ANSWERS TO THE CAMBRIDGE CHECKPOINT SCIENCE WORKBOOK 3

You may award one mark for each answer or part of an answer.

1 Photosynthesis

Starch in leaves

1 Colourless grains.

2 **a)** Beaker, test tube, tripod, gauze, heat-proof mat, Bunsen burner and white tile.
b) 1 dip leaf in hot water to kill cells; 2 boil test tube of ethanol; 3 dip leaf in water to soften it.
c) **(i)** To take the chlorophyll out of the leaf.
(ii) The Bunsen burner is turned off before ethanol is brought into the laboratory.
d) **(i)** Iodine solution.
(ii) Brown.
(iii) Blue-black.
e) **(i)** The leaf does not contain starch.
(ii) Light is needed for starch production and keeping the plant in a cupboard destarches it.

Constructing the equation for photosynthesis

3 **a)** Two trays of seedlings or two plants.
b) Keep them both in the same conditions except provide water to one plant and not the other.
c) The plant with water will be healthy while the plant without will wilt, dry up and die.

4 **a)** Put it in a cupboard for 2 days to destarch it.
b) To remove carbon dioxide from the air.
c) Set up a similar plant with sodium hydrogencarbonate to provide carbon dioxide for the plant.
d) The plant with soda lime will not have starch in its leaves but the plant with the sodium hydrogencarbonate will.

5 **a)** It will contain starch.
b) **(i)** It will not contain starch.
(ii) The plant has been without light and it needs light to make starch.

6 **a)** A green and white leaf.
b) To show that chlorophyll is needed for starch production.
c) **(i)** The leaf is brown and blue-black.
(ii) The brown parts were white and did not have chlorophyll; the blue-black parts were green and possessed chlorophyll.

7 **a)** The following should be labelled – the test tube, filter funnel, beaker, supports and Canadian pondweed.

b) A gas will have collected in the test tube.

c) **(i)** Test the gas in the tube with a glowing splint.

(ii) The gas is oxygen.

8 **a)** The amount of light is low and steady until six o'clock. It then rises to a maximum at midday and decreases until six in the evening when it remains low and steady again.

b) The amount of carbon dioxide is high and steady until six o'clock. It then sinks to a minimum at midday and increases until six in the evening when it remains high and steady again.

c) It is very similar, rising and falling at the same times.

d) In sunlight, the plants take in carbon dioxide for photosynthesis and produce oxygen.

9 **a)** CO_2 – carbon dioxide.

$C_6H_{12}O_6$ – carbohydrate.

H_2O – water.

O_2 – oxygen.

b) carbon dioxide + water $\xrightarrow[\text{chlorophyll}]{\text{light}}$ carbohydrate + oxygen

10 **a)** Nitrogen, phosphorus, potassium.

b) **(i)** Phosphorus.

(ii) Potassium.

(iii) Nitrogen.

c) They are released back into the soil where they can dissolve in water and be taken up by the roots of other plants.

2 Reproduction in flowering plants

The parts of a flower

1 **a)**

Part	Name
A	stigma
B	style
C	ovary
D	stalk
E	sepal
F	filament
G	anther
H	petal

b) The sepal.

c) The petal.

d) **(i)** The filament and anther.

(ii) The stamen.

e) **(i)** The stigma, style and ovary.

(ii) The carpel.

2 **a)** A sugary liquid.
b) The nectaries.
c) At the base of the petals.

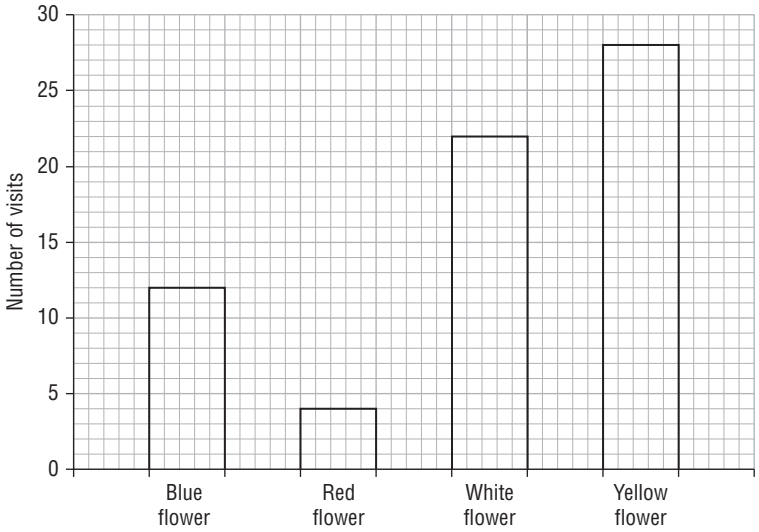
3 They produce large quantities of pollen. Their stigmas hang outside their flowers.

Pollen grains and pollination

4 **a)** A male gamete.
b) In the anther.
c) **(i)** Insect-pollinated flowers.
(ii) They help them stick to hairs on insects.
d) **(i)** Wind-pollinated flowers.
(ii) They will travel further in the wind, increasing their chance of finding another flower.

5 **a)** The pollen is transferred from the anther to the stigma.
b) Release pollen before stigmas are ready to receive them. Release pollen after stigmas are ready to receive them.

6 **a)** They must all be the same size.
b) **(i)** Sugar and water.
(ii) Dissolving.
c) The difference in concentrations may also affect how bees are attracted to flowers.
d) They should all be the same distance from the beehive and on the same side so that they get the same amount of Sun, and direction and power of any wind will be the same.
e) 12, 4, 22, 28
f)



g) No, the bees preferred the yellow and white flowers.
h) The same person could be used to make all the observations as some students may be more observant than others.

Fertilisation

7 C, E, B, F, A, D, G

8 **a)** It becomes a seed.
b) They fall away.
c) It becomes a fruit.

Dispersing the fruits and seeds

9 a) To spread them out so that they do not compete with each other for light and minerals and water in the soil.

b) To increase the chance that some will find a place to grow.

10 a) (i) The larger the wing, the further the seed will travel.

