 Look for possible responses which show that Alhazen thought about his own actions and thought about whether he agreed with the Ancient Greek ideas or not. By carrying out practical activities, he showed his ideas to be correct instead.
5 Look for answers suggesting the cloth was translucent, because the light became darker (dimmed), but apparently did not disappear. If the cloth had been opaque, it would have blocked out the light completely.
6 He looked at the stars.
7 He knew that the stars were a long way away and believed they were just too distant for rays from the eyes to reach them in an instant. Alhazen believed that the opposite of the Ancient Greeks' idea was true – that light comes from the objects we see.
8 Practical ways of exploring how light travels.
9 To compare results.

(SB page xiii)

10 Mani was an avid reader and was keen to find out things by reading.
11 When she was working with gemstones.
12 When measuring information from the solar stations she set up in India.
13 As she progressed in her field of work and collaborated more with scientists around the world.
14 Historical data about the amount of sunlight or wind power needed to generate energy, and also the amounts of ozone in the Earth's atmosphere.
15 Answers will vary.

(SB page xiv)

16 Baylis studied engineering and worked in a laboratory.
17 He worked with people who were injured and he worked as a stunt man.
18 Learning about AIDS in Africa and how villagers did not have access to radios to be educated about AIDS.
19 Questions such as: How could I make a wind-up radio that would play for longer periods of time? How could I make them cheaply?
20 How can the electric motor be made to turn efficiently?
21 How can the motion of the electric motor be done other than by hand? (Turning the handle.)

End of chapter questions (SB page xvii)

1 Answers will vary. Hypothesis should test the relationship between plant growth and light.
2 Answers will vary. Hypothesis should test the relationship between shadows and the Sun.
3 Steel is magnetic so the magnet will attract the paper clip.
4 It will evaporate as the heat of the Sun warms the puddle.

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5 a Students should produce a graph with height on the *y*-axis and time (days) on the *x*-axis.
b Students should use the graph to estimate, approximately 15 cm.
6 a Students should produce a graph with number of birds on the *y*-axis and time (days) on the *x*-axis.
b Students should plot points accurately using the data in the table.
c Students should draw a suitable line of best fit.
d Students should use the line to make an estimate for Wednesday, approximately 25 birds.
e It is an estimation, but based on a trend on a graph, so it has some scientific basis and is therefore fairly accurate, although probably not perfect.

1 Water and life

Student's Book answers

Do you remember? (SB page 1)

- Ice = solid, water = liquid, water vapour = gas.
- A compound of hydrogen and oxygen.
- Any five of: Sensitivity, nutrition, movement, growth, respiration, reproduction.
- Getting rid of harmful waste products.
- Cell wall, cell membrane, vacuole, chloroplasts, cytoplasm, mitochondria, nucleus.
- It has a long thin extension on one side which grows out into the soil.

Organs of a flowering plant (SB page 2)

1 A flower, B leaf, C stem, D root, E bud.

Transport of water through the stem and leaves (SB page 4)

2 The soil. It is taken up by the roots.

Minerals and how plants use them (SB page 7)

3 Because it lacks nitrogen, water or sunlight.
4 The soil might contain the mineral that was being omitted from the solution.

Science in context (SB page 8)

Monitoring vegetation with satellites

5 The North Atlantic and Arctic Oceans, the northern Pacific Ocean, the east of South America and Africa, the seas between north Australia and Indonesia, and the seas around Antarctica have the largest concentrations of phytoplankton.
6 In the waters described in the previous answer.

End of chapter questions (SB page 12)

1 Hairs.
2 The stem.
3 Nitrogen and magnesium. Nitrogen is needed for the development of the leaves and for making chlorophyll and proteins. Magnesium is needed to make chlorophyll.
4 The movement of water through a plant.
5 It is filtered and urea is removed with excess water, while substances that the body needs are reabsorbed after filtration.
6 Pass into the vacuole of a root hair cell, then into a xylem tube in the root, then a xylem tube in the stem and out onto the leaf stalk and vein. The molecule would then enter a gap between the cells in the lower part of the leaf and pass out through a hole in the leaf (a stoma).

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2 Photosynthesis

Student's Book answers

Do you remember? (SB page 13)

- The Sun.
- Mitochondria.
- Cell structures:
  - A Cell membrane.
  - B Cytoplasm.
  - C Nucleus.
  - D Cell wall.
  - E Chloroplast.
  - F Mitochondrion.
  - G Vacuole.
- Glucose + oxygen → carbon dioxide + water.

Science in context (SB page 15)

The willow tree experiment

1 It was not fair. He should have set up two plants in identical conditions and watered only one of them.
2 Yes, because he believed the 'element' water made the plant grow. If the plant had failed to grow, the experiment would not have supported his belief.
3 The mass of the water used in the experiment.
4 Use seedlings (5 or 10) instead of saplings as they grow faster. Weigh each seedling before placing it in a pot. Water the pots when the top of the soil appears dry. Record how much water is given to each seedling. After a week or more, when there are signs of growth, remove the seedlings, carefully remove as much soil from the roots as possible and re-weigh them. Compare your results with van Helmont and draw a conclusion.

Science in context (SB page 16)

Plants and the air

5 No, van Helmont died in 1644 and Hales was born in 1677.
6 In van Helmont's time, it was thought that there were four elements – air, water, fire and earth – but by the time of Hales and Ingenhousz, carbon, hydrogen and oxygen were identified as elements.
7 Because air had not been considered in van Helmont's work.
8 Hales showed that 'a portion of the air' helped green plants to survive and Ingenhousz identified carbon dioxide as being that 'portion of the air'.
9 Looking at the amount of evidence that has been collected and assessing its strength to see if the hypothesis is supported or refuted by it. Looking through the results to see what they might show. Then considering the limitations before making a conclusion. Following the conclusion with suggestions for further experiments and investigations to make the data more reliable and less limited.

Testing for the carbohydrate called starch in leaves (SB pages 18–19)

10 The cells may remove it.
11 It would not boil in the boiling water.
12 It would go green because it has removed chlorophyll from the leaf.
13 It would break up.
14 The white tile shows any colour change more clearly than a coloured tile.

Removing the carbohydrate called starch from a plant (SB page 19)

15 The equation does support the one made by van Helmont as carbohydrate has mass.

Carbon dioxide and starch production (SB page 20)

16 Above 7. The two chemicals are alkalis.
17 To prevent air from outside getting in and around the leaf.
18 Yes. They need to let in the light so the plant can photosynthesise.

→

What is the effect of carbon dioxide on starch production? (SB page 21)

19 It supports the equations made by van Helmont and by Hales, as it shows that water (identified by van Helmont) and carbon dioxide (identified as a portion of the air by Hales) produces a substance – carbohydrate, which has mass as identified by van Helmont.

