7A WORKBOOK ANSWERS

7Aa Doctors past and present

1 Three from: measuring heart beats, temperature, urine tests, blood tests. Accept other sensible responses.

2 The patient has spots.

3 C – Information used to say whether something is right or wrong.

4 **a** A – an organ

b Pumps blood.

5 Student discussion.

Box 1 Students' own responses, which do not need to be correct.

Box 2 Check that students are now able to say that something is alive if it can carry out all seven of the life processes (movement, reproduction, sensitivity, growth, respiration, excretion, (need for) nutrition).

7Aa Life processes

1 elephant, pine tree, human, mouse

2 **a** Something that all living things/organisms do.

b M – movement – changing position

R – reproduction OR respiration – making new life OR releasing energy

S – sensitivity – detecting changes in the surroundings

G – growth – increasing in size

R - reproduction OR respiration – making new life OR releasing energy

E - excretion – getting rid of waste

N – nutrition – needing substances to carry on living

3 oxygen, food

4 Humans stop growing after a while, trees continue to grow.

5 **a** A car will move, it will sense certain things (e.g. being broken into) and it will respire in the sense that it uses oxygen to release energy from fuel. Most cars will excrete exhaust gases and require a source of energy (nutrition).

b A car will not grow and will not reproduce; something can only be an organism if it shows all seven life processes.

6 Student discussion, followed by completion of lower box on page 3. See Q5, Box 2 above.

7Ab Organs

1 Students can either mark their answers after completing them or this page can be used in a more formative way. It is suggested that the teacher gives the student a score out of 10 without showing the student which answers were correct or incorrect. Students then need to work out for themselves which questions they gave incorrect answers for (possibly using secondary sources and/or the Student Book) and to correct their own work. Using this approach, all students will end up with all the answers correct (although some will take longer to reach this than others).

a B – brain

b A – heart

c C – break up food

d A – destroy some substances

e B – carbon dioxide

f C – oesophagus

2 See Q1 above.

3 skin

4 leaf

5 Two from: hold the plant in place, take in water, take in minerals/mineral salts (students are not expected to know the third example here at this level).

6 **a** photosynthesis

b Light is needed for photosynthesis – with less light, less food will be made.

7Ab Medical doctors (STEM)

1 explain, test, evidence, conclusion, doctors, diagnosis

2 **a** eye

b To detect light/to allow you to see.

3 only a small amount of urine produced – kidney problem; difficulty breathing – lung problem; very fast pulse – heart problem; sore chest after eating food – stomach problem

4 **a** Listen to someone's heartbeat or breathing on their chest or back.

b Expected answer will be about it being the one that allows the user to hear the heartbeat/breathing the most clearly. If students have defined 'best' in an alternative way (e.g. such as ease of manufacture), mark their answers on their merits.

7Ac Tissues

1 organ, tissue, tissue, organ

2 **a** To absorb water (from soil).

b xylem

c 6 (six) (there are six differently-coloured areas)

3 **a** D – muscle

b C – you can move your tongue

4 **a** To make food for a plant.

b xylem (This is the expected answer but accept any other tissue commonly found in leaves.)

c The leaf needs water (this is the expected answer but accept any other appropriate answer linked to the answer to part **b**).

5 Example of tissue: muscle/fat/ nervous. Function of tissue: movement / protection / carrying signals for pumping. (Note that knowledge of nervous tissue is not expected.)

6 Storage organ (accept 'root').

7Ac Microscopes (WS)

7 To magnify things, so we can see more detail.

8 From top: eyepiece lens, objective lens, stage, course focusing wheel.

9 **a** 1 Move the lowest power lens over the hole in the stage.

2 Make the gap between the stage and the lens as small as possible.

3 Place a slide on the stage. Use the clips to hold the slide in place.

4 Look down a microscope with both eyes open and adjust the light source.

5 Widen the gap between the stage and the lens, until what you see is clear (in focus).

6 To magnify more, use the next most powerful lens. Use the fine focusing wheel to adjust the focus.

b Turn the (coarse) focusing wheel.

10 **4** A small, thin piece of material/tissue that you wish to study with a microcsope.

11 **a** 1 – Use a pipette to place a drop of stain on the centre of a microscope slide. 2 – Use forceps to place a piece of thin tissue onto the drop. 3 – Use forceps to place a coverslip on one edge of the stain, and then gently lower the coverslip onto the slide (so as to avoid trapping air bubbles).

b,c Students' own answers.

12 To hold a specimen in place; to stop a specimen drying out; to hold a specimen flat.

13 Top to bottom: ×50, ×112.5, ×10

7Ad Cells

1 From top: cell (surface) membrane, nucleus, mitochondrion, cytoplasm

2 chloroplast – where photosynthesis occurs; large vacuole – storage space; nucleus – controls the cell; cell wall – rigid box that helps support the cell

3 **a** A – chloroplasts

b B – there is no light underground

4 C – It looks 600 times bigger than its real size.

5 chloroplasts/chlorophyll

6 cell wall

7 only in animal cells – blank; in both animal and plants cells – cell (surface) membrane, nucleus, cytoplasm, mitochondria; only in plant cells – chloroplasts, (large) vacuole, cell wall

8 60 mm (students should include the unit).

9 Ideally students should draw a cross section along the lines of diagram E in Student Book spread and have included nucleus, cytoplasm, mitochondria, vacuole, cell (surface) membrane and cell wall (but not chloroplasts). Encourage students to do some independent research to see how close their answers were.

7Ae Organ systems

1 cells, tissue, organ, tissues, cells, organ, tissue, cells, tissue, cells

2 A set of organs working together.

3 **a** breathing/respiratory/ventilation system

b Two of the following labelled: lung, trachea/windpipe, diaphragm.

4 **a** circulatory system

b heart, blood vessel(s)

c To carry nutrients/food/oxygen/blood around the body.

5 **a,b** excretion – urinary system – bladder, kidney; movement – locomotor system – bone, muscle; respiration – breathing system – trachea, lung; sensitivity – nervous system – brain, spinal cord

6 **a** roots, stem, leaves

b xylem

7 **a** B – water

b D – they lose it by evaporation

7Ae Transplants

1 **a** When an organ is taken from one person and put into another person.

b Any sensible suggestion that shows an understanding of the function of the heart/the circulatory system. For example, fast pulse rate, slow pulse rate, shortness of breath.

2 **a,b,c,d** Students' own diagrams and work but diagram should look similar to one of diagrams B–E and one of diagrams F–G from the spread 7Ae Organ Systems in the Student Book.

3 **a** correct

b incorrect

c correct

d incorrect

7B WORKBOOK ANSWERS

7Ba Escaped zoo animals

1 Any two from: to breed them; for visitors to learn about them; to protect them.

2 At least one male lynx and one female lynx would be needed for numbers to increase by reproduction.

3 B – photograph showing a wallaby with background that is clearly Isle of Man

Reason: It would be more difficult to fake this evidence than for any of the others.

4 Two from: they give birth to live young; they look after their young and protect them; they feed their young on milk; they both use sexual reproduction.

5 B – organ

7Ba The scientific method (WS)

1 observation – something that was seen (can lead to a question); hypothesis – an idea that could answer a question; prediction – what will happen if a hypothesis is correct; data – information collected from an experiment

2 Anticlockwise from 'question': hypothesis, prediction, data, prediction, hypothesis; top right: hypothesis.

3 The seeds at the warmer temperature sprouted first – result. The ability of animals to reproduce depends on there being males and females – hypothesis. If people lack vitamin D in their food, then they will get a disease called scurvy – prediction.

4 **a** Any suitable answer, such as:

- If the jar that was open at the start is the only one that produces flies, then the cause of those flies is probably the flies entering at the start.
- The closed jar is a control.

b Both predictions **should** expect flies after two weeks

5 Any suitable question, such as: Can sweat turn wheat into mice?

Any suitable hypothesis based on questions, such as: Sweaty clothes cause wheat to turn into mice.

Any suitable prediction based on the hypothesis, such as: If sweaty clothes and wheat are placed in a closed jar for 21 days, the wheat will turn into mice.

7Ba Animal sexual reproduction

1 **a** gamete

b egg cell

c sperm cell

d egg cell

e zygote

2 **a** Students' own text using all words supplied in word box.

b Students' own improvements.

3 **a** Any bird or mammal (or other suitable, such as a reptile).

b Internal fertilisation helps to make sure that sperm cells reach the egg cells; the animals look after their developing offspring.

4 Fewer, because the female looks after the fertilised egg cells (and the hatchlings) and so more of them survive.

7Bb Reproductive organs

1 Anticlockwise from top left: glands, sperm duct, penis, testis, urethra.

2 testis – produces sperm; gland – produces fluids that provide energy for sperm; sperm duct – carries sperm to the penis; urethra – carries semen to outside the body

3 **a** cooler

b The testes are not inside the body.

4 The top of the sperm head contains substances that break down the outer layers of the egg cell, allowing the sperm cell to enter.

5 It has a tail (to push it along) and a streamlined shape (to help it move through fluids easily). (A higher-level answer will include the reasons as well as the features; the question asks students to 'explain'.)

6 ovary, oviduct, uterus, cervix, vagina

7 cell surface membrane – controls what enters and leaves the cell; jelly coat – makes sure only one sperm can enter the egg cell; cytoplasm – contains a store of food that will provide energy for the fertilised egg cell; nucleus – controls the cell

8 It has a store of food in its cytoplasm, which is there because the fertilised egg cell is created by the fusing of the sperm and egg cells and the egg cell's cytoplasm contained a store of food. (A higher-level answer will include an explanation of where the food store came from.)

9 **a** A – men

b B – women go through menopause

7Bc Becoming pregnant

1 implantation – when an embryo sinks into the uterus lining; pregnancy – when a baby develops from a zygote in a woman's uterus; fertilisation – when male and female gamete nuclei fuse; ejaculation – when semen leaves the erect penis

2 oviduct

3 amniotic fluid, placenta, umbilical cord

4 **a,b** Placenta: exchanges substances between the blood of the mother and the baby's blood; provides nutrients/food/oxygen/water from the mother's blood to the baby; removes wastes/carbon dioxide from the baby to the mother's blood.

