

Answers

How can you improve your grades?

Page 7

1. c)
2. Think about what you already know, answer the questions in the margins, answer the review questions.
3. B, it shows that ideas are linked together.
4. In disorganised knowledge information is separated and not linked together. In organised knowledge information is linked together.
5. You can easily find the information you need to answer the question.
6. E.g. answering the review questions helped me to process the information so I learnt it and stored it in my memory.

Cell structure

Page 9

1. Movement, respiration, sensitivity, growth, reproduction, excretion, nutrition.
2. Movement – moving whole body or just a part. Respiration – releasing energy from food. Sensitivity – sensing changes and taking action. Growth – getting bigger. Reproduction – making new organisms. Excretion – Getting rid of waste. Nutrition – taking in food and using it for life processes.
3. Waste arrow coming out of bacteria, food arrow going in.
4. It cannot release energy for life processes.
5. No. It is alive and carrying out all the life processes, but the scientist did not have evidence for them all.
6. No. A robot does not carry out all the life processes. It does move and is sensitive, but it cannot carry out respiration, grow, reproduce, excrete or need food.

Page 11

1. A building block of an organism.
2. They magnified cells so they could be seen (because cells are too small to be seen with the naked eye).
3. Antonie Van Leeuwenhoek – Used a microscope to look at the gunk on his teeth – There are 'tiny animals' moving around on his teeth. Matthias Schleiden – Studied plants with a microscope – Plants are lots of cells joined together. Theodor Schwann – Looked at parts of the human body with a microscope –

Human body parts contain cells of different shapes and sizes. Schleiden and Schwann – discussed their ideas together – All organisms are made of cells. Ramak, Raspali and Vichow – Studied cells splitting in half – Organisms grow when their cells split in half.

4. X, because they are just one cell (bacteria are single-celled organisms).
5. Cells are living, they are not made of plastic, they carry out life processes, they split in half.
6. The single cell split in half to make two cells and each of these cells split in half. This splitting happened many times to make billions of cells.

Page 13

1. a) True b) False c) True d) False
2. Cell membrane – lets substances in and out. Nucleus – controls the cell. Cytoplasm – stores useful substances. Mitochondria – supplies energy. Ribosome – makes proteins.
3. Diagram shows that a substance is too large to get through the holes in the cell membrane.
4. a) Respiration b) Nutrition c) Excretion d) Growth e) Reproduction
5. Each part has a different role in a life process, which keep the cell alive.
6. The mitochondria. Her muscle cells are not able to release energy.

Page 15

1. When you imagine something as being like another thing.
2. b) The cell membrane is like the *walls* in a factory because *the walls are full of gates that let materials in and out and the cell membrane is full of tiny holes that let substances in and out.*
c) The nucleus is like the *manager* in a factory because *the manager gives instructions to the robots and the nucleus gives instructions to the ribosomes.*
d) The ribosomes are like the *robots* in a factory because *the robots put together bits to form cars and the ribosomes put together bits to form proteins.*
3. Student's own response.
4. Student's own response.
5. E.g. a cell is much smaller, a cell is not full of people, a cell is living.
6. The mistake in the DNA means that the ribosomes do not get the correct instructions

for making a protein. Without the protein, the person is colour-blind.

Page 17

1. Cell wall, vacuole, chloroplasts
2. Cell wall – strong – strengthens the cell.
Vacuole – pushes outward – keeps the cell hard. Chloroplasts – absorbs light – make food.
3. Cell drawn showing all cell parts (including cell membrane, nucleus, cytoplasm, mitochondria and ribosomes) correctly labelled.
4. a) Plants don't eat food because *they make their own using photosynthesis*.
b) Plants don't need a skeleton for support because *they have a vacuole in their cells that push outwards on the cell wall to keep the cells rigid, which support the plant*.
5. It cannot make food. Without food it cannot release energy during respiration so cannot carry out any life processes.
6. It has got more light, so can carry out more photosynthesis and make more food. With more food it can release more energy for growth.