Light and starch production (SB page 21)

20 If it is found that no starch is produced in the aluminium-covered leaf, this could be due to the closeness of the covering, rather than because the light is blocked out. To control for this possible effect, a cover is placed on the other leaf too. This cover is transparent. The only difference between the two leaves is that one is exposed to light and the other is not, so if there is any difference in starch production between the two, it must be because of the effect of light.

Photosynthesis and oxygen (SB page 24)

21 The reactants are water and carbon dioxide. The products are carbohydrate and oxygen.

Can you repeat Priestley's experiment? (SB page 24)

22 Look for responses beyond a simple yes/no answer. Ask students to explain their reasoning, based on their results and conclusion.

End of chapter questions (SB page 26)

1 Yes. In the equation for respiration, the products are water and carbon dioxide, and in the equation for photosynthesis, the reactants are water and carbon dioxide.
2 If the starch was to remain in the leaves, you would not be able to tell if starch production had taken place during the course of the experiments.
3 The plant will produce more bubbles. Photosynthesis is a chemical reaction and increased warmth increases the speed of the reaction. This increase results in the plant producing more oxygen.

3 Genetics

Student's Book answers

Do you remember? (SB page 27)

- Vertebrates and invertebrates.
- It has scales, fins and gills. A mammal has hair, four legs and lungs.
- An amphibian has a smooth skin, is often damp and most have four legs. Birds have a skin covered in feathers and have the first pair of legs modified into wings.

Science in context (SB page 29)

Gregor Mendel, Hugo de Vries and genes

1 To prevent them self-pollinating.
2 To prevent insects from pollinating the flowers.
3 Plants use pollen to reproduce.
4 It reduces error and makes the results more reliable, because it reduces the effects of chance. If only one experiment is performed, there is a chance that an unusual result may occur. If many experiments are performed, a pattern will be seen, which reduces error in drawing conclusions and makes the results more reliable.
5 He could describe patterns seen in the results.
6 He was looking critically at sources of secondary data and comparing results and methods used by others.
7 Darwin's Pangenesis hypothesis.

Chromosomes and genes (SB page 31)

8 a Alberto: from the mother – eye colour; from the father – hair colour, hair texture, absence of freckles, attached ear lobes.
b Benita: from the mother – hair colour, freckles; from the father – hair texture, eye colour, attached ear lobes.
c Carlos: from the mother – hair colour and texture, eye colour, freckles, free ear lobes; no clear features from the father.
d Dorita: from the mother – hair texture, eye colour, free ear lobes; from the father – absence of freckles, hair colour.

Sex chromosomes (SB page 32)

9 Because there is an equal chance of a chromosome from a female gamete combining with an X or a Y chromosome from a male gamete.

Chromosomes and gametes (SB page 34)

10 a 25
b 25
c 50

Science in context (SB page 36)

Finding out about DNA

11 She studied the structure of molecules by firing x-rays at them.
12 It provided them with evidence on which to base their ideas.

Darwin and his work (SB pages 39–40)

13 That they all developed from a species of mockingbird or finch from South America.
14 Animals and plants produce a large number of offspring. The size of the plant or animal population in a habitat usually stays the same or may change if conditions in the habitat change.
15 Individuals in a species vary.
16 Insects.

End of chapter questions (SB page 43)

1 Something that has been received or given to another, usually from one generation to the next.
2 An observable feature that is always found in a particular organism.
3 They may show variation in their sizes, colours, markings, curiosity.
4 The way a feature differs across a group of things, such as size or markings in the litter of kittens.

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5 A chromosome is a thread-like structure that appears when a cell nucleus divides and contains DNA. A gene is a section of DNA that contains the information about a particular characteristic, such as hair colour or eye colour, that can develop in the organism.
6 Because we have evidence that it is the material that passes from one generation to another.
7 a Those with beaks longer than 5 cm will survive and breed. Those with beaks shorter than 5 cm will die.
b The birds now have beaks 8 cm, because they have adapted to feeding on the worms at that depth in the sand.

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4 Care in fetal development

Student's Book answers

Do you remember? (SB page 44)

- Reproduction is a process which keeps a plant or animal species in existence by one generation of the species producing offspring which go on to have offspring themselves, and so on.
- Definitions such as:
  - Pollination – the transfer of pollen from the anther of one flower to the stigma of another.
  - Fruit – a structure in which the seeds grow and is used to disperse them.
  - Seed – a structure which contains an embryo plant and food store.
  - Germination – the process in which the plant inside the seed begins to grow and bursts out of the seed coat.
- The students' response to this will depend on the materials that they have used before starting this course. Look for a general statement, such as: 'It is a period of time around the age of 10–13 in girls and 12–14 in boys when certain changes take place in the body, which make the body capable of reproduction.'

Science in context (SB page 48)

Neonatal care

1 The issue for a baby that is born early can be controlling and maintaining its body temperature at a healthy level.

2 It was applied in the following ways – in the construction of a heater that could keep babies warm, the invention of a thermostat which could be used in a circuit with the heater to keep the temperature constant for the baby, the knowledge that the baby needs a supply of oxygen in the incubator and the installation of a fan to provide a flow of fresh air. The application of a humidity control, improved oxygen supply by tubes, food supply by tubes and a life-signs monitor to keep a check on the baby's health.

3 It has allowed populations to increase by reducing the death rate of babies in their first days of life.

End of chapter questions (SB page 49)

1 The babies are smaller than normal and less able to resist attacks of disease.

2 a Yes. The smoker's baby will grow more slowly and have a higher heart rate.

b No. The smoker's baby may weigh less than normal and have damaged lungs and nervous system. It may even die before it is born.

3 a The baby may have nerve damage, a smaller head than normal, abnormal development of the eyes nose and lips and can have poor coordination and memory, inability to concentrate well and be more active than normal (hyperactive).

b The baby will be smaller than normal, less able to fight disease and may be dependent on the drug the mother was taking.

5 Environmental change and extinction

Student's Book answers

Do you remember? (SB pages 50–51)

- Definitions:
  - A place where a plant or animal lives.
  - The passing of harmful substances up a food chain where they become more concentrated at every link, causing permanent damage or death.
  - A species which enters an ecosystem in which it is not naturally found and causes damage to that ecosystem.
- Fossils are the remains of plants and animals which are preserved in rock from the time when they lived.
- Desert, tropical grassland or savannah, rainforest.
- A habitat survey is a scientific investigation of a habitat to describe it in terms of the plants and animals living there as accurately as possible.
- A quadrat – it is used to record the plants growing in a certain area of ground. A sweep net – it is used to collect small animals from the leaves and flower stems of herbaceous plants, especially grasses.