Amnion: bag that holds amniotic fluid, which protects the baby from bumps.

Umbilical cord: contains blood vessels that link the baby to the placenta; to carry nutrients/food/oxygen/water/wastes/carbon dioxide to/from the baby.

7Bd Gestation and birth

1 embryo – 8 weeks; foetus – 32 weeks; gestation – 9 months

2 To check development of the foetus – to make sure it is healthy. To work out the age of the foetus – to predict the date of birth.

3 2 – The cervix muscles relax, making the cervix wider. 3 – The uterus muscles contract very strongly and push the baby out through the vagina. 4 – The uterus muscles contract strongly to push out the afterbirth.

4 **a** The vaccination stops her being infected by a virus that can cause deformities in her foetus.

b It gives the baby antibodies, which can help to prevent diseases caused by microorganisms.

7Bd Saving endangered species (STEM)

1 They became extinct in the wild because of hunting.

2 **a, b** Students' own ideas and design.

7Be Growing up

1 B – 10 to 15 years

2 **a** B – stronger body smell, hair grows on face and chest, voice deepens (or 'breaks'), pubic hair grows, testes start to make sperm cells, hair grows in armpits, testes and penis get bigger, shoulders grow wider

b G – stronger body smell, ovaries start to release egg cells, pubic hair grows, hair grows in armpits, hips get wider

c Circle: ovaries start to release egg cells, testes start to make sperm cells.

3 Student's own answers

4 sex hormones, testes, ovaries, acne, emotional, adolescence

5 An egg cell is released from an ovary into an oviduct.

6 **a** C

b A

c It makes a thick soft lining of the uterus for the zygote to sink into.

d To be able to support, feed and protect the embryo.

7 **a** menstruation

b She misses her period/menstruation.

8 **8** Student's own answers.

7Be The work of zoos

1 **a** **i** true

ii true

iii true

iv false

v false

vi true

b Student's own answers.

2 Any suitable suggestions that copy the natural habitat as far as reasonably possible in an artificial setting, such as: keep the enclosure cool (to match mountain temperatures), provide fast-flowing water through the enclosure.

7C WORKBOOK ANSWERS

7Ca Fitness

1 **a,b** circulatory system – heart; digestive system – small intestine, stomach, oesophagus, large intestine; excretory system – kidneys, bladder; gas exchange system – diaphragm, lungs

2 **a** organ

b It is made of several different tissues (e.g. epithelial, muscle).

3 Students' own answers appropriate to factor, such as: suppleness – how high you can lift a leg; strength – how heavy a weight you can lift with one arm; speed – how fast you can run 100 m; stamina – how many star jumps you can do without stopping.

7Ca Muscles and breathing

1 ventilation – when air moves into and out of the lungs; gas exchange – when oxygen enters blood in the lungs and carbon dioxide leaves the blood; respiration – the cell process that releases energy and produces carbon dioxide; excretion – when waste substances leave the body

2 Gases are carried around the body in the blood.

3 **a** breathing/respiratory/gas exchange system

b Any two suitable, such as: heart, blood vessel/artery/vein.

4 The cells can contract/get shorter and then relax, causing the ribs to move.

5 **a** A – air enters the lungs

b B – muscles in the diaphragm contract, so the diaphragm moves downwards

7Cb Muscles and blood

1 **a** Labels (anticlockwise from top): lungs, vein, artery, muscle, capillaries.

b double

c Blood passes through the heart twice for each circulation it makes of the body.

d It contracts to push blood through and out of the heart.

e The left side of the heart has to push harder to move blood round the body, but the right side only pushes blood through the lungs back to the heart. More muscle allows more force.

2 in bone marrow

3 **a** plasma

b red blood cells

c white blood cells

d red blood cells

4 **a** artery

b Has a thick muscular wall and tough outer layer.

c Very thin wall.

d Large space inside so blood at low pressure can flow easily.

7Cb Scientific questions (WS)

1 **a,b i** scientific

ii non-scientific and ethical

iii scientific

iv non-scientific but not ethical

v scientific

2 **a** Question **ii** is ethical because it is something that some people might think was wrong to do and others think was right.

b A scientific question can be answered using information from experiments and investigations, whereas a non-scientific question cannot.

c Students' own answers.

3 Suitable data for questions **i**, **iii** or **v**, such as:

i Carry out brain scans of taxi drivers and compare with non-taxi drivers to look for differences in the size of some parts.

iii Measure the pulse rate of older and younger people.

v Measure your own pulse rate before and at the end of exercise.

7Cc The skeleton

1 knee joint – movement; backbone – support; skull – protection

2 It has fixed joints which hold the bones of the skull together tightly for protection of the brain.

3 **a** To withstand the forces on them from support/movement.

b So that they are easy to move.

c It has strong compact bone on the outside and light spongy bone inside.

4 Student's own answer.

5 **a** Anticlockwise from top right: muscle, tendon, bone, cartilage, ligament.

b Muscles pull on bones when they contract.

c slippery, muscles, bones

6 **a** Hinge, because movement of the lower arm is only in one direction.

b ball and socket

c hip and shoulder

7Cd Muscles and moving

1 bones, muscles

2 **a** legs

b increase/get larger, grow larger/increase in size

c grow thicker/stronger because the muscles will pull with greater force

3 A – When muscles contract they can pull on bones. E – When muscles relax they cannot push or pull on bones.

4 Electrical impulses are sent from the brain down the spinal cord and into nerves that connect to the muscles in her hand. The impulses cause some muscles to contract to move her fingers.

5 To provide energy from respiration so muscle cells can contract.

6 **a** pulls on/lifts, lifts; extend/lower, stretches

b Because the relaxed muscle needs to be stretched out by the contracting muscle in the pair, so that it is ready to contract again.

7 Note: identifying specific muscles is difficult because there are layers of different muscles around the shoulder that make possible a wide range of movements. The following descriptions are only a guide and other answers may be possible (particularly if looking at a diagram of the musculature of the shoulder).

a i top of upper arm bone, collar bone

ii top of upper arm bone, shoulder blade/back of rib cage

iii top of upper arm bone, top of shoulder/base of neck

iv upper arm bone under arm pit, shoulder blade/back of rib cage

b Any suitable answers, such as: rotate the upper arm in the joint, bring the arm across the front of the body.

7Cd Artificial limbs (STEM)

1 Any suitable features such as: strong, light, hard, breakable, make blood cells, grow with age (up to adulthood), repair themselves.

2 Any suitable feature with appropriate reason, such as:

- real bones can grow/repair themselves, because they are living
- not as easy to control, because an artificial leg does not contain nerves that connect the brain to the muscles.

3 **a** Students' own answers in completed table.

b Students' own answers depending on values in criteria table.

i The feature that scored best on the criteria should be identified.

ii The feature that scored least on the criteria should be identified.

iii A change to the feature named in **ii** so that it should score better on one or more criteria.

7Ce Drugs

1 **a** M – paracetamol, salbutamol, ibuprofen; R – cocaine, heroin, caffeine.

b They affect the way the body works.

2 **a** Reduces pain.

b Can damage the liver.

3 **a** It slows down the speed at which impulses pass through the nervous system.

b Depressants make reaction time longer, which can be dangerous in situations where fast reactions are needed, such as driving.

c Any one from: heroin, solvents, alcohol.

4 Caffeine is a stimulant/speeds up reactions of the nervous system.

7Ce Drugs and sport

1 **a** Increases size/strength of muscles.

b The heart can push blood more easily round the body, which means more oxygen and nutrients gets to muscle cells so they can contract faster/harder.

c During exercise, muscle cells need more oxygen for respiration and produce more carbon dioxide. So more exchange of gases is needed between the air and blood in the lungs.

2 **a** bone marrow

b To carry oxygen.

c Any one from: contain haemoglobin (which carries oxygen); have large surface area for faster exchange of oxygen with tissues; contain no nucleus so have more space for haemoglobin.

d Their blood can carry more oxygen than usual. So their muscle cells will get more oxygen and be able to carry out respiration faster. That will release more energy so the muscles will be able to contract faster/harder.

3 **a** Non-scientific and ethical.

b It cannot be answered using investigations or experiments because it depends on each person's view. And it is a question of what people think is right or wrong.

4 Stimulants speed up reactions, which would help an athlete respond faster than usual.

7D WORKBOOK ANSWERS

7Da Exploring the world

1 **a,b** Similar to the following using all three words provided: Fertilisation of the female gamete by the male gamete produces a zygote.
2 One from: shelter, water, a mate.
3 **a** Any feature of the species, such as: body shape, teeth shape and number, fur, tail.
b Any variation in a feature, such as: body mass, tail length, fur colour.
4 **a** forest plants → deer → people
b Any suitable answer that shows how loss of forest will affect deer and therefore people, such as: they would have to eat other food than deer/they would have to move to forest where there are deer.