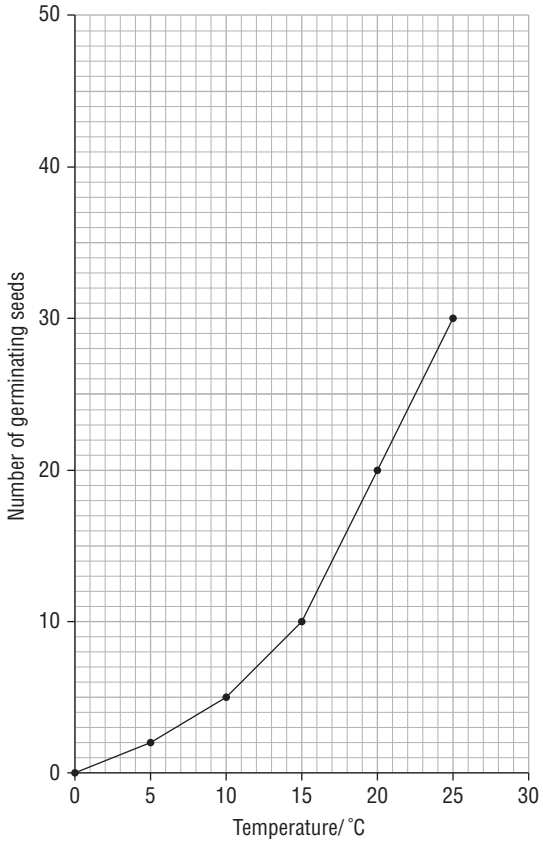
(ii) The larger wing has greater air resistance so wind will push on it with greater force and make it travel further.

b) Hairdryer, clamp and stand, ruler, forceps, tape measure.

c) The seeds and wings are all different sizes.

d) Set up the hairdryer with a clamp and stand, switch it on and hold one of the seeds from group A in a pair of forceps at a certain height above the hairdryer on the side where the air is blowing. Drop the seed and measure and record how far it travels. Repeat with all of the other seeds in group A, and then with all of the seeds in the other groups. Compare the distances travelled by the different seed types.

11 a)



b) (i) The number of seeds germinating.

(ii) The temperature chosen by the scientist.

c) 40

d) (i) None.

(ii) It would be too hot and the heat would kill the seeds.

3 Adapting to a habitat

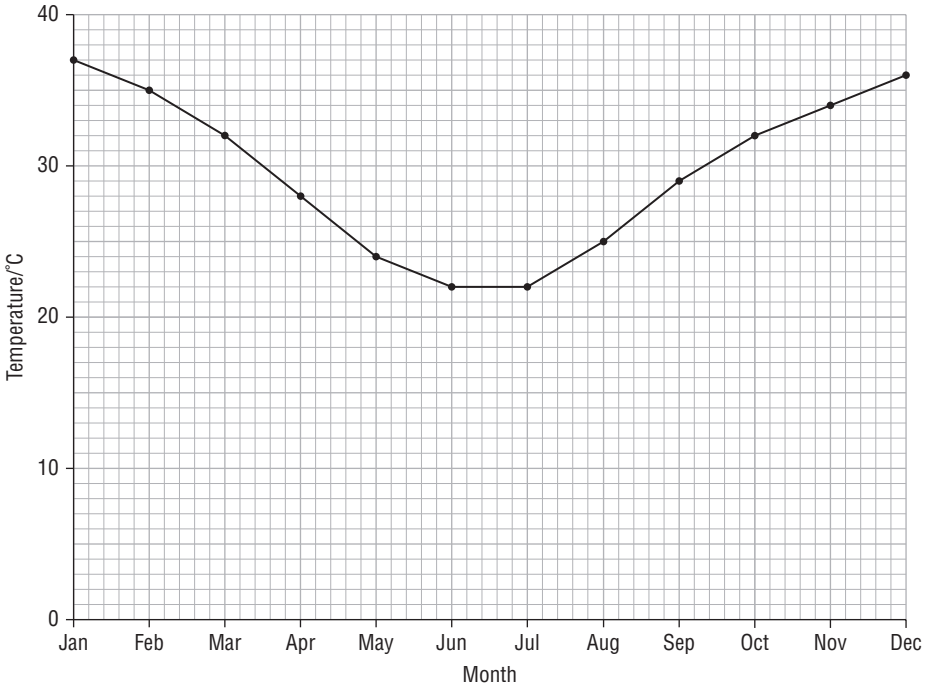
1 a) Grow long roots.

b) It could grow prickles or spines or make chemicals that taste bad or are poisonous.

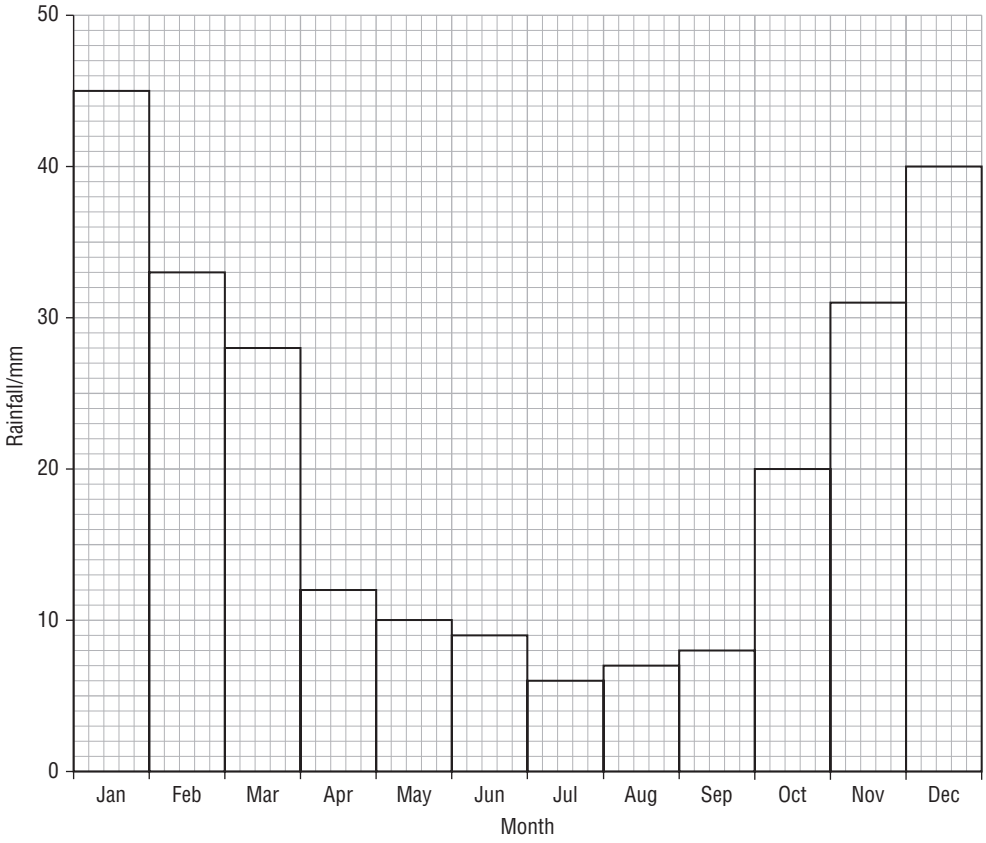
c) Grow longer beaks or develop digging behaviour.