The environment (SB page 51)

1 The ground has areas of bare soil and some areas are covered with grass. There are groups of shrubs growing together with a large number of tall trees further away. It appears to be the habitat of elephants.

Organisms in the environment (SB page 52)

2 It means that an organism is highly adapted to survive in its habitat.

3 The population will become smaller as some plants are not adapted to the higher temperature. As the temperature continues to rise, in time all the plants will die out because they cannot adapt to it.

Science in context (SB page 53)

Observing chimpanzees

4 Great knowledge and enthusiasm for animals.

5 The use of the opposable big toe to grip branches as the chimpanzee moved through the trees.

6 They used them to help kill and eat mammals, such as colobus monkeys.

7 They were originally thought to be mostly herbivores, but Jane showed that they are also carnivores and are capable of making tools to feed on termites.

Ecological models: the food web (SB page 54)

8 a The populations of voles and beetles may grow as one of their predators is removed. As their populations increase, there is more food for the owl and the robin, and their numbers may increase too. If there were more robins, then there would be more food for the sparrow-hawk and its numbers may increase.

b The finches and beetles would die out or move away. The robins would eat more of the woodlice and caterpillars and their numbers would fall. This would result in less bark and fewer leaves being eaten. The size of the sparrow-hawk population would fall as there are fewer birds to eat. The numbers of shrews would fall, owing to there being fewer woodlice. The population of voles would fall as the owls would have to eat

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more of them. As the population of voles falls, the foxes and owls may move away to find more food. The population of plants may increase as there would be fewer voles feeding on their roots.

Population change (SB page 55)

9 2500 plants.

10 The evidence is not very reliable because the number of grass plant in the lawn may vary over the whole area. There might have been more plants in some squares and fewer in others.

11 a The spider numbers for the three sweeps could be added together and divided by three to find an average, which is almost seven. This figure could then be multiplied by the total number of sweeps.

b $7 \times 80 = 560$ spiders, or three sweeps yielded 20 spiders, so 80 sweeps would yield $80 \div 3 = 27 \times 20 = 540$ spiders.

c It is not very reliable as some of the calculations involve approximations and it is estimated that only a very small area is sampled. Take more samples to make a total of ten samples, then the number of spiders can be multiplied by eight. This prevents using approximations and provides more data about spider numbers.

12 It shows a pattern of rising and falling populations of the hare and the lynx.

13 There are a number of years with a large population, followed by a number of years with a lower population. There are nine periods of high population and low population. It is nearly as regular as a wave.

14 The lynx population has periods of highs and lows like the hare population, but the highs are not as great as those of the hares.

15 If the lynx does not prey on any other animal than the snowshoe hare, it could be an accurate suggestion. However, the lynx might feed on other animals whose skins have not been collected, and it might be a variation in the populations of these other animals that causes the population of the lynx to vary.

Endangered species (SB page 56)

16 The numbers in the population will remain the same.

17 This will depend on the region in which the student lives.

Extinction events (SB page 59)

18 – Late Ordovician – ice age, volcanic action, weathering of rocks.
– Late Devonian – volcanic action, development of land plants, reduction in carbon dioxide.
– Permian–Triassic – volcanic action, global warming.
– Triassic–Jurassic – global warming.
– Cretaceous–Tertiary – asteroid.
– Anthropocene extinction – human activity.

End of chapter questions (SB page 60)

1 A feature of the body that allows it to survive in the particular circumstances of a habitat (such as weather conditions or conditions in the soil).

2 A food chain and a food web.

3 Estimate how many buckets you would need to empty the pond, then multiply this number by four.

4 Critically endangered, and extinct in the wild.

5 It will reveal a great deal of detail about how the species is adapted to its habitat, and habitats can be conserved in such a way as to meet these adaptations so that the species can continue to thrive in it.

6 Sample the habitats in which they are known to exist with the appropriate equipment. Sample habitats which are similar but are not known to have the species present. Sample the habitats at different times of year as the species may go through different stages of its life cycle at different times of year and some stages are more obvious than others (for example, flying insects and their larvae). Keep surveying over a number of years and if there are no recordings of the species, it can be declared extinct. Some species considered extinct for many years are suddenly seen again, so there is a small chance that the species is not extinct but surviving in a habitat that has not been surveyed.

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6 The periodic table

Student's Book answers

Do you remember? (SB page 61)

- An atom is a particle from which all substances are made.
- The atom has a central nucleus composed of protons and neutrons. This is surrounded by a 'cloud' of electrons.
- No, they are not. Each element is made of a particular types of atom which is different from the atoms of other elements.
- An element is substance made by one type of atom. It cannot be split up by chemical reactions into simpler elements.
- The arrangement of elements set out in order of their atomic number.

Science in context (SB page 62)

John Dalton and atomic weights

1 He observed that the weight of oxygen was seven times greater than that of hydrogen, instead of eight times.
2 He thought that all atoms combined in a ratio of 1:1.

An example of early scientific equipment (SB page 62)

3 It would have been very easy to make mistakes, because the levelling screws may not be set properly, errors may be made in observing the plumb bob so that it does not point vertically down, and there may also be errors in reading the scale.

The first use of chemical symbols (SB page 63)

4 Magnesia (magnesium oxide), lime (calcium oxide), soda (sodium carbonate), potash (potassium carbonate), strontian (strontium carbonate), barytes (barium oxide).
5 H, C, O, P, S, Fe, Zn, Cu, Pb, Ag, Au, Pt, Hg.

Looking for patterns in the properties of the elements (SB page 65)

6 The idea of atomic weights investigated by Dalton formed the basis of the sorting-out process used by Döbereiner and Newlands.
7 Yes, they could, because over 12 new elements had been discovered by the time Döbereiner was working on the problem, and a further 10 had been discovered by the time Newlands made his studies.

Science extra: How the periodic table was made (SB page 66)

8 The work of Newlands. The work of scientists who corrected Dalton's idea about how atoms combine.
9 He saw how the elements' properties and their ability to join with other atoms varied periodically (that is, in a regular pattern).
10 He thought that there were probably elements that were not yet known, and left gaps in his table that could be filled in as they were discovered.
11 He looked at the patterns of properties and predicted the properties of the unknown elements. As these elements were discovered later, it was found that they did indeed have Mendeleev's predicted properties, which suggested that the table could be used to show the relationships of all elements.

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The periodic table and atomic number (SB page 67)

12 Horizontally.

13 a 20
b 15
c 17
d 19

14 a 12
b 8
c 6

Group 1 in the periodic table (SB page 68)

15 a The trends are that as you go down the group, the melting points and boiling points decrease.
b The only pattern seen are the trends described in the answer to part **a**.
c The density of lithium, as it is lower than the elements beneath it, and if the density followed the trend of the melting and boiling points, it would be higher than sodium.