7Da Variation

1 **a** Any suitable similarity, e.g. eyes face forward, similar basic shape.
b Any suitable difference between gorilla and chimpanzee, such as: chimpanzee has rounder top to skull, gorilla has shorter distance between teeth and eyes.
c Any suitable variation of skull between gorillas, such as: overall size, size of eye sockets.
d There is more variation in features between each group than within the group.
2 Student's own answers.
3 continuous – length of hair, height, foot length; discontinuous: having a scar, shoe size

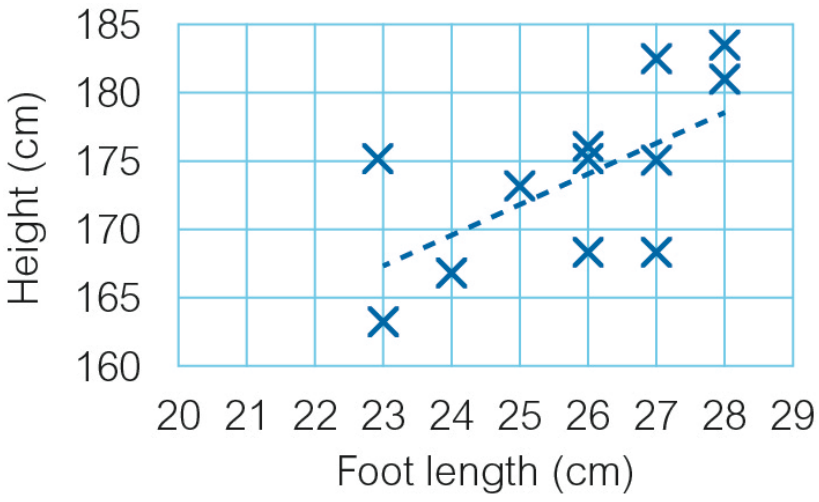
7Da Charts and graphs (WS)

1 **a** continuous
b Number of = frequency
c No, because the variable is continuous.
d height
e Yes, because they form a bell shape with the most common in the middle.
2 **a** discontinuous
b As a bar chart of eye colour on the horizontal axis and number of students on the vertical axis, with a vertical bar for each colour and space between the bars because the data are discontinuous.
3 **a** Graph should:

- have labelled axes
- have units in brackets after each axis label
- have a title
- have numbers on the scales written in
- have divisions on the scales evenly spaced
- fill as much of the paper as possible
- be plotted with small neat crosses
- be plotted accurately
- be drawn in (sharp) pencil.

b Line of best fit as above.

The line of best fit shows that as height increases, foot length also increases.
c Student's own answers.
d Student's own answers. Could include: not labelling axes, mixing up axes, using too little of the paper, finding the line of best fit.



7Db Adaptations

1 **a** light, temperature, wind
b Any other physical environmental factors such as: wetness/dryness, soil quality, altitude.
2 adaptation – feature that helps an organism survive; community – all the plants and animals in an area; ecosystem – all the organisms and abiotic factors in an area; habitat – the place where an organism lives
3 To reduce water loss.
4 **a** pond/water
b Any suitable adaptation, such as long leaf stems so leaves float on top of water/roots can grow in soil at bottom of pond to get nutrients / flexible leaf stems to stop water currents breaking them.
5 The gamete from each parent contains a slightly different mix of instructions for each inherited feature.

7Dc Effects of the environment

1 **a** Leaf colour because leaves are usually green.
b amount of light/dark
2 fading light level
3 **a** In early January there is almost no daylight. Day length increases each month until June, when there is no dark/24 hours of light. Then day length decreases to December, when there is almost no daylight.
b Any suitable adaptation that is related to lack of light/photosynthesis in times of limited daylight, such as: plants drop leaves in months where there is little light; smaller plants survive underground as bulbs; exist as seeds or similar during months of little light.
c Any suitable adaptation that is related to lack of plant food to eat when there is little light, such as: migrate to where there is more food; hibernate/sleep during months of little food.

7Dd Effects on the environment

1 **a** pondweed, mayfly larva, dragonfly larva, common frog, heron
b heron – apex predator; pondweed – producer; mayfly larva – prey of frog; stickleback – carnivore that eats snails
c frog or dragonfly larva (they both eat mayfly larvae)
2 D – omnivore
3 **a** intraspecific, increase, decrease
b They might starve or move away (to find frogs and fish at other ponds).
4 **a** Individuals of the same species living in the same area.
b food; increases; decreases, because there is less food/fewer hares for them to eat
c Any one from: fewer lynxes; more plants to eat; milder weather, meaning that more offspring survive.

7Dd Greener cities (STEM)

1 **a** Student's own answers giving examples that are relevant to their own country.

b Most useful knowledge circled in table, should include climate and suitable plants for growing on the apartment block.

2 Students' own drawings labelled using information from the table to show how resources will be provided for plants and animals to live on the block.

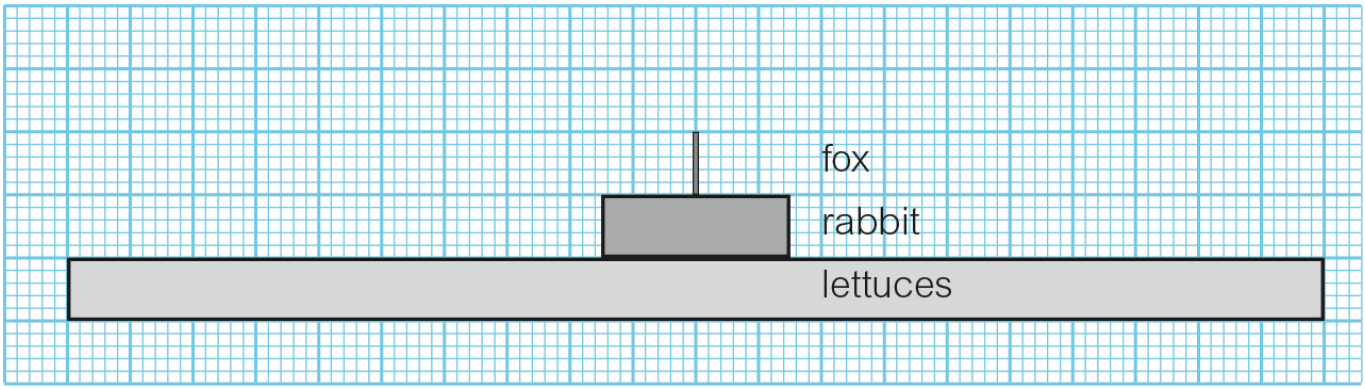
7De Transfers in food chains

1 lettuce – producer; caterpillar – primary consumer; sparrow – secondary consumer; sparrowhawk – top consumer

2 C – energy stored in substances in the sparrow's tissues

3 **a** To kill insect pests on the crops/increase crop yield/reduce pest damage to crop.
b DDT is persistent/lasts a long time in the environment.
c Farmers used DDT, which was absorbed by worms. Blackbirds ate worms, and the DDT from the worms stayed in their bodies. The amount in a blackbird's body wasn't enough to harm them. When peregrine falcons ate blackbirds, they took in enough DDT to cause their eggs to have thin shells and break. So no chicks hatched from the eggs.

4 **a,b,c,d**



e Student's own answers.

5 Many fleas can live and feed on a single rabbit.

7De Nomads

1 **a** **i** Any animal that only eats plants, e.g. elephant.
ii Any animal that only eats meat, e.g. lion.
b Any animal that eats another species, e.g. lion and zebra.
c **i** Any biotic factor, e.g. food supply, predation, disease.
ii Any abiotic factor, e.g. temperature, rainfall, soil type.

2 Student's own changes to question 1.

3 Discontinuous. You either have measles or you do not.

4 Any two advantages, such as: sleeping needs less energy than moving; food not available during cold winter.

5 species, habitat, population, community, ecosystem

6 **a** From top to bottom: heron, bristlenose fish, microscopic algae.
b A small number of herons eat a larger number of bristlenose fish, which eat a lot of microscopic algae.

7E WORKBOOK ANSWERS

7Ea Mixtures and separation

1 **a** S: sand, gravel, plastic; L: water, cooking oil; G: carbon dioxide, oxygen
b Any suitable description, such as: solid – holds its own shape; liquid – fixed volume but not a fixed shape, flows to fill bottom of container; gas – no fixed shape or volume, spreads out to fill all space.
2 Student's improved answer.
3 **a** a liquid/solvent that contains dissolved solids/solutes
b B – evaporation
c It is the only method that separates dissolved substances from liquid. Evaporating and sieving separate solids from a mixture. Diluting does not separate.
4 Yes. Any suitable reason, such as: a fizzy drink contains dissolved carbon dioxide; fish use dissolved oxygen to breathe.

7Ea Forensic science (STEM)

1 It separates the solid substances so that they can be analysed and compared with a known sample.
2 **a** Student's own corrections. These could include:
b possible moves:
step D (placing the filter paper cone into the funnel) could be easier to do after placing the filter funnel into the neck of the flask
step E (stirring the mixture) to just before pouring, as otherwise some sand will settle at the bottom of the mixture and will not pour
possible addition: dampening the filter paper cone before placing it in the funnel to get it to stay in place better
c diagrams that show how to fold the filter paper to form a cone

7Ea Mixtures

1 suspension – a liquid containing small pieces of an insoluble substance that sink slowly; colloid – a liquid containing small pieces of an insoluble substance that do not sink; mixture – two or more substances jumbled up together; solution – a liquid containing dissolved substances
2 It contains substances other than water, such as mud, human waste and other solids.
3 **a** solution – sea water, fizzy drink; colloid – milk, Styrofoam™, fog; suspension – paint
b Student's own answers, such as:
solution – coffee, tea, juice
colloid – mayonnaise, butter, jelly
suspension – sand/water mix, oil/water mix.
4 Student's own response.
5 B – solution
6 From top (bold words more scientific): mixture of sand and water, filter paper cone, filter funnel, solids/sand/**residue**, conical flask, liquid/water/**filtrate**.
7 **a** false
b true
8 Flow chart similar to: waste water from homes → sieved to remove large solids → settle and strained, or filtered to remove smaller solids → treated with chemicals to clump finest particles.

7Eb Solutions

1 insoluble, soluble, solvent, solute
2 **a** 20 + 150 = 170 g
b No substances have been created or destroyed so mass is conserved.
3 Concentration is the mass of substance dissolved in a particular volume of solvent.
4 **a** 32 × 5 = 160 g
b This is the mass that would form a saturated solution.
c Heating the water above 20 °C would increase the solubility of the copper sulfate.

7Ec Safety when heating (WS)

1 closed – tall, wavy yellow flame; half open – medium height blue flame; fully open – short blue flame with pale blue cone at top of burner
2 roaring blue – hottest above pale blue cone; medium blue – for heating tubes of liquid; yellow – safety flame, leaves sooty layer on surfaces
3 So the burner is lit with a safety flame, which is less hazardous than a blue flame.
4 **a** Burns from touching hot parts.
b Could easily catch fire in burner flame.
c Explosion or fire caused by gas escaping.
5 Heat increases the rate of evaporation of the liquid/solvent.
6 Close the air hole of the burner, then hold a lit splint about 2 cm above the burner and turn on the gas.
7 **a** heatproof mat
b medium blue
c close the airhole to give a yellow safety flame or turn off the gas
d eye protection
e half full
f tongs
g remove the basin from the heat and allow to cool and evaporate slowly
8 Students' own responses.
9 It is not very hot, like the noisy blue flame, so it is easier to stop the heating before the solution starts spitting. It is not smoky-like/it is hotter than the yellow flame.