Adaptations to the seasons

2 a)



b)



c) (i) The Southern Hemisphere.

(ii) The warmest temperatures are in October–March.

d) (i) Two.

(ii) It has a hot season when some rain falls and a cold season when there is little rain.

e) Desert.

f) Camel-like animals; cactus-like plants.

3

Spring	Summer	Autumn	Winter
A H K	F I L	B D E	C G J

4 To find more food as their current food supply decreases.

Adaptations to a habitat

5

Feature	Mangrove swamp	Lake
salt water	✔	
fresh water		✔
daily rise and fall of water levels	✔	
seasonal rise and fall of water levels		✔
risk of drying out in drought		✔
no risk of drying out in drought	✔	
no movement of mud		✔
regular movement of mud	✔	

b) It must be able to grow in fresh water and mud that does not move. It must be able to stand seasonal variations in water level and even drought conditions.

6 **a)** The details of birds' feet in different habitats.

b) To use wire to make a model bird foot.

c) She set it up to blow on the card representing the bird's body to knock the bird off its perch.

d) The length of the front toes, the length of the leg, the size of the body and the distance of the hairdryer from the perch.

e) The length of the back toe.

f) The bird with the longest back toe.

g) The bird with the shortest back toe.

Extreme adaptations

7 **a)** Eyes, pits, tongue.

b) Pits.

c) **(i)** The mouse.

(ii) It is much warmer than its surroundings.

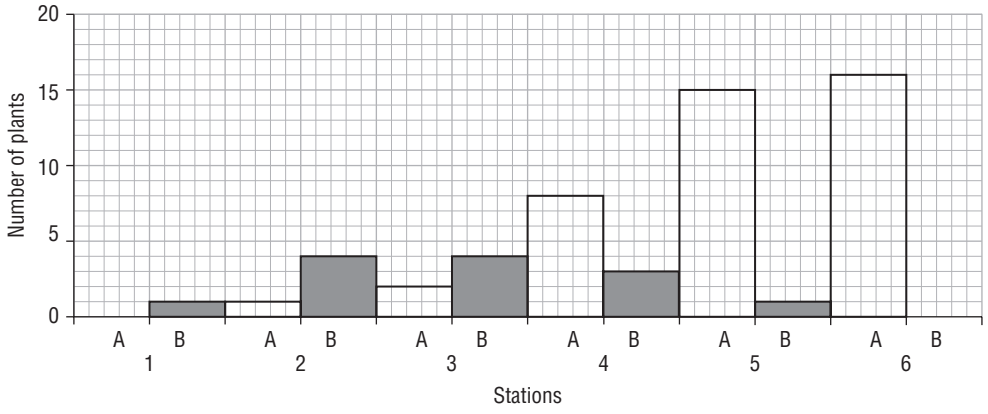
d) The areas detected by the pits overlap.

e) Poison.

8 **a)** A straight line through a habitat along which plants and animals living there are recorded at intervals.

b) A square frame that can be used randomly or on a line transect to record organisms in the habitat.

c)



d) As the light increases, the number of species B decreases. As the light increases, the number of species A increases.

e) **(i)** Not enough light.

(ii) Too much light.

f) **(i)** No.

(ii) There could be a temperature difference. The tree root might be drawing in water so there is a difference in soil moisture along the transect. The tree root might be releasing a poison (as in walnut).

4 Ecosystems

The growth of ecology and A vocabulary of ecology

1 **a)** North America.

b) South America.

2 **a)** A large region of the Earth generally covered by the same community of plants and animals and all parts having the same weather.

b) Desert and tropical and subtropical grassland.

c) Desert.

3 Oceanic.

4 The number and variety of species in an ecosystem.

5 Plants, animals and microorganisms.

6 Light, wind frequency, soil type, temperature, humidity, presence of rocks.

Food chains and Food webs

7 **a)** Afrotropical, Palearctic, Indo-Malay, Neotropical and Oceanic.

b)

Ecological term	Organism
producer	grass
primary consumer	grasshopper
herbivore	grasshopper
secondary consumer	lizard
tertiary consumer	mongoose
carnivores	lizard, mongoose
top carnivore	mongoose
prey	grasshopper, lizard
predators	lizard, mongoose

8 **a)** Crustaceans – shrimp, crab, lobster. Molluscs – octopus, snail, slug.

b) phytoplankton ➔ zooplankton ➔ krill ➔ fish ➔ seal ➔ killer whale

c)

Whale	Secondary consumer	Tertiary consumer	Quaternary consumer
humpback	✔		
killer			✔
sperm		✔	

d) If there are fewer fish, many seals might starve to death and their numbers would fall so the whale would have to switch to eating squid to maintain its supply of food.

e) The Sun.

Ecological pyramids and Decomposers

9 **a)** The pyramid should be labelled, starting at the bottom – producer, primary consumer, secondary consumer, tertiary consumer.

b) The bottom box should be narrow to represent one log; the middle box should be wide to represent 100 termites; the top box should be narrower than the middle box but wider than the bottom one to represent the two chimpanzees.