16 Yes, as you go down the group, the elements get more reactive with water.

Chemical properties of the alkali metals (SB page 68)

17 The trend will be that as you go down the group, the reaction will become stronger. Lithium will have a slow reaction with oxygen, while sodium will be faster, and potassium will be faster still.

End of chapter questions (SB page 69)

1 Dalton, Döbereiner, Newlands, Mendeleev.
2 He used chemical balance scales.
3 a The number of protons present in the nucleus.
b Because it allows us to know the number of protons in the nucleus and therefore the atomic number is unique to each element.
4 Potassium is softer than sodium.
5 Potassium.
6 It sets out all the elements in an orderly way so the relationships between them can be clearly seen.

7 Bonds and structures

Student's Book answers

Do you remember? (SB page 70)

- An element is a substance made from one type of atom. It cannot be split up by chemical reactions into simpler substances. A compound is a substance made from atoms of two or more elements that have joined together by taking part in a chemical reaction. It can be split up by chemical reactions into simpler substances.
- It had a positively charged centre called the nucleus and a space around it in which there were negatively charged electrons.
- Electrons.
- a Protons
  b Electrons
  c Neutrons.

Water (SB page 73)

1 The hydrogen atoms become stable by sharing an electron with the oxygen atom, giving it two electrons in its shell. The oxygen atom becomes stable by sharing the electrons in the two hydrogen atoms to give its outer shell eight electrons.

Methane (SB page 73)

2 The carbon atom becomes stable by sharing the electrons from the four hydrogen atoms to make an outer shell of eight electrons.

Science in context (SB page 75)

The use of molecular modelling in chemical research

3 The model allows the scientist to see the position and relationships between the atoms that make up the molecule. They can link up the structure shown by the model to the chemical properties of the molecule and use this information to make new molecules, which may improve the performance of the molecule in chemical reactions.

4 Models of complicated molecules can be made more easily and can be easily viewed from different angles.

Giant covalent structures (SB page 79)

5 The atoms share their electrons with other atoms around them and this makes them bond strongly together. With exception of graphite, there are no free electrons to move around, so they cannot conduct electricity. Since a property of metals is the conduction of electricity and most covalent giant structures do not conduct electricity, this suggests that they are non-metals.

End of chapter questions (SB page 81)

1 They are arranged in circular orbits around the nucleus called shells.
2 The helium atom has a nucleus made from two protons and two neutrons with an electron cloud containing two electrons.
3 A covalent bond forms when one atom shares one or more of its electrons with another atom or atoms.
4 An ionic bond forms when one or more electrons move between atoms so that their outer shell or orbit of electrons becomes full, making the atoms stable.
5 They form bonds to make themselves more stable.
6 a They both have bonds which link the atoms together and need a great deal of energy (high melting and boiling points) to break them down.
  b The giant covalent structure forms a molecule; the giant ionic structure forms a lattice. When placed in water, the giant ionic structure dissolves but the giant covalent structure may not.

8 Density

Student's Book answers

Do you remember? (SB page 82)

- Mass is the amount of matter in a substance.
- Gravity.
- The volume of an object is the space occupied by a certain amount of matter.
- A measuring cylinder.
- Density.

Measuring the density of a rectangular solid block (SB page 84)

1 0.958 g/cm³

2 a 958 kg/m³

b It is denser than ice and polythene but less dense than Perspex®. Ice and polythene are closest in density.

c Divide it by 1000.

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Measuring the density of an irregularly shaped solid (SB page 85)

3 2.6 g/cm³

Floating and sinking (SB page 88)

4 a Paraffin oil is less dense than water. Water is less dense than mercury.

b Corn oil would float on the water.

5 a Float – its density is less than water.

b Float – its density is less than water.

c Sink – its density is greater than water.

6 a Float – its density is less than mercury.

b Sink – its density is greater than mercury.

c Float – its density is less than mercury.

7 Because the density changes with temperature.

8 The density of the human body is similar to the density of water.

9 It will rise higher because there is a greater difference in density between the object and the salty water than there was between the object and the pure water.

Density in gases (SB pages 89–90)

10 The mass of a liquid is found by weighing a container and then pouring the liquid into the container and weighing again. The mass of the liquid is found by subtracting the first mass value from the second. The mass of a gas is found by weighing the container and the gas, then removing all the gas with a vacuum pump and weighing the empty container. The mass of the gas is found by subtracting the second mass value from the first. The vacuum pump is used to draw the gas out because a gas cannot be poured into a container like a liquid.

11 a No. It is denser than the Martian atmosphere.

b No. It is denser than the Martian atmosphere.

Science in context (SB page 92)

Balloons and scientific research

12 The rising and falling of clothes being dried over a fire. Embers from a fire rising and falling and smoke continuing to rise.

13 The sheep represented (or was a model for) a human in terms of size and weight. The duck was used to flying high so should have been able to survive. The chicken is not adapted for living high in the atmosphere so if it survived (like the sheep), it meant that it was safe to travel at these heights.

14 The risk assessment would be concerned with making sure that the fire could not set the balloon or the animal carrier ablaze.

15 Helium is an inert or noble gas and is very unreactive, so it is not a fire risk.

16 Thermometer, barometer, wind-vane, anemometer, a device to measure the humidity.

End of chapter questions (SB page 92)

1

Material	Density/kg per m³
expanded polystyrene	15
cork	250
wood	650
ice	920
polythene	920
Perspex®	1200
aluminium	2700
steel	7900
copper	8940
lead	11350
gold	19320

2 1m³ of steel.

3 They weigh the same. The lower-density cork would need more volume for the same mass.

4 Hydrogen is less dense than air. Carbon dioxide is denser.

5 Yes. The average density of Saturn is lower than that of water.

6 Expanded polystyrene has a lower density than the atmosphere of Venus.

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9 Displacement reactions

Student's Book answers

Do you remember? (SB page 93)

- Any two acids, such as hydrochloric acid, sulphuric acid, nitric acid, citric acid, tartaric acid, ascorbic acid, ethanoic acid, lactic acid, uric acid. Any two alkalis, such as sodium hydroxide, potassium hydroxide, calcium hydroxide, ammonia solution.
- A word equation is used to describe what happens in a chemical reaction in words. It is a model of the reaction; on the left are the reactants and on the right are the products of the reaction.
- A symbol equation uses the symbols for the elements that make up the reactants and products instead of words.
- Sodium is the most reactive.

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The displacement of hydrogen by magnesium (SB page 95)

1 A weak alkaline solution.
2 The OH groups lost electrons and the magnesium atoms gained them.
3 The electron from each atom has joined with the electron of the other atom. They are shared between the two atoms.