7Ec Evaporation

1 solvent, liquid, gas, solute, concentrated, solid
2 Faster in the warm ponds, because the rate of evaporation increases as the temperature increases.
3 **a** That is the temperature at which all the liquid ethanol turns into a gas.
b The water is not pure/contains some solute, because the temperature is higher than the boiling point of pure water.
4 The percentage of water increases because it evaporates more slowly than the ethanol. Eventually, all of the ethanol will have boiled and only 100% water will be left.
5 **a, b** Answer similar to: crush the rock salt into small pieces; place the rock salt in water so the salt dissolves (heating gently will increase rate of dissolving); filter the mixture to remove the solids; evaporate the water from the salty solution to leave table salt crystals.

7Ed Chromatography

1 C – individual solutes separated from a solvent
2 Dots of the inks were placed near the base of the paper. The paper was then placed in the beaker. A small amount of solvent was placed in the beaker, so that the level of solvent was below the ink dots on the paper.
3 **a** blue
b, c Any suitable conclusion, such as: the red colour is pure, the others are mixtures; the blue is formed from two different colours/blue and red; green contains the same blue as the blue dye.

7Ee Distillation

1 desalination, evaporation, condensation, distillation
2 Because they do not get much rain.
3 Concentrated salty water or solid salts, because the salts do not evaporate.
4 **a** Suck-back happens when the heat is switched off and liquid is sucked back into the delivery tube, which can break the glass tube. Make sure the delivery tube is not in the liquid when the heat is switched off.
b Any other suitable hazard related to using an open flame on the burner, with suitable risk management, such as:
burns from touching hot parts
loose hair could catch fire – tie hair back
anti-bumping granules in water to prevent boiling over.
5 **a** condenser/Liebig condenser
b The condenser contains cold water that cools the steam as it passes through. This causes more steam to condense into liquid so more pure water is collected from a particular volume of sea water.
c Measure the temperature at boiling. If above 100 °C, there are salts in the water that increase its boiling point.
6 **a** Sea water is dangerous to drink and once any fresh water has been used the people will soon need more.
b Bacteria in the water do not evaporate, so this is a good way to separate them from the water and make the water safe to drink.

7Ee Safe drinking water

1 filtering – separates solids from a liquid; evaporation – separates all the solutes from a solution; chromatography – separates out a mixture of solutes (from a solution); distillation – separates the solvent from a solution
2 **a** Filter the dirty water through the fabric supported in a funnel or similar, to remove solids in the water.
b Energy from the Sun's rays passes through the transparent cover so the water heats up and evaporates. The steam condenses on the inside of the cover and trickles down into the container.
c Boiling will kill any microorganisms that were in the apparatus.
d A burner to heat the water to boiling point and a thermometer to measure the boiling point.

7F WORKBOOK ANSWERS

7Fa Chemistry in the home

1 Child B; because they are drinking from a bottle that has a warning label on it.

2 Any three reasonable uses of chemical substances in the home.

3 Two from: drinking it, spilling it on skin, splashing it in the eyes.

4 Two from: keep it away from them, wear suitable protection (gloves, goggles, protective clothing).

5 **a** sour

b bad/harmful

c corrosive

d universal indicator/pH scale (Note that students are not expected to know all these answers and will re-visit this question in 7Fc.)

7Fa Hazards

1 laboratory – one from: hydrochloric, sulfuric, nitric; home – one from: citric, acetic

2 A hazardous substance can cause harm to your health (or any reasonable alternative).

3 **a** B

b sour, sharp

4 ethanoic acid, citric acid – in foods

dilute sodium hydroxide, dilute nitric acid, dilute sulfuric acid, dilute hydrochloric acid – in laboratories

ammonia, caustic soda (sodium hydroxide) – in household cleaners

5 **a** A + F + E

b F

7F Controlling risk (WS)

1 Student running with glass beaker. Pouring from bottle labelled ‘corrosive’, without eye protection. Bunsen burner heating a beaker of liquid left unattended.

Plus, three reasonable precautions, such as: no running in the laboratory; wear eye protection when handling chemicals; do not leave practical work unattended when in progress.

2 **a** For example, hydrochloric acid.

b For example, it is difficult to pour the acid from a bottle into a test tube without spilling.

c For example, pour the acid into a small beaker before putting it in the test tube.

3/4 **a** correct

b correct

c incorrect (it means explosive)

d incorrect (it means flammable)

e correct

7Fb Indicators

1 pure water – neutral; hydrochloric acid – acid; sugar solution – neutral; oven cleaner – alkali

2

Solution	**Colour of litmus**		**Colour of red cabbage indicator**	**Acid, alkali or neutral?**
	Red litmus	**Blue litmus**		
lemon juice	red	red	red	**acid**
toothpaste	**blue**	**blue**	purple	**alkali**
pure water	red	blue	pink	**neutral**
vinegar	**red**	**red**	**red**	acid
soap solution	blue	blue	**purple**	**alkali**

3 Correct order: C, B, D, A, F, E

4 It is alkaline.

5 **a** yellow

b pink

6 a neutral substance; an acidic substance; a strongly alkaline substance; a weakly acidic substance; a weakly alkaline substance

7 Student's own answers.

7Fc Acidity and alkalinity

1 **a** laboratory

b household cleaners

c laboratory

d food

e household cleaners

f laboratory

g food

h laboratory

2

Name of chemical	Colour of universal indicator	Acidic, alkaline or neutral	pH number
hydrochloric acid	red	very acidic	1
water	**light green**	neutral	**7**
sodium hydroxide solution	**purple**	**very alkaline**	14
carbon dioxide solution	**yellow**	not very acidic	**5/6**

3 A – pH is a way of measuring how acidic or alkaline a liquid is.

4 toothpaste – pH9; sulfuric acid – pH1; oven cleaner – pH13; rainwater – pH5; salt solution – pH7

5 With universal indicator paper or solution; with a pH meter or probe.

6 A liquid with a very high or a very low pH is likely (but not certain) to be harmful.

But pH does not tell us if the liquid is toxic, flammable, explosive etc., i.e. what risk it presents.

7 e.g. Testing samples of water (drinking, river, lake), which can tell us if the water has been polluted. Other examples might include testing foods, soils or the air.

8 Quality of response comparing answers to Chemistry in the Home Q5. In particular it might be expected that the answer to part (c) be changed to 'corrosive'.

7Fd Neutralisation

1 C – the reaction between an acid and a base to form a salt and water only

2 **a** sodium chloride

b Show an understanding that the product will not be a pure substance for a given reason e.g.

- If you used universal indicator to check that the mixture was neutral, then the salt would be contaminated with UI, which may be bad for you.
- If you do not use UI the mixture may not be neutral, and you may end up eating salt that is contaminated with sodium hydroxide, hydrochloric acid or some other laboratory substance.

c A suitable change might be the use of a pH meter instead of UI paper or UI solution. Give credit for any valid response that satisfies the question.

3 **a** lithium chloride + water

b sodium hydroxide; water

c sodium chloride + water

d lithium sulfate + water

4 **a** citric acid + sodium hydroxide → sodium citrate + water

b

acidic	alkaline	neutral	neutral
reactant	reactant	product	product

7Fd The chemical industry (STEM)

1 Any four products, such as: dilute acids, bleach, dyes, foods.

2 **a** Take sample, add UI, compare to chart, note pH value, repeat at intervals.

b (A pH meter is) more accurate, easier to use/automate.

c Factory B; inconsistency in pH of product implies poor product control, so the production process in this factory needs to be analysed and improved to give a consistent product.

7Fe Neutralisation in daily life

1 magnesium hydroxide + hydrochloric acid ⇒ magnesium chloride + water

2 **a** D – to reduce pollution

b A – is a base, which neutralises acidic waste gases

3 sulfuric acid + calcium hydroxide ⇒ calcium sulfate + water

4 sulfuric acid and potassium hydroxide

5 Take a measured volume of hydrochloric acid in a beaker. Add universal indicator. Add an indigestion tablet and stir to dissolve. Continue adding indigestion tablets until neutralised. Repeat this exactly with other tablets. The one that requires the fewest number of tablets to neutralise the acid is the best indigestion tablet.

7Fe Danger at home

1 **a** salt + water

b neutralisation

2 **a** sodium chloride + water

b potassium sulfate + water

c sodium nitrate + water

d calcium chloride + water

3 **a** heat was released/generated

b neutralisation

c sodium hydroxide + sulfuric acid → sodium sulfate + water

4 A – alkali; B – neither; C – neither; D – insoluble base; E – neither

7G WORKBOOK ANSWERS

7Ga Sorting rubbish

1 To save resources; to save energy.

2 solid, liquid, gas

3 **a** solid

b paper, aluminium, glass

4 **a** Solids flow and liquids do not. Solids keep their shape and liquids do not.

b They both keep their volume.

7Ga Solids, liquids and gases

1 **a** The gas

b You can push the plunger in on that one; because only the gas is compressible/goes into a smaller volume.

2

State of matter	Keeps its shape	Keeps its volume	Able to be compressed	Able to flow
solid	✓	✓		
liquid		✓		✓
gas			✓	✓

3 **a** 0.002 g

b 0.06 g

c 0.06 g

4 **a** A – pH 1

b Universal indicator – goes red/orange/yellow.

7Gb Hypotheses and theories (WS)

1 **a** An idea about how or why something happens.

b C – The boiling point of water depends on the amount of salt in it.

2 data, data, hypothesis, data, hypothesis, data, hypothesis

3 **a** Any two from: it can be used to make predictions; it explains observations; it is supported by many experiments; there are no experiments that show that it is wrong.

b A theory is tested and always backed by evidence; a hypothesis is only a suggested possible outcome, and is testable and falsifiable.