Ecosystems

10

Organisms	Take in carbon dioxide	Produce carbon dioxide	Take in oxygen	Produce oxygen	Release minerals
producers	✔	✔	✔	✔	
primary consumers		✔	✔		
secondary consumers		✔	✔		
decomposers		✔	✔		✔

How populations change

11 10/1000 20/1000 – population decreases
20/1000 20/1000 – population does not change
15/1000 10/1000 – population increases.

12 **a)** Making sure all adults are healthy enough to breed; provide extra care in rearing young.

b) Protect animals from predation.

5 Human influences on the environment

Humans in the environment

1 Shells – containers; stone – building materials; wood – fuel; flint – knives; skins – clothes.

2 **a)** Fuel and raw materials.

b) Air pollution and habitat destruction.

c) The world population increased.

The Earth's changing atmosphere

3 **a)** It escaped from volcanoes.

b) Photosynthesis.

c) Oxygen.

d) Ozone.

e) It prevents the harmful ultraviolet rays reaching the Earth's surface.

f) CFCs have been produced (in aerosols, fridges and air conditioning), which have made holes in it and reduced its thickness.

4 Carbon dioxide, oxides of nitrogen, carbon monoxide, sulfur dioxide.

5 D, B, G, F, A, E, C

6 **a)** Sulfur dioxide and oxides of nitrogen.

b) Sulfuric acid and nitric acid.

c) The pH goes down.

d) **(i)** It will increase. The invertebrates are not present to feed on it.

(ii) It will decrease because there is nothing for the fish to eat.

e) **(i)** Aluminium.

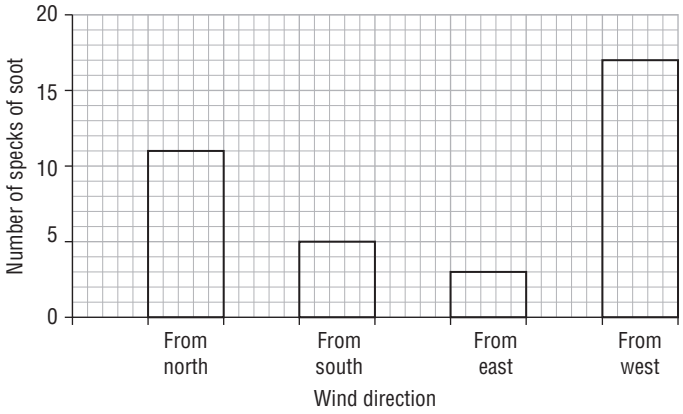
(ii) Fish.

(iii) They suffocate and die.

7 **a)**

Board	Number of specks of soot
wind from north	11
wind from south	5
wind from east	3
wind from west	17

b)



c) **(i)** North west.

(ii) The wind from these two regions carried the most soot.

d) **(i)** Yes.

(ii) The wind might be blowing at different speeds. High-speed winds might drop fewer soot particles than low-speed winds.

Water pollution

8 Any three from: textiles, paper-making, tanneries, metal works.

9 **a)** A great increase in the algae population.

b) Fertiliser.

c) Bacteria.

d) Large numbers of water animals die.

10 In any order:

1 It prevents oil being flushed out into the sea.

2 The oil is conserved, slowing down the search for more.

Indicators of pollution

11 **a)** B

b) 3–7

c) All stations will have bushy lichens.

Intensive farming

12

Fact	Inorganic fertiliser	Organic fertiliser
contains manufactured chemical compounds	✔	
needs activity of decomposers		✔
contains animal and human wastes		✔
provides minerals instantly	✔	
does not need activity of decomposers	✔	
provides minerals slowly		✔
builds up soil structure		✔
can be added while crop is growing	✔	
constant use destroys soil structure	✔	
cannot be added to crop while it is growing		✔

13 They compete for sunlight, water and minerals and may be infested with microorganisms that cause disease in the crop.

14 Narrow-spectrum insecticides – they kill a smaller range of insects.

15 Using an animal species to reduce (or control) the population of another species by predation.

16 **a)** To provide ideal conditions for photosynthesis in her crop plants to produce the maximum yield.
b) Because each crop may need different amounts of carbon dioxide, light and heat to produce a maximum yield.
c) Water and nutrients.

6 Classification and variation

The main groups of living things

1 Protoctista – one cell body with nucleus – amoeba.
Fungi – have spores and hyphae – yeast.
Monera – one cell body without nucleus – bacteria.

2 **a)** Algae.
b) Ferns.
c) Conifers.

3 **a)** **(i)** Jellyfish.
(ii) Algae (seaweed).
(iii) Echinoderm (sea urchin).
(iv) Bird.
b) A seashore (the sea).
c) The bird.

Keys

4 **a)** A – Lesser weever, B – Lesser sand-eel, C – Armed bullhead, D – Three-bearded rockling.
b) Lesser weever.
c) Lesser sand-eel.

Inherited characteristics

5 A characteristic that is passed from one generation to the next.

Cells and reproduction

6 Nucleus.

7 There are two genes for each body feature in a cell. There are large numbers of genes on a chromosome.

8 **a)** Eggs and sperm.
b) In the pollen grain.
c) In the ovule.
d) 12
e) Fertilisation.
f) A zygote with 24 chromosomes.

9 **a)** They swap portions.
b) They have slightly different combinations of features from their parents.

Selection

10 B – long roots to find water in dry conditions; D – short stem to reduce being blown about; F – food for crop production can be made at a lower temperature; H – seeds not blown away, will stay in place until time for harvesting.

11 **a)** The best suited of two species will survive in a habitat.
b) Adaptation.

12 A species may change over time through the process of natural selection.

CHEMISTRY

7 The structure of the atom

1 Indivisible particle.

2 Matter is neither created nor destroyed.

The structure of the atom

3 **a)** Proton – positive charge; electron – negative charge; neutron – no charge (neutral).
b) Neutral.

4 **a)** A electron, B shells, C nucleus.
b) **(i)** Nucleus.
(ii) It contains protons, which have a positive charge.