The reactivity series of metals (SB page 96)

4 a Calcium, sodium, potassium.
b Zinc, iron, copper.

The reaction of metals with acids (SB page 96)

5 a Magnesium + sulfuric acid → magnesium sulfate + hydrogen.
b Zinc + hydrochloric acid → zinc chloride + hydrogen.
c Calcium + nitric acid → calcium nitrate + hydrogen.

Displacement of metals (SB page 99)

6 a The reaction produces silver nitrate and gold because silver is more reactive than gold.
b The reaction produces zinc sulfate and copper because zinc is more reactive than copper.
c The reaction produces magnesium sulfate and copper because magnesium is more reactive than copper.
d There is no reaction as gold is less reactive than magnesium.

End of chapter questions (SB page 99)

1 There is a vigorous reaction.
2 Potassium displaces hydrogen in the water molecule and forms potassium hydroxide, while the hydrogen forms a gas.
3 Iron is more reactive than copper.
4 Magnesium is a more reactive metal than zinc.

10 Preparing common salts

Student's Book answers

Do you remember? (SB page 100)

- When studying reactions between metals and acids.
- A substance with a pH of less than 7 that reacts with a metal to produce hydrogen. They may be corrosive and those that are safe to eat taste sour.
- 1–6
- Universal indicator.
- They produce hydrogen and the metal salt.
- A substance which is made from the atoms of one element, or the molecules of just one compound. In other words, pure substances are substances that contain only one type of particle.
- The process in which a liquid turns into a gas (water vapour) without boiling.

Preparation of zinc chloride (SB page 103)

1 It has a larger surface area and therefore reacts more rapidly.
2 A solution of zinc chloride.
3 To speed up the process of removing the water by evaporation.
4 Zinc + hydrochloric acid → zinc chloride + hydrogen.
5 It tells you that when zinc reacts with hydrochloric acid, zinc chloride and hydrogen are produced.
6 Zinc + sulphuric acid → zinc sulfate + hydrogen.
7 When zinc and sulfuric acid are brought together, zinc sulfate and hydrogen are produced.
8 a Magnesium + sulfuric acid → magnesium sulfate + hydrogen.
b Iron + nitric acid → iron nitrate + hydrogen.
c Calcium + hydrochloric acid → calcium chloride + hydrogen.
d Lead + sulfuric acid → lead sulfate + hydrogen.
e Aluminium + hydrochloric acid → aluminium chloride + hydrogen.
f Tin + nitric acid → tin nitrate + hydrogen.

➜

Preparation of calcium chloride (SB page 105)

9 There was an excess of acid to take part in the reaction with the calcium carbonate (marble) chips.
10 All the acid had been used up so there was none left to react with the excess of marble chips.
11 To remove the solid from the liquid.
12 Calcium carbonate + hydrochloric acid → calcium chloride + carbon dioxide + water.
13 a i Zinc carbonate + sulfuric acid → zinc sulfate + carbon dioxide + water.
ii Aluminium carbonate + hydrochloric acid → aluminium chloride + carbon dioxide + water.
iii Magnesium carbonate + nitric acid → magnesium nitrate + carbon dioxide + water.
iv Copper carbonate + sulfuric acid → copper sulfate + carbon dioxide + water.
v Calcium carbonate + nitric acid → calcium nitrate + carbon dioxide + water.
vi Lead carbonate + hydrochloric acid → lead chloride + carbon dioxide + water.
b ii, v, i.

Science in context: Salimuzzaman Siddiqui and chemicals from natural products (SB page 108)

14 Students' own answers.
15 Curiosity, imagination and creativity.
16 Scientific names are understood by scientists all around the world and are used to identify the plants here as both have at least two common names. 'Snake root' and 'heal all' might not be ordinary names of these plants in other parts of the world, for example.
17 He set up a research institute under the guidance of Hakim Amjal Kahn, with whom he must have worked well, as he named a chemical after him. He also worked on research projects with other scientists and their students. He was asked to set up another research programme and founded the Pakistan Academy of Sciences and the Pakistan Council of Scientific and Industrial Research, and was a founder member of the World Academy of Sciences.
18 Yes. He ran the Hussain Ebrahim Jamal Research Institute of Chemistry until he was 93 and then carried out research in his laboratory.

End of chapter questions (SB page 109)

1 The metal salt and hydrogen.
2 The metal salt, carbon dioxide and water.
3 Fold a piece of filter paper to make a cone, and insert it into a filter funnel. Support the funnel above a collecting vessel, and pour the mixture of solid and liquid into the paper cone.
4 It is used as a drying agent, in food processing and seasoning, in medicine and in speeding up the setting of concrete.
5 Cosmetics, some deodorants, making rayon fibres from cellulose, making glue, bleaching paper, in making herbicides and sewage treatment, in chemical investigations.
6 A solid structure with flat sides.
7 The solution is placed in an evaporating dish and gently heated. The heat is then removed and the solution is left in the laboratory, where it continues to lose water through the process of evaporation and the crystals form.
8 A spatula, conical flask, support (clamp and stand), filter funnel with filter paper in it, beaker, evaporating dish, gauze, tripod, Bunsen burner, heat-proof mat used in the laboratory.
9 His discoveries are an inspiration to other scientists. He set up research programmes, the Pakistan Academy of Science and the Pakistan Council of Scientific and Industrial Research, which became The World Academy of Sciences, which also has a Young Affiliates Network.

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11 Rates of reaction

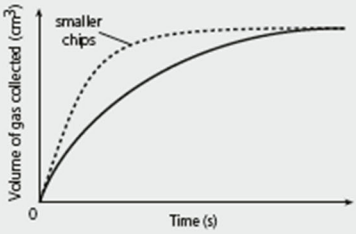
Student's Book answers

Do you remember? (SB page 110)

- Mass refers to the amount of matter in a sample of a substance.
- Reactants are the chemicals which take part in a chemical reaction. Products are the chemicals that are produced by the chemical reaction.
- It has more of the dissolved substance in it than the other liquid does.
- Temperature refers to the hotness or coldness of a substance. It is a measure of the amount of thermal energy something contains.

Particle size (SB page 117)

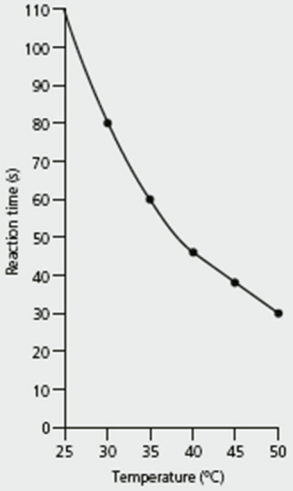
1 a



b The reaction would be faster, with more gas produced earlier, because the surface area of one of the reactants has been increased.