4 From the top, words should be: hypothesis, prediction, experiment, data.

5 **a** It is bigger in the room with the fire lit.

b Why does the balloon increase in size when the fire is lit?

c The size of the balloon depends on the temperature of its environment.

d Measure the temperature of the room and the size of the balloon. Increase the temperature and measure the balloon size as temperature increases.

e The balloon will get larger as the temperature increases.

7Gb Particles

1 B – Particles move all the time; E – There are forces of attraction holding the particles together; G – Forces vary in strength for different states of matter.

2 A – liquid; B – solid; C – gas

3 Note: Wording may vary but meaning should be clear.

State of matter	Arrangement of particles	Movement of particles	Strength of forces between particles	Suitable example
solid	close together	vibrate in fixed position	*strong*	e.g. wood
liquid	*fairly close together*	move past each other	weaker	e.g. water
gas	far apart	*move in all directions*	very weak	e.g. air

4 **a** Gas particles are far apart, and can be squeezed closer together to reduce the total volume. In a liquid, particles are close together and cannot be squeezed any closer together so the liquid cannot be compressed.

b Gases have no fixed shape or volume, as their particles are free to move in all directions. This allows gases to spread out and fill all the space in a container.

c When soluble solids dissolve in liquids, the tiny solid particles are separated from one another and spread through the liquid. As the solute particles are so spread out, you can then see through the solution.

5 Solids and liquids are different because in solids, particles are held close together and vibrate in fixed position. In liquids they are held fairly close and can move past each other. The bonds between particles are much stronger in a solid than in a liquid.

6 **a** C – A brown colour slowly spreads through the water.

b C – The brown tea particles are constantly moving.

7Gc Brownian motion

1 **a** B – Moves jerkily in many different directions.

b A – Is hit by air particles moving in random directions.

2 Brownian, particle, prediction, experiment, test, data, theory

3 **a** 100 000 000 nm

b There would be a lot of nm involved and too many 0s.

c Any two small things, such as: virus particle, molecules (such as DNA, glucose, water).

7Gd Diffusion

1 Box Y should show dots on both sides after a long time. Ideally, the same number of dots on each side.

2 **a** A – A gas spreads out.

b B – Particles of a gas move in random directions.

3 particles, particles, particles, liquids, particles, gases

4 Sugar dissolves. Particles are in the liquid – they diffuse, moving randomly in all directions, and so they eventually all mix up together and the whole drink tastes sweet.

7Ge Air pressure

1 We are surrounded by air and its particles are hitting us all the time. Air pressure is just the force of these particles hitting a surface.

2 **a** There is gas pressure inside it caused by particles hitting the surface. This keeps it inflated.

b The particles will get close together/more dense.

c It will increase.

d Too much pressure on the surface.

3 A – The gas pressure inside the balloon is greater than outside it.

4 **a** A space with nothing inside, no particles.

b No air particles so the air pressure outside is greater and causes the thing to get squashed/crushed.

5 less, inside, outside, greater

6 **a** There should be (fewer or) equal number of air particles drawn inside the tyre. A label added to state this.

b Particles inside the tyre would slowly escape and the tyre would deflate.

c Student discussion. The correct diagrams should be as outlined in parts **a** and **b**. The better diagrams will show:

1. equal numbers of particles inside and outside the tyre in drawing X
2. labels explaining this.

d, e Students' own responses.

7Ge Forecasting the weather (STEM)

1 Students' own answers using the correct symbols to represent sun, cloud, heavy rain, light rain and strong winds.

2

Pressure at X (kPa)	Wind direction	Pressure at Y (kPa)
100	→	130
125	←	113
129	←	122
160	→	190

3 The student should have used arrows pointing from the south. They will describe how the arrows are large to show strong wind and point in the direction that the wind is blowing (from south to north).

7Ge Waste

1 **a** Particles vibrate in fixed position, strong attraction forces.

b Particles move past each other, weaker forces of attraction.

c Particles are free to move as much as they like in all directions, weakest forces of attraction.

2 Air is made of tiny particles, moving about randomly in all directions. These particles hit the soot particle and push it around causing it to move in a random manner.

3 In Y, there should be a grouping of particles near the poison leak. In Z, the particles should be spread throughout the pond evenly.

4 B – The amount of methane depends on the amount of rotting waste.

7H WORKBOOK ANSWERS

7Ha Our material world

1 **a** From left: liquid, gas.

b From top left, going clockwise: melting, evaporating, condensing, solidifying (or freezing).

2 A solution is a mixture where a solid has been dissolved in a liquid.

3 Evaporation

4 B – During evaporation, particles leave the liquid as a gas; C – Evaporation gets faster as the liquid gets hotter.

5 chemical change – frying an egg, iron rails rusting; physical change – boiling a kettle to make steam, mixing sand and water, water turning to ice.

7Ha Sorting resource data (WS)

1 quantitative, descriptions, discrete, numbers, data, limited

2 **a** Suggested answer:

- axes should be labelled to say what they show
- write the units after each axis label
- the graph should have a title
- numbers on the scales should be written in
- divisions on the scales should be evenly spaced
- the graph should fill as much of the paper as possible
- use small neat crosses to plot points
- plot points accurately
- draw in (sharp) pencil.

b, c Student's own answers.

3 **a** Sort by increasing/decreasing years left.

b Suitable graph with four correctly plotted bars to show the length of time the four metals will last. The bars should be the same width, and the height of each bar should be drawn as a straight horizontal line.

4 **a Volume of air (in the beaker); and time the candle burns for.**

b i quantitative

b ii continuous

7Ha The air we breathe

1 **a** true

b false

c false

d false

2 A list of all the elements that have been discovered.

3 **a** B – an element

b C – it only contains one type of atom

4 **a** atom – the simplest type of particle – the argon atom

element – contains only atoms of the same type – the gold atoms

molecule – two or more atoms joined together – the oxygen molecule

compound – contains atoms of different types that are chemically joined – lead sulfide

b **i** An element contains only one type of atom; a compound contains more than one type of atom joined together.

ii An atom is a single particle; a molecule is two or more atoms joined together in groups.

5 **a** nitrogen

b oxygen

c carbon dioxide

6 Students' own answers.

7Hb Earth's elements

1 atoms

2 C – quantitative

3 two, joined, element, atoms, same, molecule

4 **a** Fe

b Na

c Ca

5 **a** oxygen

b Any two from: oxygen, helium, nitrogen, argon, neon.

6 **a** jewellery

b saucepans

c pencil lead

7Hc Metals and non-metals

1 Any three from: solids with high melting and/or boiling points; shiny (when polished); malleable; good conductors of heat and/or electricity.

2 Iron, nickel and cobalt.

3 It is brittle, it has a low melting point, it does not conduct heat or electricity.

4 **a** metal; because it is malleable, has a high melting and/or boiling point and it conducts heat and electricity.

(Element B is a non-metal because its melting and boiling points are lower and it doesn't conduct (heat or electricity).)

b Element A because it conducts electricity and/or it is malleable.

c Melting and boiling points.

5 It can be shiny; it can conduct.

6 So we do not run out or because it saves energy or money.

7Hc Obtaining metals (STEM)

1 an ore

2 physical, chemical, physical

3 **a** oxygen, carbon

b one

4 **a** The data contains the main costs. (Minor costs that could be mentioned include environmental clean-up.)

b Total cost of handling 1000 kg of ore is £90.00.

c 1000 kg of ore (1% copper) produces 10 kg of copper.

Selling at 10 × £4.50 = £45.00, which is less than the cost of £90.00 to produce it. So process will make a loss.

d It would need to sell at £9.00 per kg to avoid making a loss.

7Hd Making compounds

1 A mineral is a compound that is found naturally and an ore is a compound where there is metal that can be extracted.

2 compounds, elements, elements, compound, elements

3 B – Silicon dioxide is made from a metal joined with a non-metal.

C – Silicon dioxide is a compound made from silicon and oxygen.

4 **a** potassium bromide

b calcium oxide

c tin sulfide

d magnesium fluoride.

5 **a** sulfur

b Glowing and giving out heat.

c iron sulfide

6 **a** flames and purple fumes and the white solid

b aluminium iodide

7He Chemical reactions

1 One or more new substances are formed.

2 Any three from: a solid forming; a gas being given off; a colour change; or heat is given off.

3 **a** nitrogen and oxygen

b nitrogen dioxide

4

Reactants		Products
a magnesium + oxygen	→	magnesium oxide
b hydrogen + iodine	→	hydrogen iodide
c aluminium + iodine	→	aluminium iodide

5 **a** Because new substances are made.

b oxygen

c heat/Bunsen burner/spirit burner

d B – thermal decomposition

6 **a**

i oxygen

ii carbon dioxide

iii calcium oxide

iv magnesium oxide + carbon dioxide.

b **i** breaks down into elements; **ii** to **iv** break down into compounds

c Bubble through limewater, which goes cloudy.

7 D – There is a chemical reaction, in which one of the products is water.

8 **a** sodium, phosphorus and oxygen

b lead, nitrogen and oxygen

c copper, sulfur and oxygen

7He Problems with elements

1 **a** Metals: lead, mercury.

b Non-metals: sulfur, arsenic.

c Compounds: lead sulfide, lead oxide.

d The waste contains toxic chemicals.

2 Any three from: metals conduct heat; conduct electricity; shine when polished; are malleable; have high melting and boiling points.

3 **a** Picture A (frying eggs) shows a chemical change; picture B (water boiling) shows a change of state.

b Frying eggs makes a new substance and cannot easily be reversed. Boiling water retains the substance and the steam can be turned back into water (by cooling).

7I WORKBOOK ANSWERS

7Ia Energy and changes

1 **a** food

b fuel in the bus (petrol/diesel)

c battery/cell

2 **2** The bus needed the most, as it is larger and travels a long way. The torch needs the least as it is producing only a small amount of light.