5 It always has the same number of protons. The number of neutrons can vary.

6 About the speed of light.

The atomic structure of 20 elements

7 Oxygen – O – bottom picture; hydrogen – H – middle picture; helium – He – top picture.

8 The periodic table

1 The number of protons in an atom.

2

Group	Name	Symbol	Atomic number
1	potassium	K	19
2	beryllium	Be	4
4	silicon	Si	14
5	nitrogen	N	7
7	fluorine	F	9
8	argon	Ar	18

Groups of the periodic table

3 **a)** 7
b) 2
c) 1

4 a)

Element	Melting point/°C	Boiling point/°C	Group	Group name
A	649	1097	2	alkaline earth metals
B	–100.9	–34	7	halogens
C	63.5	760	1	alkali metals

b) Physical properties.

5

Element	Chemical property	Group	Group name
A	dissolves in water to form an acid	7	halogens
B	dissolves slightly in water to form an alkaline solution	2	alkaline earth metals
C	dissolves readily in water to form an alkaline solution	1	alkali metals

6 a)

Element	Information	Name	Group
A	pale yellow-green poisonous gas	fluorine	7
B	forms bones and teeth	calcium	2
C	combines with oxygen, silicon, and aluminium to form an emerald	beryllium	2
D	used to make batteries	lithium	1
E	forms the orange glow in some street lamps	sodium	1
F	red-brown liquid with poisonous fumes	bromine	7

b) Oxygen – 6, silicon – 4, aluminium – 3.

7 a) Helium – meteorological balloons; krypton – airport landing lights; xenon – photographers' flash guns; argon – wire filament light bulbs.

b) The noble gases.

c) They are very unreactive.

8 a) Colourless.

b) Ammonia.

c) Hydrocarbon.

The periods of the periodic table

9 a) A horizontal line of elements.

b) (i) 2

(ii) Carbon, nitrogen, oxygen and fluorine.

c) 6

9 Endothermic and exothermic reactions

Endothermic reactions

1 a) No.

b) It is a physical process, which is reversed by freezing.

2 a) citric acid + sodium hydrogen carbonate ➔ sodium citrate + carbon dioxide + water

b) Carbon dioxide.

3 **a)** Calcium carbonate.

b) **(i)** 3

(ii) Ca, C and O.

(iii) Calcium oxide (lime) and carbon dioxide.

c) Gas.

4 Raising the temperature increases the rate of photosynthesis.

Exothermic reactions

5 Combustion.

6 **a)** **(i)** A suction pump.

(ii) The X should be at the end of the tube on the right.

b) **(i)** Condensation.

(ii) Water.

(iii) Cobalt chloride paper.

(iv) Blue to pink.

c) **(i)** Limewater.

(ii) Carbon dioxide.

(iii) The limewater goes cloudy.

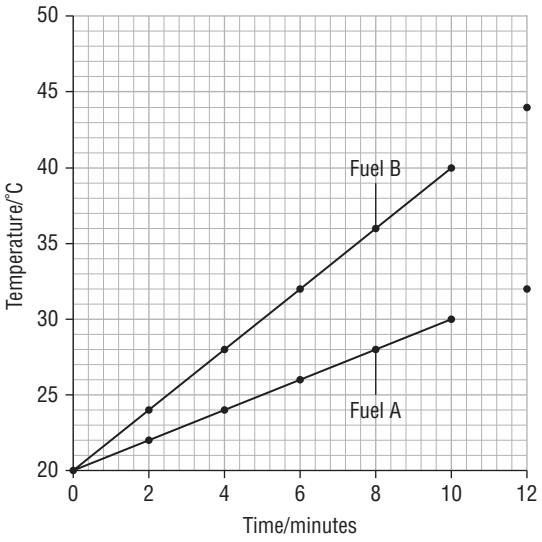
d) hydrocarbon + oxygen ➔ carbon dioxide and water

7 **a)** Loss of mass 5 g.

Rise in temperature 10 °C.

b) $2.1 \times 10/5 = 2.1 \times 2 = 4.2$ kJ

8 **a)** and **b)**



c) 12 °C.

9 **a)** Respiration.

b) In all living things (plants, animals, fungi, microorganisms).

c) Photosynthesis.

d) Air and water.

e) To keep living things alive.

10 A process in which oxygen is added to a substance.

11 B, D, A, E, C.

12 Iron powder – releases heat in an exothermic reaction; charcoal – spreads out heat; salt water – catalyst (speeds up reaction); vermiculite –insulation (slows down the release of heat).

10 Patterns of reactivity

1 **a)** Under oil.

b) To stop it reacting with oxygen and water in the air.

Reaction of metals with oxygen

2 **a)** It glows, makes yellow sparks and a black powder.

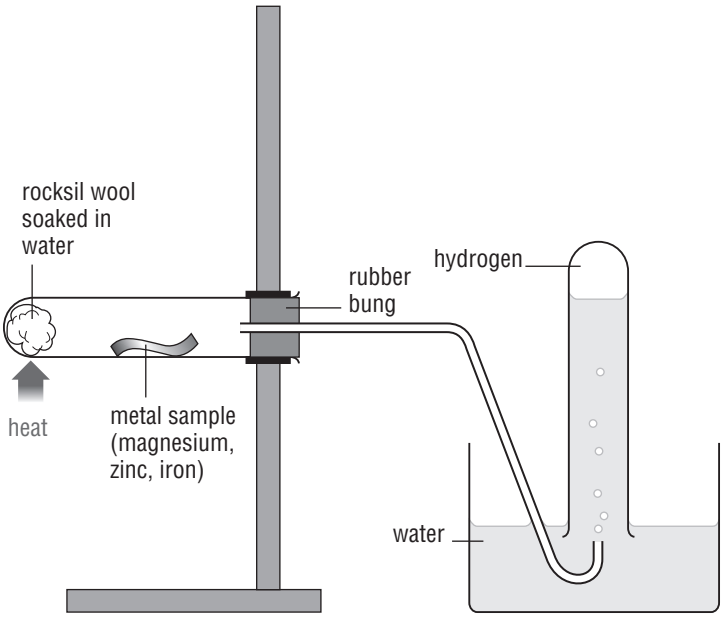
b) Not changed.

c) Forms a black powder on the surface.