Temperature (SB page 118)

2 a



b A curve.
c 70 seconds.
d 31°C

3 Sodium thiosulfate + hydrochloric acid → sodium chloride + water + sulfur + sulfur dioxide.

4 The milk by the radiator will smell unpleasant and be sour, while the milk in the fridge will not smell or taste unpleasant. The warmth from the radiator will speed up the reactions between fat and oil in the milk and oxygen in the air, which make chemicals that give a bad smell and taste.

The triangle of fire (SB page 119)

5 Water affects the heat side of the triangle of fire. It reduces the temperature of fuel so that it cannot burn. Water can help in controlling forest fires by being poured onto the burning trees from a helicopter or aeroplane. This water will cool down the wood, stop it from burning and from transferring the flames through the forest.

Science in context (SB page 121)

Catalysts

6 She wrote a book in which the equipment, materials and methods were clearly described.

7 No. Elizabeth Fulhame studied chemical reactions on metals and also on other solvents. Sir Humphrey Davy spent time discovering elements and also worked on how experiments could be speeded up. Johann Wolfgange Döbereiner, who spent time sorting out the elements, also worked on how experiments could be speeded up.

8 Catalysts are very important. They are used to speed up chemical reactions in the production of plastics, fertilisers and acids. They are used in devices called catalytic converters, which change harmful chemicals in engine exhausts into water, carbon dioxide and nitrogen. This makes the exhaust gases less harmful to people living in cities, where there is a large number of vehicles moving around every day.

End of chapter questions (SB page 123)

1 The rate is the speed at which a chemical reaction takes place.

2 The mass of calcium carbonate would decrease as it took place in a chemical reaction to form a calcium salt and the carbon dioxide would leave the liquid.

3 In a syringe, directing the gas produced in an enclosed flask into a delivery tube and collecting the gas escaping into a water trough with a test tube or boiling tube.

4 a 6 square centimetres.
b 1000
c 6000 square centimetres.
d The tiny cubes have a surface area one thousand times greater than the one centimetre cube.

5 It increases. The particles taking place in the reaction move faster and increase their chances of touching particles with which they can take part in a chemical reaction.

6 The damp logs need to take up some heat to make the water in them evaporate. This lowers the temperature, so the reaction between the wood and the oxygen slows down.

7 Shazia collected equal masses of small logs from the tree and twigs from the bush, judging them by their weight in her hands, and then timed how long each sample took to burn. The twigs burnt up faster than the logs.

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12 Energy

Student's Book answers

Do you remember? (SB page 124)

- Kinetic energy.
- Stored energy.
- Sound energy.
- Energy changes:
  - a Chemical energy is changed into light energy and heat energy.
  - b Kinetic energy is changed into strain energy.
- Energy which we cannot use.
- Something that exists in different forms, such as electrical energy, light energy, sound energy, heat energy, the energy of something moving.

Thermal energy, internal energy and temperature (SB page 125)

1 The full kettle holds a larger mass of water, which can hold a larger amount of internal energy. More thermal energy needs to be supplied to reach a certain temperature, such as the boiling point.

2 The pan full of water, because of its much greater mass.

Conservation of energy (SB pages 127–28)

3 The stored energy in the cheetah is being released in exothermic reactions in the muscles which make it move. Although the heat is lost from the cheetah, it is not lost from the environment, because it passes into the air and warms it.

4 The light energy from the Sun is being conserved in an endothermic reaction, in which molecules are made which make the plant grow.

Heat dissipation (SB page 128)

5 Accept any sensible everyday examples, such as leaving a door open and letting heat out (in the air) of a home into cooler surroundings, a car engine releasing heat into its surroundings, or a warm drink cooling down.

Conduction (SB page 129)

6 The pin nearest the candle will fall off first, then the pin next to it, and so on until all the pins have fallen. This will happen because the heat is conducted along the rod and as the rod gets hot, it melts the wax holding the pin to the rod, and the pin falls.

→

Convection (SB page 131)

7 The hot air above the burning coal rises and carries the particles of soot with it. The upward force of the moving air is greater than the weight of the individual soot particles, so they move upwards.

8 a During the day, the air above the land will warm more quickly than the air above the sea. This warmer air will rise and the cooler air from above the sea will move in over the land, causing a breeze from the sea to the land.

b The wind will blow in across the promenade from the sea. The land is warmer than the sea.

c Yes, the wind direction will be reversed. At night, the air above the relatively warm surface of the sea rises, and the air above the cooler surface of the land moves in to take its place. This causes the wind to blow out from the land towards the sea.

Science in context (SB page 134)

Uses of cooling by evaporation

9 The path begins in the compressor, where the particle is squashed together with other particles to become part of a heated gas. The particle then moves on to the condenser, where it cools and becomes a liquid with the other particles around it. The liquid passes into an expansion chamber, where the liquid evaporates and the particle separates from those around it as it forms part of a gas. The gas then goes to the compressor, where the particle starts on another path around the system.

End of chapter questions (SB page 137)

1 Heat energy.

2 They move about more.

3 It rises.

4 Thermometer.

5 Energy is neither created nor lost (destroyed); it just changes form.

6 In conduction, the particles in a substance pass on the heat energy from one to another. In convection, the particles take the heat with them as they move through the substance.

7 Heat travels as electromagnetic waves through air or a vacuum.

8 It eventually dries up. Some of the molecules of water at the surface of the moisture have so much energy that they escape from the liquid and form water vapour in the air. This leaves some water behind, but again, some molecules have so much energy that they leave too, and in time the whole of the liquid turns into water vapour and the surface becomes dry. As evaporation occurs, the amount of energy left in the liquid on the surface is reduced and its temperature drops, making it cooler.

9 a A device which can detect infrared radiation and convert it into electrical energy to make the picture.

b Detecting warm objects at night in the countryside, or hidden by smoke in a fire, and in medicine to diagnose disorders of the body without touching them.

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13 Waves

Student's Book answers

Do you remember? (SB page 138)

- They vibrate. They move from side to side about a fixed point. They spread out and squash together to make sound waves.
- No. There are no particles to vibrate and make a sound wave.
- You could hold a book 20 cm in front of your face below your mouth and then say a long 'ahh', listen to the sound, raise the book in front of your mouth and listen and hear that the sound is louder due to the reflection of more sound waves.
- An echo is a reflected sound which arrives more than one tenth of a second apart in certain circumstances, such as the sound you hear when clapping just over 17 metres from a high wall.