3 **a** Any three sensible answers, such as: lights, heating the home, cooling the home, TV/radio/entertainment, heating water, cooking food, washing machine/any other domestic appliances.

b Any three sensible answers, such as: lights, heating/cooling, tannoy/bells, projectors, computers.

4 Students could refer to two from: gas, electricity, solid fuel, or could refer to two from: on the top of the cooker, in an oven, using a microwave oven.

5 Student's own answers. Students are not expected to be able to answer this question correctly at this point. The question is asked again in 7Ie.

7Ia Energy from food

1 balanced diet – a diet that gives you the right amount of energy and all the nutrients you need; diet – all the things you eat; nutrient – a substance in food that your body needs; joule (J) – the unit for measuring energy.

2 For growth and repair; to let you move and keep warm.

3 A person takes in energy stored in their food and uses it to stay alive, to grow, and for moving about. If they use more energy than they take in, they will use energy stored in fat or muscle and lose weight. If they take in more energy than they use, the spare energy is stored as fat or muscle and they will gain weight.

4 **a** Divide the portion size by 100 g then multiply by the energy per 100 g (or equivalent explanation).

peas – 288; lamb – 990; dahl (lentils) – 675

b 1 meal = 900 + 288 + 990 = 2178 kJ; 9000/1287 = 4 meals

7Ia Fair comparisons and ratios (WS)

1 **a**, **b** Any two from: same volume of water in tube; same distance of burning nuts from tube; same starting temperature of water.

2 **a** Divide the temperature rise by the mass of the piece of biscuit.

b A – 1.25 °C; B – 1.54 °C; C – 1.00 °C

c The pieces of biscuit are different sizes/have different masses.

3 1.25 : 1.54

4 Yes, the ratio of energy stored in bread and cheese (represented by the temperature rises) is 1 : 2, so if twice the mass of bread is eaten as cheese, the same energy will be obtained.

5 **a** 300 : 100 = 3 : 1

b 300 : 150 = 2 : 1

7Ib Energy transfers and stores

1 **a** B – thermal energy

b A – gravitational potential energy

c C – strain energy

d D – kinetic energy

e C – strain energy

f A – gravitational potential energy (accept kinetic energy, the water is also moving)

2 **a**, **b** Student's own answers to question **1**/group work

3 Any three from: food, cells/batteries, other named fuels such as petrol, coal.

4 Nuclear energy or atomic energy (either answer is acceptable).

5 transferred, stores, stored, created, conservation

6 **a** Three answers, such as: light bulbs, fires, electric lights, candles.

b Three answers, such as: musical instruments, radios, TVs.

c Any three electrical appliances.

7 Any three sensible suggestions such as: car engine, lifting a bag, throwing a ball.

8 force, elastic, strain (or elastic potential), force, toy aeroplane, kinetic

9 **a** nuclear, fuel, electricity, heating, thermal

b 2000 J – energy cannot be created or destroyed, so all that goes in must come out again.

c Box with 'chemical energy stored in petrol/fuel', arrow with 'energy transferred by forces in the engine/car', box with 'kinetic energy stored in moving car'.

7Ic Fuels

1 Burn them to release energy.

2 Any three suitable suggestions, such as: generating electricity, heating, cooking, running cars/buses.

3 **a** coal

b It stops the dead organisms rotting.

c They get buried, squashed and heated.

d Millions of years.

4 Any two from: petrol, diesel, bottled gas.

5 found underground – both; made from the remains of living organisms – fossil fuels; used in cars and lorries – fossil fuels; used to generate electricity – both

6 Electricity is not a fuel in itself, it is a way of transferring the energy stored in a fuel into another form.

7 **a** oil

b For two reasons: we are not sure how much is left and we are not sure how fast we will continue to use them.

8 We are using them up faster than they are being formed. Renewable resources are those where the resource is replenished at about the same rate it is being used (as for biofuels), but we are using fossil fuels much faster than they are forming.

9 waste materials from animals, plants

10 gas, natural gas, non-renewable, non-renewable; water, energy, renewable, renewable; burnt, fuel cells, oxygen, electricity

7Ic Transporting goods (STEM)

1 **a** petrol, diesel (hydrogen is also a possible answer)

b chemical energy

c biofuel

2 **a** The need to provide energy for a long time, the weight of the fuel, the amount of energy needed

b nuclear fuel, as it can store a lot of energy in a small mass

3 Primary data advantages include:

you can choose what data to collect
you know how well the experiment went, which makes it easier to evaluate the data.

Primary data disadvantages include:

you may not have the apparatus needed to carry out the experiment
you may not have time to repeat the experiment to allow you to check your data.

Secondary data advantages include:

It may be quicker and easier to find data on the internet or in books than it is to carry out experiments.

Secondary data disadvantages include:

You may not get enough detail about how the experiment was carried out, so you may not be able to evaluate the data well.

4 Shortest route from A to D is A-B-E-D (14 km).

7Id Other energy resources

1 **a** Generating electricity.

b Any two from: solar power, biofuels, geothermal.

2 **a** Solar cells convert energy transferred by sunlight to electricity.

b Solar power stations use energy from the Sun to make steam, which is used to generate electricity. (Some solar power stations use convection to drive turbines in a chimney, but this type is not covered in the Student Book.)

3 Tides, waves, hydroelectricity (in any order).

4 **a**, **b** biofuels – any time; geothermal – any time; hydroelectric – any time; solar – depends on the weather, only at certain times; tides – only at certain times; waves – depends on the weather; wind – depends on the weather.

5 From the Sun; energy from the Sun (transferred by light) was converted to the energy stored in plants, plants were buried and transformed to natural gas.

7Ie Using resources

1 **a, b**

Statement	A or D?	Fossil fuels	Nuclear fuel	Renewable resources
available at any time	A	✓	✓	
cheap compared to other resources	A	✓		
convenient to use in vehicles	A	✓		
most are not available all the time	D			✓
no polluting gases	A		✓	✓
non-renewable	D	✓	✓	
release polluting gases	D	✓		
renewable	A			✓
very expensive	D		✓	

2 **a** carbon dioxide

b Makes the Earth warmer.

3 **a** Any three suitable suggestions, such as: walk/cycle instead of using cars; insulate homes so we need to use less for heating in cold countries and less for cooling in hot countries; keep houses cooler so we use less for heating; buy more efficient appliances so that less energy is wasted.

b Any two from: to make them last longer, because they are non-renewable / because burning them adds carbon dioxide to the atmosphere, which contributes to climate change.

7Ie Efficiency

1 **a, b** electricity; gravitational potential – useful; thermal – wasted.

2 Bulb A is the most efficient because it only wastes 2 J of energy every second, compared with wasting 16 J.

3 20 J – 4 J = 16 J

4 **a**, **b**, **c** (Arrow) energy transferred by electricity; (top box) energy stored in the hot water (thermal energy) – useful energy; (bottom box) energy stored in the kettle and the surroundings, which get warmer (thermal energy) – wasted energy.

7Ie Making changes

1 Non-renewable resources do not depend on the weather as many of the renewable resources do; power stations can be built almost anywhere and the power stations already exist; using the existing power stations and paying for the fossil fuels is still cheaper than investing in new generating systems that do not have fuel costs.

2 **i** To reduce the amount of carbon dioxide added to the atmosphere/carbon dioxide produced is contributing to climate change.

ii To make supplies last longer.

3 **a** Efficient appliances use less energy to do a particular job than inefficient or less efficient appliances.

b Electricity is a way of transferring energy, not a store. Using less energy uses up less of our fossil fuel/nuclear resources.

4 **a** Various answers are possible, depending on how students assume the electricity for charging the batteries is generated.

Chemical, if the electricity was generated in a coal- or oil-fired power station.

Nuclear, if the electricity was generated in a nuclear power station.

The Sun, if the electricity was generated in a fossil fuelled power station or one powered by biofuels, by solar cells/a solar power station, or by wind, waves or water.

The Earth, if students assume a geothermal power station.

b Student's own answers.

ESWS 7J WORKBOOK ANSWERS

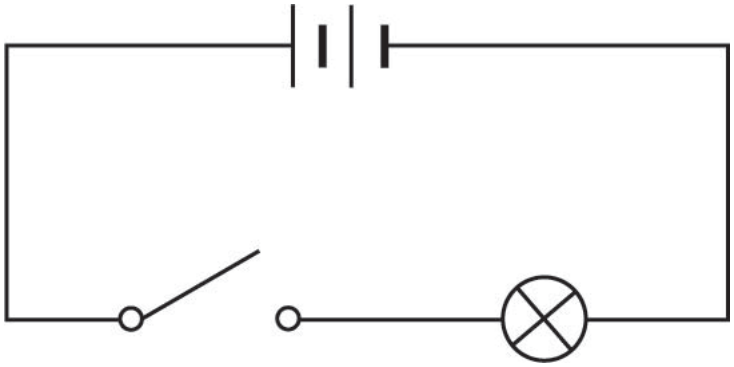
7Ja Discovering electricity

1 Any three sensible suggestions, such as: using a light, computer, phone, etc., eating refrigerated food, or food cooked using electricity.

2 plastic – insulator; copper – conductor; aluminium – conductor; rubber – insulator; wood – insulator; glass – insulator

3 Metal is used for the wires because metals are good conductors of electricity. Plastic is used to cover the wires because plastic is an insulator. This stops the electricity causing harm if someone touches the wire.

4



7Ja Switches and current

1 ammeter – a component that measures how much electricity is flowing; ampere (A) – the unit for measuring current; component – something in a circuit, such as a cell or bulb; current – the flow of electricity around a circuit; energy – something that is needed to make things happen or change; filament – a thin piece of wire inside a bulb that glows when current flows through it

2 When the switch is open there is a gap in the circuit so the current cannot flow. When the switch is closed there is a complete circuit so the current can flow and the bulb comes on.

3 **a** The other bulb will not come on because the missing bulb has made a gap in the circuit.

b Student's own answers.

4 A – The current is the same everywhere in a circuit.

D – Current only flows if there is a complete circuit.