Reaction of metals with water

3 **a)** Investigating the reaction of a metal with steam.

b)



c) See diagram above.

d) **(i)** Hydrogen.

(ii) Put a lighted splint near the mouth of the test tube and listen for the pop.

e) Magnesium, zinc, aluminium, calcium.

Reaction of metals with acids

4 **a)** Trough, delivery tube, thistle funnel, bung with two holes, test tube, conical flask.

b) **(i)** Hydrogen.

(ii) In the test tube.

c) Metal chloride + hydrogen.

d) He could use the same amounts of acid and metal and compare the amounts of hydrogen produced at the end of the reaction.

e) Magnesium, aluminium, calcium, zinc.

5 **a)** The copper dissolves in the liquid and forms copper sulfate solution.
b) It comes out of the silver sulfate solution.
c) Copper is more reactive than silver and displaces it to form copper sulfate.
d) **(i)** Yes.
(ii) The iron is more reactive than copper and so displaces it, making a green iron sulfate solution; the copper comes out and coats the nail.

6 1 Potassium, 2 Sodium, 3 Calcium, 4 Magnesium, 5 Aluminium.

11 Preparing common salts

1 As a drying agent; setting concrete.

2 Making cosmetics; in sewage treatment.

Acids and their salts

3 Copper sulfate – blue; iron(III) chloride – brown; sodium chloride – white; cobalt nitrate – red; nickel sulfate – green.

4

Apparatus number	Apparatus name	Use of apparatus
1	Bunsen burner	A
2	conical flask	H
3	filter paper	F
4	clamp and stand	I
5	gauze	C
6	evaporating dish	J
7	spatula	D
8	tripod	E
9	beaker	B
10	filter funnel	G

b) E, B, A, G, F, D, C.
c) It is filtered again.

5 **a)** Copper carbonate.
b) Copper metal does not react with acids.

12 Rates of reaction

1 A measure of the speed of change in a reaction.

Measuring rate of a reaction

2 **a)** A top pan balance.
b) C, E, A, D, B
c) A syringe.

Factors affecting rates of reaction

3 A measure of the amount of solute in the solution.

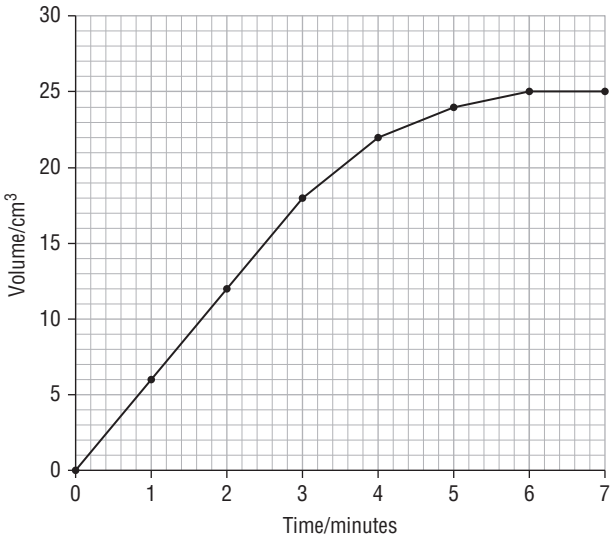
4 **a)** They are getting smaller.

b) It is getting larger.

c) **(i)** Less than 5 minutes.

(ii) The increase in surface area means the reactants can come into contact more quickly and the reaction is faster.

5 **a)**



b) **(i)** Below the line of the first graph.

(ii) The reaction takes place more slowly at the lower temperature and less gas is produced in each minute.

Catalysts

6

Statement	Tick if correct
A catalyst only speeds up one reaction.	✔
A catalyst speeds up lots of reactions.	
A small amount of catalyst is needed to speed up a reaction.	✔
A large amount of catalyst is needed to speed up a reaction.	
The catalyst is chemically changed in the reaction.	
The catalyst is not chemically changed in the reaction.	✔
A catalyst cannot be used again after taking part in a reaction.	
A catalyst can be used again after taking part in a reaction.	✔

7 **a)** hydrogen peroxide ➔ water + oxygen

b) Manganese dioxide.

c) Place a glowing splint in the gas. If it is oxygen, the splint will relight.

8 **a)** Carbon monoxide, nitrous oxide and hydrocarbons.

b) Carbon monoxide stops oxygen circulating around the body *or* nitrous oxides cause acid rain.

c) Platinum and rhodium.

d) Water, nitrogen and carbon dioxide.

9 **a)** Enzymes.

b) Proteins.

c) Liver or digestive system.

d) Fats and proteins.

The particle theory and rates of reaction

10 a) They must collide together.

b) (i) It decreases.

(ii) It slows it down.

c) (i) It speeds them up.

(ii) It increases it.

(iii) There are more collisions.

d) It brings them together so they can react faster.

PHYSICS

13 Density

Comparing densities

1 **a)** Cut down each log to the same dimensions, then place it on a balance to find its mass.
b) density = mass/volume

2 **a)** Measure the length, height and width of the block and multiply all three dimensions together.
b) $5 \times 5 \times 5 = 125\,cm^3$

3 **a)** A, G, C, H, B, E, F, D
b) By subtracting V2 – V1.
c) $D = 90/30 = 3\,g/cm^3$.

4 **a)** D, A, F, C, E, B.
b) Density = M2 – M1/V.
c) $120 – 100/14 = 1.4\,g/cm^3$.

Floating and sinking

5 **a)** g/cm^3.
b) kg/m^3.
c) **(i)** Vegetable oil.
(ii) Water.
(iii) Maple syrup.
(iv) The less dense material always floats on the denser material.
d) Below the vegetable oil, above the water.

Density of gases

6 **a)** F, C, I, A, H, D, G, B, E
b) Density = M1 – M2/V

7 **a)** The density decreases.
b) The density increases.
c) They are measured at the same temperature and pressure – at 0 °C and a pressure that will support 760 mm of mercury in a vertical tube.

14 Pressure

1 Any four from: start an object moving, stop an object moving, change its direction of movement, change its speed of movement, change its shape, change its size.