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The particle model and the spread of sound (SB page 140)

1 The tines of the tuning fork represent a vibrating object. The table-tennis ball represents a particle in the air. The movement of the ball shows what happens to an air particle when it strikes a vibrating surface and shows how it can pass this movement on.

The pitch of a sound (SB page 143)

2 a Highest pitch is 10 000 Hz; lowest pitch is 50 Hz.
b Hertz.

Science extra: The Doppler effect (SB page 144)

3 The sound wave could have a wavelength of 2 cm (just a standard length) when the bike is stationary. When it is moving at speed towards you, the waves need to be shorter and more closely packed together. When the bike is moving away, they need to be longer and more drawn out.
4 Students should make up words to represent the sounds. For example, when the motorbike is stationary, 'rom', when it is moving towards, 'riiiiim' and when it is moving away, 'ruuuuum'.

Modelling sound waves (SB page 148)

5 Yes. The strengths of the model are that it lets you visualise how the waves are behaving and that the movement of the wave-generating object is like the twanging ruler. The limitations of the model are that sound waves act in three dimensions, while water waves only act in two. Also, the model only shows waves in a liquid and not a gas or solid.

End of chapter questions and answers (SB page 150)

1 They also vibrate.
2 a It has a large amplitude and a short wavelength.
b It has a large amplitude and a long wavelength.
c It has a small amplitude and a short wavelength.
3 The sound gets louder.
4 The frequency of the sound waves increases so the pitch of the sound is higher.
5 a When the crests of the waves meet at the same place. When the crest of one wave arrives at the same place as the trough of another wave.
b i The rarefaction of one wave is added to the rarefaction of another wave.
ii The rarefaction of one wave is added to the compression of another wave.

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14 Electrical circuits

Student's Book answers

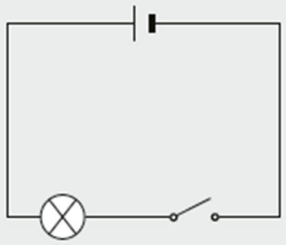
Do you remember? (SB page 151)

- A metal, or carbon.
- Pottery (ceramic), wood.
- That all the components are connected into the circuit securely.
- An ammeter measures current.
- Electrons.

A simple electrical circuit (SB page 152–153)

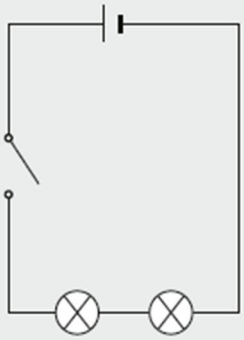
1 a Press the switch down so the two pieces of metal in it touch together.
b Remove the pressure from the switch so that it springs back, and the two pieces of metal no longer touch.
2 a The electrical current flows around the circuit.
b The current of electricity stops flowing.

3

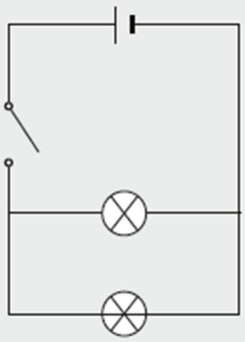


Series and parallel circuits (SB page 153)

4 a



b



Measuring current (SB page 153)

5 a They become dimmer. The current flowing through each one is reduced.
b They become brighter. The size of the current has been increased.

Measuring voltage (SB page 156)

6 **Similar:** They are both connected into the circuit across the terminals of the cell.
Different: The ammeter is in series and the voltmeter is in parallel.

Calculating resistance (SB pages 159–160)

7 Resistance $= \frac{3}{0.4} = 7.5$ ohms.

8 a Current $= \frac{12}{4} = 3$ amps.
b More current, as shown by applying the equation – current $= \frac{12}{2} = 6$.

Variable resistors (SB page 162)

9 a To the right.
b To the left.
10 a Turn it to the right. By doing this, you are reducing the length of wire that the current passes through and so reducing the resistance to the current. This means that less energy is used by the current pushing through the wire and more energy can be used to make the lamp brighter.
b Turn it to the left. By doing this, you are increasing the length of the wire that the current passes through and so increasing the resistance to the current flow. This means that more energy is used by the current pushing through the wire and less energy can be used by the lamp so it becomes dimmer.

Science in context (SB page 165)

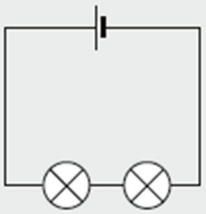
Superconductors

11 He studied how gases behaved as they turned into liquids.
12 Helium turned into a liquid at a very low temperature.
13 A superconductor allows all the energy in a current to pass through it. When passing through an ordinary conductor, some of the current's energy has to be used to overcome the resistance of the conductor.
14 Equipment to cool down the superconductor.

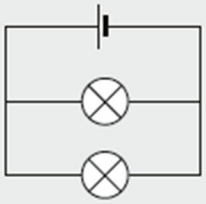
End of chapter questions and answers (SB page 166)

1 a Two cells, three wires, a lamp and a switch.
b One cell, three wires, a buzzer and a switch.
c Three cells, four wires, a variable resistor, a lamp and a switch.

2 a



b



3 a It leaves the cell, travels through the lamps and the switch and back to the cell.
b It leaves the cell then splits into two; each current flowing through the lamps is half the strength of the total current. When the two currents meet up again, the current returns to full strength to pass through the switch and back to the cell.

4 An ammeter is used to measure the strength of the current. It is set up in a series circuit with the other components.

5 The voltage is the ability of the cell to drive a current around a circuit. It is also the potential difference between two points in a circuit.

6 No. You set it up in parallel with a component in the circuit and find the voltage or potential difference across the component.

7 The ability of a material to oppose the movement of electrons through it is the property called resistance.

8 a 30 ohms.
b 15 ohms.

15 Planet Earth

Student's Book answers

Do you remember? (SB page 167)

- Igneous, sedimentary, metamorphic.
- Crust.
- Mantle.
- Yes. Tectonic plates are huge slabs of rock which cover the surface of the Earth.
- Where two tectonic plates push together.
- Yes. As the Earth spins, it is thought that the movement of the solid metal in the inner core and the liquid metal in the outer core generate the magnetic field that makes it seem like the Earth has a large bar magnet inside it.
- Figure **a** is an ammonite fossil. Figure **b** is a fossil of a fish. They both show that living things existed millions of years ago.

Science in context (SB pages 168)

Changing ideas about the Earth

1 There are four areas of land at the North Pole, there is a huge area of land around the South Pole, North America is a huge land mass incorporating Canada and Greenland, the shape of South America is too wide and too short, Australia is placed on the left-hand side of the map.

Evidence for tectonic plates (SB page 169)

2 Weathering is the breaking down of the surface of the rocks into smaller fragments in situ. Erosion is when the surface of rocks is broken down and transported by air and water to another place.