5 X

6 Answers may include: broken bulb, missing bulb, flat battery/cell, broken wire inside the torch, broken switch.

7Jb Models in science (WS)

1 model, represent, science, complicated

2 X written next to the pump; Y written next to the 'water with ink in it' label, or pointing to the water; Z written next to the water wheel.

3 **a** X – the marbles

b Y – the escalator

c Z – the bell

4 **a** It stays the same, because the funnel catches all the water that runs over the waterwheel.

b It gets less after it passes the hole in the track, because some of the marbles fall through the hole.

7Jb Testing models (WS)

1 B – Measure the current at different places in a circuit.

2 **a** All the ammeter readings should be the same.

b The current would be different at different places in the circuit/before and after the current flows through the bulb.

3 The current is the same everywhere in a circuit, so Sam's model is the better one.

4 They are made of real objects that Sam and Nat can touch.

5 **a** The arrows are just drawings on paper.

b A computer model of the solar system, or any other sensible suggestion.

6 Students' own answers.

7Jb Models for circuits

1 current, charges, energy, components, conducting, insulating

2 The charges are too small to see.

3 3, 1, 4, 2

4 **a** radiator

b pipes and water

c boiler and pump

5 **a** the volume/amount of water flowing per second (or equivalent answer)

b the temperature of the water/the energy stored in the water

7Jb The power station model

1 **a** the cell

b the bulb or other component

c the charges

d the energy transferred by the charges

2 The number of trucks/wagons is the same everywhere in the circuit.

3 Any suitable answer, such as: the mine is only providing coal but a cell pushes the charges around as well as providing them with energy, or the factory is not obviously transferring useful energy to its surroundings.

4 **a** Add a barrier/gate that the trucks could not pass through.

b This is adding a barrier to the circuit, a switch works by making a gap in the circuit, which would be like taking up some of the railway line.

c Students' own answers.

7Jc Series and parallel circuits

1 **a**, **b** Correct drawings of series circuit with cell and two bulbs, and parallel circuit.

2 **a** wrong

b correct

c wrong

d correct

e wrong

3 OR. Because the bulb comes on if switch Y OR switch Z is closed (or both are).

4 Final column should be (from top): off, on, on, on.

5 The bulbs in a parallel circuit can all be controlled at once if the switch is in the main part of the circuit. Suitable diagram of a parallel circuit with cell and four bulbs to illustrate this, with the switch in the same part of the circuit as the cell.

7Jd Changing the current

1 **a** voltage

b Voltmeters are connected in parallel; ammeters are connected in series.

2 … the amount of energy transferred by the current/the energy change/drop as the current passes through it/the difference in energy carried by the current each side of the component.

3 **a** Makes it more difficult for current to flow/reduces the current.

b correct symbols for resistor and variable resistor

4 It decreases.

5 **a** B – Y is higher than X.

b C – It is easier for current to flow when there are more branches.

6 **a** The current will get less, because the resistance of the circuit is higher/it is harder for the current to flow when there are more bulbs.

b The current will increase, because the overall resistance of the circuit is lower as there is an extra alternative route for the current.

7Jd Building robots (STEM)

1 **a** Faster, as a greater current can transfer more energy to the motor (or similar explanation).

b Its resistance should be reduced/made smaller.

c Low – if they had a high resistance, energy would be transferred in the wires and wasted.

2 Abstract – it is not a model you can pick up.

3 **a** 1 – eyes; 2 – brain; 3 – hands/feet, or muscles

b 1 – camera or infrared sensors; 2 – computer

4 **a–c** Students' own answers.

7Je Using electricity

1 It is at a higher voltage.

2 Electricity may run through your body and cause burns, or cause the heart to stop working.

3 **a** It increases.

b The current might increase enough to cause a fire in the wiring.

4 Students' own answers.

5 **a** live – brown; neutral – blue; earth – yellow and green (can be in any order in the table)

b So they can be connected to the correct places in plugs/sockets.

6 It could cause a fire.

7 **a** It melts.

b To cut off the current if it gets too high.

8 The 10 A one; the 5 A fuse would melt/blow if a 6 A current flowed through it and the 13 A fuse might let too much current flow.

9 circuit breaker

10 **a** The cable grip stops the wires being pulled from the pins.

b The earth wire is for safety – stops current flowing to the outside of appliances.

c The live pin connects to the live mains wiring.

11 The apparatus listed should include: power supply/cells, ammeter, variable resistor, connecting wires, fuse wire, heatproof mat. The answer should include a suitable circuit diagram and a description of steadily increasing the current until the fuse melts.

12 Students' own answers.

7Je A world without electricity

1 Circuit drawn with cell, bulb and ammeter in series, and a voltmeter across the bulb.

2 The resistance of the circuit and the voltage of the supply/cell.

3 As you add bulbs, the resistance of the circuit increases, so a smaller current flows. The smaller the current, the dimmer the bulbs.

4 Set up a circuit with both components in. Measure the voltage across each component. The one with the higher voltage across it is transferring the most energy.

5 The answer will mention lights being on or off together, or a broken bulb resulting in all other bulbs going off. The answer may also include the following: the brightness of bulbs in a house would change as other people switched bulbs on or off; the change in brightness would be linked to changing resistance and changing current.

7K WORKBOOK ANSWERS

7Ka Forces

1 area – centimetre squared (cm^2); length – centimetre (cm), metre (m); force – newton (N); mass – gram (g)

2 **a** Contact forces must touch the thing they are acting on; non-contact forces do not need to be touching.

b Contact forces – gravity, static electricity, magnetism.

Non-contact forces – three from: air resistance, water resistance, friction, upthrust, or a description of pushing or pulling something.

3 **a** Weight acting downwards. Friction from her shoes, pulling and pushing forces from her hands and feet, all acting upwards. The downwards and upwards forces are balanced.

b Gravity is pulling the climber downwards. She starts to move down. When the rope becomes taut it starts to stretch. As it stretches, it exerts an upwards force on the climber. The more it stretches the greater this force will become, until eventually it is the same size as her weight. At this point the two forces will be balanced.

Students may also state that when the forces become balanced, the climber is already moving downwards, so her speed will not immediately change. As the rope stretches further, the upwards force increases, so she begins to fall more slowly. Eventually the force from the rope is big enough to make her start to move upwards. Eventually she will become stationary at the point where the force from the stretched rope balances her weight.

c Her weight is balanced by an upwards force from the rope.

7Ka Different forces

1 Make it change speed, direction or shape.

2 Any sensible suggestions are valid. Examples include:

Friction: stop tyres slipping on a road, allow you to pull a rope, make brakes work.

Upthrust: make ships/balloons float.

Gravity: pull things downwards/make things fall.

Magnetism: attract iron objects, stick notes to fridges, hold doors closed.

Air resistance: slow down things moving through air, make things move when the wind blows.

Static electricity: attract things.

3 gravity, magnetism, static electricity

4 **a** A

b The arrow is longest.

c Arrow drawn with a length shorter than those shown.

d They will start to move/move faster.

5 **a** A large arrow pointing to the left drawn to the left of A.

b An arrow pointing to the right drawn to the right of B.

c A small arrow to the left drawn to the left of C.

6 **a**, **b** Upwards arrow labelled upthrust; downwards arrow labelled gravity (or weight). These arrows should be the same size as each other.

Left arrow labelled (forwards) force from engines/propellers; right arrow labelled air resistance. Equal sizes.

The vertical arrows should be much larger than the horizontal ones, but students are not expected to know this.

7 **a** The force of gravity pulling on something.

b newtons (N)

c The amount of matter in something.

d kilograms (or grams) (kg or g)

8 Gravity is not as strong on the Moon as it is on the Earth.

9 **a** Any sensible answer such as eating/drinking, going to the toilet.

b Your weight also changes, because the force of gravity on you depends on how much mass you have.

7Kb Springs

1 **a** C – extension **b** D – plastic

2 4 N

3 9 cm

4 **a** A

b A and C; the graphs are straight lines/the extension is proportional to the force.

c A, as it stretches the most for a small weight. This would make the scale easier to read/make it possible to detect small differences in force.

7Kc Friction

1 rubber – H; oil – L; wax – L; sandpaper – H

2 brakes, engines, solid, smooth, lubricant

3 air, water, surfaces, shapes (last two in either order), resistance

4 **a** To reduce friction and make the bicycle go faster.

b Oil reduces the friction between the brake blocks and the wheel so the brakes would not work.

c Rain acts like a lubricant and reduces the friction between the brake blocks and the wheel.

5 Friction in a car's brakes is useful – true.

Tyres grip the road better when it rains – false.

Lubricating a bicycle makes it harder to ride – false.

An engine will soon stop working if there is no oil in it – true.

Having very smooth soles on your shoes makes walking easier – true.

7Kd Pressure

1 force, area, area; area, force, force

2 pascal, Pa

3 **a** The sharper the point, the smaller its area and the greater the pressure. This means that with a sharper point a smaller force is needed to achieve the same pressure so it is easier to push the pin into the wall.

b The force on your finger/thumb is the same as the force pushing the pin into the wall, so the area needs to be much larger than the point of the pin so that the pressure on your finger is small enough not to damage the skin.

4

Box	Weight (N)	Area	Pressure	Units
A	6	1.5 cm^2	4	N/cm^2
B	9000	3 m^2	3000	N/m^2
C	6	20 cm^2	0.3	N/cm^2
D	200	0.5 m^2	400	N/m^2

Divide the area by the pressure.

7Kd SI units (WS)

1 pascal – standard; hour – not standard; newton – standard; metre – standard; litre – not standard; gram – not standard (the kilogram is the standard unit); joule – standard

2 joule – J – energy; metre – m – length; second – s – time; metre squared – m^2 – area; kilogram – kg – mass; metre cubed – m^3 – volume; metres per second – m/s – speed

3 **a** metres

b metres squared

c seconds

4 **a** newtons (accept pascal)

b metres cubed

c newtons

d kilograms

7Kd SI units and prefixes (WS)

1 **1 a** The standard units are sometimes not a convenient size.

b,c

Prefix	Symbol	Meaning
nano-	n	1/1 000 000 000 (one billionth)
micro-	μ	1/1 000 000 (one millionth)
milli-	m	1/1000 (one thousandth)
centi-	c	1/100 (one hundredth)
deci-	d	1/10 (one tenth)
kilo-	k	1000
mega-	M	1 000 000

2 **a** cm or mm

b kJ

c mg (accept g)

d μm

3 **a** Students' own answers, such as: Science is carried out in different countries and it is important that scientists can reproduce/replicate/understand what other scientists have done.

b If everyone in a particular place is using the same set of units, there will be no problems. Using a common/understandable set of units is more important when people in different places buy and sell goods or exchange information.