Pressure on a surface

2 The force produced by gravity acting on an object.

3 **a)** A $6 \times 4 = 24\,cm^2$
B $6 \times 2 = 12\,cm^2$
C $2 \times 4 = 8\,cm^2$
b) A $48/24 = 2\,N$
B $48/12 = 4\,N$
C $48/8 = 6\,N$

4 **a)** The cow on its feet.
b) The cow's weight acted through a much smaller area of body and pushed with much greater pressure, which pushed more mud out of the way.

5 Her weight remains the same but her area in contact with the snow greatly increases with her skis on, so the pressure on the snow is reduced and she does not sink.

6 The studs reduce his area of contact with the ground and increase his pressure on it, making his grip stronger, so he does not slip.

7 **a)** The point.
b) The head.

8 Sharpening the knife reduces the larger surface area of a blunt knife to a smaller one, which can produce more pressure when cutting.

Pressure in liquids

9 The sides of the beaker and the bottom.

10 **a)** When there is no longer any water above it.
b) It sinks and becomes more vertical.

11 **a)** Transmitting pressure from one place to another.
b) Hydraulic jack for lifting cars; brake system on cars.

Pressure in gases

12 C, F, D, H, A, G, E, B

13 **a)** Because it is at a higher pressure than the air.
b) **(i)** They would be pushed out.
(ii) The air pressure is lower than the pressure inside the can.

14 **a)** Large fans.
b) A skirt around the edge.
c) The upward pressure of the trapped air.

15 Turning on a pivot

1 It changes the size or direction of a force.

2 **a)** **(i)** They both are.
(ii) The terms fulcrum and pivot are both used for the same thing.
b) The supporting point around which a lever moves.
c) The arms.

3 The load is the force acting on a lever that resists movement.
The effort is the force applied to the lever to overcome the load.

Types of levers

4

Lever	Class	Example
A	third	bottle opener
B	first	crow bar
C	second	human arm

Moments

5 Around a point supporting the lever.

6 Archimedes.

7 When a body is in equilibrium (or balanced) the sum of the clockwise moments about any point equals the sum of the anticlockwise moments about that point.

8 The moment produced by Shen = 450 × 2 = 900 Nm. To balance this Bo needs to sit 900/300 = 3 metres from the point.

16 Electrostatics

1 Electrons.

2 **a)** The sleeve loses electrons.
b) The balloon gains electrons.

3 **a)** They push each other apart.
b) They both have the same negative charge and as similar charges repel, the balloons push each other apart.

4 **a)** The sleeve gains electrons.
b) The Perspex loses electrons.

5 **a)** The balloon moves towards the Perspex.
b) The Perspex is positively charged and the balloon is negatively charged so the opposite charges attract each other.

Insulators and conductors

6 An insulator will not let electricity pass through it and stores it. A conductor lets electricity pass through it and cannot store it.

Induced charges

7 **a)** A negative charge.
b) The electrons move into the wall away from the surface.
c) A positive charge.
d) The force between the positive and negative charges – an electrostatic charge.
e) **(i)** It is stronger.
(ii) If it was weaker, the balloon would fall.

Sparks and flashes

8 B, F, D, E, A, G, C

9 **a)** The air particles rub on it and charge its surface.
b) The tyres have conductors, which pass the charges to the ground.

10 Sheet lighting occurs between different parts of a cloud.

Forked lightning occurs between the cloud and the ground.

11 A van de Graaf generator.

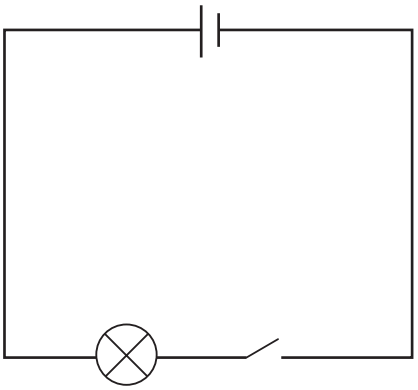
12 A capacitor.

17 Electricity

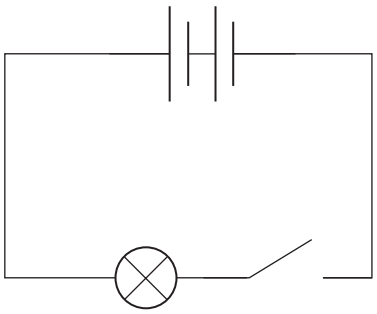
Simple circuits

1 **a)** The electrons move from the negative terminal to the positive terminal.
b) Cell.
c) It gives out light and heat.
d) The lamp is dimmer.
e) The chemicals that take part in the reaction in the cell are used up.
f) **(i)** It stops flowing.
(ii) The electrons cannot pass through air; air is an insulator.

2 **a)** The X is on the right by the shorter vertical line.
b)



c)



d) **(i)** It shines more brightly.

(ii) Only a simple answer is required, such as the second cell gives more electrical energy to the circuit.

3 **a)** Aruni.

b) Aluminium is a metal and a conductor; wood is an insulator.

Resistance and Other circuit components

4 A resistor, B buzzer, C variable resistor.

5 **a)** It melts.

b) It stops the flow of current.

c) A larger than normal current.

d) It stops a large current flowing that could cause fires.

e) It is a switch, which is sensitive to large currents and switches off.

Amperes

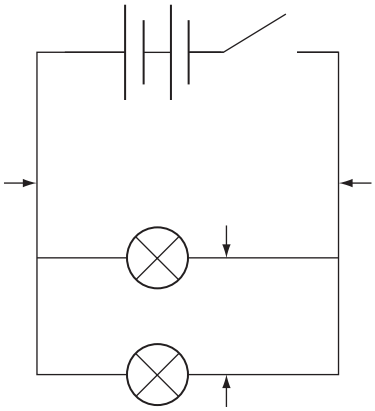
6 **a)** The flow of current in a circuit.

b) Connect red terminal to positive terminal of cell.