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Evidence from volcanoes and earthquakes (SB page 173)

3 Volcanoes are often found at plate boundaries, so the lines or chains of volcanoes follow along the boundary lines.

Evidence from magnetism (SB page 173)

4 The minerals in the newly emerged surface rock are influenced by the Earth's magnetism and line up in a particular way. The rocks are continually produced and over time the magnetic field changes, and this is recorded in the minerals. Later, the magnetic field changes again. The distances between the changes in field can be used to compare how fast the rock is being produced and how fast the plates are moving.

End of chapter questions and answers (SB page 178)

1 Igneous and metamorphic.
2 By the weathering of rock, erosion of the fragments and the packing together of the fragments to make new rock.
3 A freshwater, crocodile-like reptile.
4 When the plant first grew, all the continents were joined together so they were found throughout this supercontinent.
5 Earthquakes happen when plates move, especially at plate boundaries, where friction and energy is released in the form of seismic waves.
6 Thermal convection happens when molten rock closer to the inner core is hotter than molten rock closer to the crust. The magma nearer to the core rises within the mantle towards the crust, creating a circular movement or current within the magma. Students have the option to draw a diagram here which should clearly show the layers crust and mantle and should use arrows to show the convection currents within the mantle.

16 Cycles on Earth

Student's Book answers

Do you remember? (SB page 179)

- A cycle of changes through which rock materials pass, from molten rock in the mantle, to igneous rock at the surface, to weathering and erosion and the formation of sedimentary rock, to metamorphic rock in the Earth's crust, back to molten rock in the mantle.
- They are weathered and the fragments are carried away by the process of erosion and may form sedimentary rock elsewhere, which if buried in the crust, may become metamorphic rocks.
- It is the cycling of water between the oceans, the atmosphere and passing over or through the land.
- The sea water evaporates and becomes water vapour, which when it rises in the atmosphere, condenses to form tiny water droplets that form clouds.
- The process occurring in all living things in which energy is released from food to be used for all life processes, and in the process carbon dioxide and water are produced. It occurs in the cells of all living things.
- A herbivore is an animal that eats plants, a carnivore is an animal that eats other animals, and an omnivore is an animal that eats both plants and animals.
- Decomposers break down the bodies of dead plants and animals and release the minerals they contain back into the soil, where plants can use them for growth. They recycle the minerals in the dead bodies of plants and animals so that they can be used again in food chains in a habitat.

Photosynthesis (SB page 181)

1 It is a chemical reaction which takes in heat.

Feeding (SB pages 185–186)

2 Answers such as rabbit, cow, sheep, goat, insects.
3 Yes. They are the first consumers in the food chain and feed on the producers.
4 Wolf, lion, owl.
5 Yes. They all feed on animals that are primary consumers. A fox feeds on rabbits; an owl feeds on mice.

➜

6 There are seven food chains:
- Tree → giraffe → cheetah → vulture
- Tree → giraffe → vulture
- Tree → giraffe → lion
- Tree → elephant → cheetah → vulture
- Tree → elephant → vulture
- Tree → giraffe → lion
- Tree → giraffe → cheetah → lion

Climate change (SB page 189)

7 The weather is a description of the conditions in the atmosphere at a place over a short period of time, such as a day or a week. Climate refers to the average conditions experienced in a place over a longer period of time, such as a year or more.

Why might climates be changing? (SB page 190)

8 It shows a pattern of alternating periods of high concentration and low concentration of carbon dioxide.

9 It shows a pattern up until 1940 of rising and falling temperatures, but from 1970 it has shown an upward trend.

Sea level change (SB page 191)

10 This will depend on the student's location. Away from the coast, the change in sea level may not have an effect, although people who are displaced from the coast may come to live there. People living on the coast or on islands may live in areas that will be progressively affected.

Extra water in the atmosphere (SB page 191)

11 Habitats may be destroyed or change to one more suitable for dry conditions. Farm crops will be affected, causing food shortages. Livestock will die, producing food shortages.

End of chapter questions (SB page 195)

1 It forms structures in the plant which are then digested by herbivores to make structures in their bodies. The carbon moves onto a carnivore when the herbivore is eaten and forms structures in the carnivore's body. When the carnivore dies, the carbon may pass into the bodies of decomposers. At each stage in the food chain, some carbon may be released as carbon dioxide in respiration.

2 Carbon combines with oxygen quickly and heat is given out in the process. If a flame is produced, burning is said to be taking place.

3 Greenhouse gases trap heat energy from the sun and cause the atmosphere to warm up.

4 Students should name any extreme weather event such as: hurricanes, tornadoes, or snowfall. They should explain that climate change is contributing to increased frequency of events occurring.

5 The answer here will depend on the students' circumstances. Generally, there will be a raise in overall temperature and more frequent violent storms, which people may be making plans to address.

6 Reduction in the use of energy by not travelling about the planet, growing all food locally with those in hotter areas using genetically modified crops and livestock. Reducing recycling by wearing same clothes for longer and using all private vehicles for much longer, staying local or using public transport. Spending time tending habitats to increase carbon assimilation from the atmosphere.

17 Earth in space

Student's Book answers

Do you remember? (SB page 196)

- Mercury, Venus Earth, Mars, Jupiter, Saturn, Uranus Neptune.
- A galaxy is a huge group of stars (some with planets) formed from stellar dust.
- A planetary system is a star with one or more planets in orbit around it.

Asteroid collision (SB page 198)

1 The far side has more craters. The hypothesis could be that the near side of the Moon is protected by the Earth, which has had asteroid collisions that would have reached the Moon.

Mass extinctions (SB page 200)

2 It stops them growing by reducing the amount of light and heat.

3 They do not have enough herbivores to eat so starve and many will die.

4 The answer will depend on the location of the student. It would ultimately affect everyone on Earth, but the nearer the student's location to the impact, then the more severe the consequences.

End of chapter questions (SB page 206)

1 The solar system – planets, moons, asteroids.

2 The forces of gravity between them and Jupiter.

3 A change in the force of gravity can cause an asteroid to change its orbit.

4 It would send out a huge amount of dust and ash if it crashed onto land. This would create clouds, blocking out the Sun, and possibly produce an impact winter. If it landed in the sea, it would send up huge amounts of water which form clouds that also block out the Sun's heat and light.

5 It is believed to have formed in the Big Splash event, when a planet-like object collided with the Earth and was destroyed. A ring of rocks formed around the Earth and came together to form the Moon.

6 It helps us to understand how we have come to exist on a planet and the care we must take in conservation to keep us here. It helps us to look out for approaching asteroids and make plans to avoid impact. Science is a human activity about discovery and astronomy provides huge opportunities to find out about the universe and our place in it.