7Ke Balanced and unbalanced

1 **a** **i** Make it start moving.

ii Make it change speed.

b **i** Nothing – it stays still.

ii Nothing – it continues to move at the same speed.

2 The correct words are:

unbalanced, bigger, speed up

balanced, the same size as, stay at the same speed

unbalanced, backwards, slow down

3 **a** Apply the brakes.

b It will make them slow down.

4 **a**, **b**

6	As the bicycle speeds up, the friction and air resistance forces get bigger and bigger.
7	Eventually they balance the force from the pedals.
5	The bicycle goes faster.
1	The bicycle is not moving to start with, so the force from the pedals is much greater than friction forces.
2	The bicycle starts to move.
4	The force from the pedals is still greater than the friction forces.
9	This is the top speed of the bicycle.
3	When the bicycle is moving slowly, the friction forces are not very big.
8	When this happens the bicycle will continue to move at the same speed.

5 **a** They will be smaller.

b It will be faster, because she will be able to go faster before the friction forces balance the force she can put on the pedals.

6 When you first hang something on a force meter the forces are balanced so the spring begins to stretch.

As the spring stretches it produces a bigger force.

Eventually the forces are balanced, and the force meter shows the weight of the object.

7 The weight will be stronger than the force from the spring, so the mass will move downwards. When the spring has stretched further, the forces will be balanced again and the force meter will show the new weight.

7Ke Designing structures (STEM)

1 **a** If members of a team use different units, different parts of the building/structure may not fit together, or may not be strong enough. They may order/buy the wrong quantities of materials.

b Using a convention for symbols makes sure everyone working on the project can understand which units are being used.

2 **a** Force arrow downwards from car.

b They must be the same size/balance the weight.

c An upwards arrow drawn on each bridge support, half the length of the student's weight arrow.

3 **a–c** Students' own answers.

7Ke Safety standards

1 Mass is the amount of matter in an object, and is measured in kg. Weight is the force of gravity pulling on the mass, measured in newtons.

2 **a** If they were going to ski on very soft snow, they might want bigger skis to make sure they did not sink in. The bigger area of the skis means there will be a lower pressure underneath them.

b Students' own answers, such as: beneath crampon points in mountaineering to grip on the ice, under the end of a ski pole used by a slalom skier.

3 **a** Weight acting downwards. Friction from her shoes, pulling and pushing forces from her hands and feet, all acting upwards. The downwards and upwards forces are balanced.

b Gravity is pulling the climber downwards. She starts to move down. When the rope becomes taut it starts to stretch. As it stretches, it exerts an upwards force on the climber. The more it stretches the greater this force will become, until eventually it is the same size as her weight. At this point the two forces will be balanced.

Students may also state that when the forces become balanced, the climber is already moving downwards, so her speed will not immediately change. As the rope stretches further, the upwards force increases, so she begins to fall more slowly. Eventually the force from the rope is big enough to make her start to move upwards. Eventually she will become stationary at the point where the force from the stretched rope balances her weight.

c Students' own answers.

7L WORKBOOK ANSWERS

7La Animal sounds

1 **a** Answers may include: talking, beeps at pedestrian crossings, microwave oven 'pings'.

b Answers may include: car horns, reversing alarms, sirens.

2 Two from: talking/singing/humming/shouting/whispering; whistling; clapping; belching, passing wind; sneezing; coughing; tongue slaps; tummy rumbles etc.

3 **a** the drum skin

b the strings

c vocal cords (accept throat)

d the air inside the recorder/flute

e a cone inside the loudspeaker

f its wings

4 **a** louder

b higher

5 Note that students are not expected to know all the answers to this question at this stage in their study of the unit.

6 **a** Students may provide some of the following detail in their answers: the noises are sound waves, caused by vibrations, that travel through air as longitudinal waves. In the waves, air particles are moved backwards and forwards, creating areas of high and low pressure.

b They listen for the echo when their sound is reflected by an obstacle or their prey. The length of time for the echo to return tells them how far away it is.

7La Making sounds

1 **a** B – high volume

b C – the amplitude of the vibrations

c A – the number of vibrations per second

d C – hitting a long bell gently

2 Students' own answers

3 **a** 500 Hz

b The sound will have a higher pitch.

4 **a** Lower sounds are made when larger objects vibrate, so the one making the lower sound is likely to be bigger than the other one.

b It can hit its chest harder.

5 Go to a zoo/listen to animal sounds and make a list.

7Lb Moving sounds

1 **a** Arrow drawn pointing to the right.

b Arrow drawn similar to one of the red arrows on diagram C in 7Lb Moving Sounds in the Student Book.

2 X, because the amplitude is greater/the particles are moving further as the wave passes.

3 **a** There is no air in space to pass the vibrations on.

b The sound passes through the air in one helmet then through the solid helmets to the air in the second helmet.

c Students' own answers.

7Lb Speed of sound

1 Bar chart correctly plotted, with bars in ascending order and axes labelled.

2 The particles are closer together so it is easier for the vibrations to be passed on.

3 **a**, **b** Sound spreads out from the man, and the energy they transfer is also more spread out, so there is less energy for your ears to detect as you get further away.

4 Your hands/the cone make all the sound waves move in one direction, so they do not spread out as much and the sound will still be loud enough to hear at a greater distance. This means the energy is concentrated compared with shouting without the cone/hands, so the sound is louder at a given distance.

7Lb Line graphs and scatter graphs (WS)

1 The speed of sound column.

2 **a** **i** line graph

ii neither

iii scatter graph

iv scatter graph

3 **a** **i** B

ii B

b Correct words are: lowest, lower; largest, louder.

7Lb Using line graphs and scatter graphs (WS)

1 The speed increases as the temperature increases.

2 **a** Graph plotted correctly:

neatly and accurately plotted points

points joined with a line of best fit

axes labelled correctly, including units

suitable title.

b The graph is a straight line, going up as the relative humidity increases.

c She is incorrect. The speed increases as the relative humidity increases.

d Students' own answers.

7Lc Detecting sounds

1 eardrum, bones, cochlea

2 **a** bones

b cochlea

c eardrum

d eardrum

e auditory nerve

f ear canal

3 Loud sounds can damage hearing.

4 Put an object such as a bell inside a box. Measure the sound intensity outside the box with different materials wrapped around the box/stuffed inside the box. Students may also explain how to make fair comparisons or suggest repeating the measurements.

5 **a**, **b** Students' own answers.

7Lc Microphones and hearing ranges

1 **a** Sound waves make a diaphragm inside the microphone vibrate. Electrical circuits detect the vibrations and convert them into changes in an electrical current.

b Students' own answers.

2 Infrasounds are too low for human ears to hear; ultrasounds are too high.

3 **a** dolphins

b humans

4 Sound waves enter the ear canal and make the eardrum vibrate. These vibrations are amplified by the ear bones and passed to the cochlea. Tiny hairs in the cochlea detect the vibrations and create impulses which travel to the cat's brain along the auditory nerve.

7Ld Using sound

1 absorb – the energy stays inside the material; transmit – the energy passes through the material; reflect – the energy bounces off the material

2 **a** Finding their way around; finding their prey.

b The distance and direction of an object.

3 So they only use their own sounds to help them to navigate/find prey; if they detected another bat's calls by mistake, they could not use it to locate objects.

4 **a** (In part A, the sonar equipment on the ship) sends a pulse of ultrasound downwards.

(In B, the) ultrasound is reflected by the sea bed.

(In C, the) ship/sonar equipment detects the ultrasound echo.

(The sonar equipment works out the depth using) the time it takes for the sound to return.

b Some of the ultrasound will be reflected by fish beneath the ship. The sonar will detect two echoes. The first one will be from the fish.

c Student's own answers

7Ld Working with sound (STEM)

1 It is easier to compare data.

2 **a** Probably in lessons, as the corridors and the dining halls are quietest.

b Eating lunch/having a lunch break, as the dining hall is much noisier.

3 **a** Any sensible suggestions, such as: students talking, bells, doors banging, footsteps, traffic noise from outside.

b Any sensible mitigation ideas related to the original suggestions, such as: not talking/talking more quietly, making the bells quieter, walking instead of running, etc.

4 **a**, **b** Responses depend on students' results.

c He has only investigated the corridors at a time when hardly anyone is using them. His conclusion would be valid if it referred only to lesson time.

7Le Comparing waves

1 **a** Labels, anticlockwise from top: crest, particle movement, trough, direction of travel, amplitude.

b Students' own answers

2 Up and down.

3 **a** Some of it is transferred to the water and it spreads out across the surface as waves.

b Drop a heavier stone (as it will have more energy).

4 Correct words are: more, spread out, smaller.

5 Waves can be reflected by the cliffs, so they could be coming from the direction of the sea and from the direction of the cliffs. Some of the waves may be bigger because if the peaks of a wave from the sea and from the cliff occur together their effect will add up and make a bigger wave.

7Le Animals and noise

1 **a** Fork A will have a higher sound than B because it is smaller and so will vibrate at a higher frequency, and a quieter sound because the amplitude of its vibrations is less.

b 2, 4, 1, 5, 3

2 **a** Students may provide some of the following detail in their answers: the noises are sound waves, caused by vibrations, that travel through air as longitudinal waves. In the waves, air particles are moved backwards and forwards, creating areas of high and low pressure.

b They listen for the echo when their sound is reflected by an obstacle or their prey. The length of time for the echo to return tells them how far away it is.

c Students' own answers.