7 The reading at A is the same as B.

8 **a)** 4

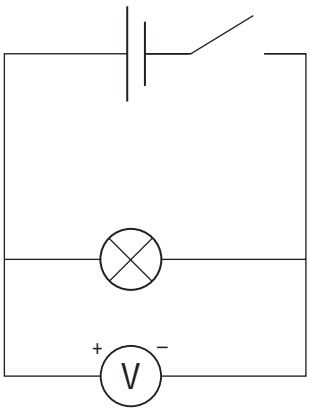
b)



Voltage

9 A difference in potential energy.

10



18 Heat energy transfers

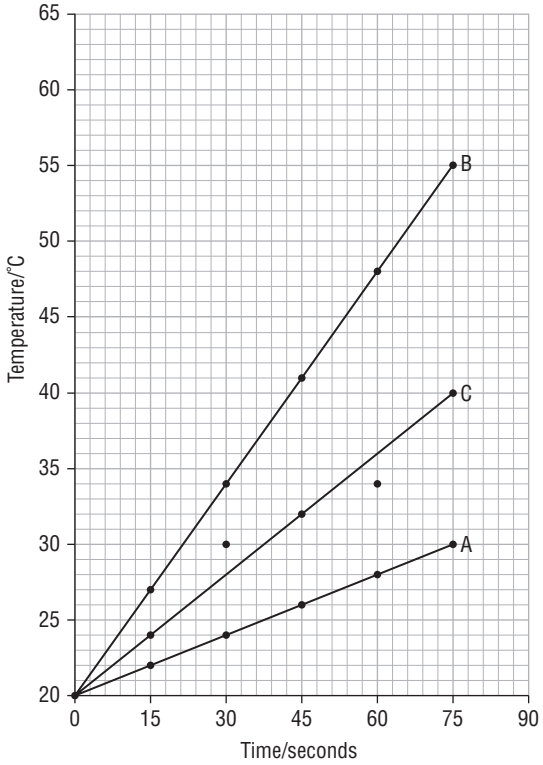
Heat and internal energy

1 The kinetic energy of the atoms and molecules in a substance.

2 Faster than in a cold substance.

3 **a)** Make the strips the same dimensions. Make sure that the ends of the strips are the same temperature before they are put up against the heat source.

b)



c) A 32 °C; B 62 °C.

d) See graph above.

e) 44 °C.

f) The data logger or sensor could have developed a fault; the heat source may not have been transmitting heat constantly; there may be some impurities in the material that are slowing down and speeding up transfer.

4 **a)** Beaker, thermometer, kettle, measuring cylinder.

b) Put it all around the beaker, make a top and bottom.

c) (i) B

(ii) It contains more air and air is a good insulator.

5 The hot air rises making a convection current, which carries the smoke particles upwards. As the air rises, it cools and slows down until it stops and spreads out. As it cools further it sinks and takes the smoke particles with it.

6 a) Electromagnetic waves.

b) There are no particles in a vacuum to transfer the heat by conduction or convection. The electromagnetic waves of radiation do not need particles to carry energy.

7 a) Use the measuring cylinder to add the same amount of water to each can; take the temperature of the water in the cans and check they are the same. Leave them in the Sun for the same amount of time and read the temperatures again.

b) (i) The black tin will have the warmer water.

(ii) The black surface absorbs the heat more rapidly.

Evaporation

8 a) The faster-moving particles escape into the air.

b) It decreases.

c) It decreases.

d) It decreases.

9 a) It increases evaporation.

b) It decreases.

c) Conduction.

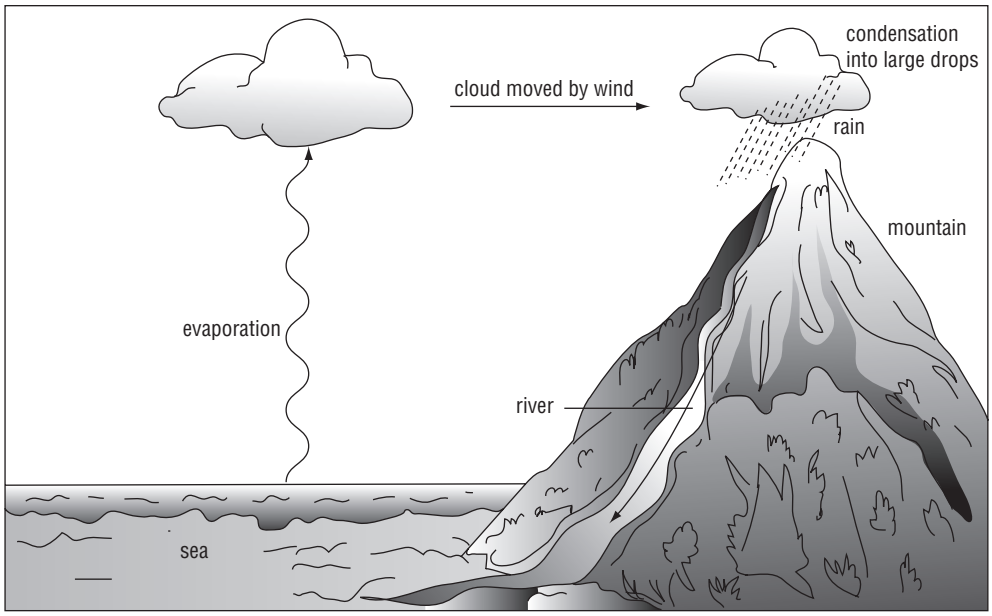
19 World energy needs

Energy pathways on Earth

1 C, F, D, G, B, A, E. (NB: Letters G, B and A can be in any order between D and E)

The water cycle

2



Winds, waves, tidal and geothermal energy

3 Tidal – gravity; geothermal – radioactive materials; wind – convection currents; waves – moving air on a surface.

Fossil fuels

4 **a)** The Sun.
b) Open-cast mining.
c) Natural gas, oil.
d) **(i)** Oil.
(ii) Marine habitats (sea and shore).

Non-renewable fuels

5 **a)** The source is limited and once used up cannot be renewed.
b) Radioactive materials.

Renewable energy sources

6 A source that can be replaced as it is used up, so that it does not run out.

7 (In any order) solar panel – heat, solar cell – light.

8 **a)** Up and down.
b) Electrical.

9 **a)** Kinetic energy.
b) Turbines.
c) Electrical.