Page 19

1. Bacteria, yeast and most protists are *single-celled* organisms. They are only made up of *one* cell.

Part	Bacteria	Yeast	Protist
Cell membrane	✓	✓	✓
Nucleus	X	✓	✓
Cytoplasm	✓	✓	✓
Mitochondria	X	✓	✓
Chloroplasts	X	X	✓
Ribosomes	✓	✓	✓
Vacuole	X	✓	✓

3. A – cell wall B – DNA C – cytoplasm
D – ribosome E - flagellum
4. Algae. They have chloroplasts, which they use for photosynthesis.
5. If it is not a cell it is a virus. If it does not have a nucleus, it is a bacteria. If it has a nucleus but also a cell wall it is yeast. If it is none of these it is a protist.
6. It is a protist. It has a flagella so is a bacteria or a protist. But it has a nucleus and a vacuole so cannot be a bacteria.

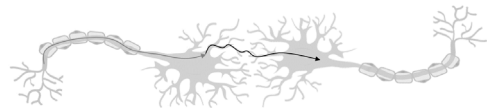
Specialised cells

Page 21

1. Brain – Sensitivity, Ovary – Reproduction
Muscles – Movement, Heart - Respiration
2. Skull – made of hard bone – to protect the brain.
3. It will lift upwards, towards the upper arm.
4. Animals need lots of different body parts because *each body part has a different role in a life process*.
5. C, D, A, B
6. His brain, nerves or sense organs. These are the parts for sensitivity and this life process is not working properly.

Page 23

1. a) False b) False c) True d) False
2. a) To carry oxygen from the lungs to all cells in the body. b) They contain haemoglobin and they have no nucleus. c) The haemoglobin grabs oxygen. Having no nucleus means there is more space for haemoglobin and oxygen.
- 3.



4. They have different shapes or extra bits, which are special features so the cell can do its job.
5. The muscle cells in the heart contract, which makes the heart smaller and pushes the blood out. The muscle cells then relax, and the heart goes back to its original size to allow more blood to enter.
6. The cilia catch the dust to stop it reaching your lungs.

Page 25

1. Roots – root hair cells, stem – xylem cells, leaves – palisade cells
2. Diagram shows water entering the roots, moving up the stem and into the leaves.
3. a) To carry out photosynthesis. b) They are packed full of chloroplasts. They are long. c) The chloroplasts are for photosynthesis. The cells are long so sunlight has to travel through as many chloroplasts as possible.
4. They have special features so they can carry out a special job.
5. The xylem carries water to the leaves. Without water, photosynthesis could not happen in the palisade cells so the plant could not make food.
6. Root hair cells have a long extension to allow lots of water to enter the roots. The water is

carried up the stem (trunk) in xylem cells. These have no cytoplasm and have a gap at the end of each cell wall, so the cells form a tube allowing water to flow upwards through them and into the leaves.

Mixed-up questions

Recall (page 26)

- a) microscope b) membrane c) multicellular d) cell wall e) flagellum
- a) S b) M c) M d) M e) S f) M g) S h) M
- Vacuole, cell wall, chloroplasts.
- a) ribosomes b) chloroplasts c) nucleus d) mitochondria e) vacuole f) cell membrane g) cell wall
- a) ribosomes b) nucleus c) cytoplasm d) cell membrane e) mitochondrion
- Extensions coming out of the cell membrane.
- Cell wall
- a) Red blood cell – carry oxygen – no nucleus b) Palisade – photosynthesis – many chloroplasts c) Root hair – absorb water – an extension d) Muscle – movement – contracts
- 9.

Cell part	Present in plant cell?	Present in bacteria cell?
Cell wall	✓	✓
Cell membrane	✓	✓
Nucleus	✓	X
Mitochondria	✓	X
Chloroplasts	✓	X
Cytoplasm	✓	✓
Ribosomes	✓	✓

- a) nerve cell b) in nerves c) It has lots of branches at the end to pass messages to the next cell. It is very long to carry messages all the way around the body.

Describe & explain (page 27)

- a) multicellular. It is made up many cells joined together. b) X
- Any two from: They do not have a nucleus/chloroplasts/a vacuole. They might have a flagellum.
- a) A multicellular organism b) A cell contains parts/it is not solid (cells contain cytoplasm, which is a liquid)/life processes happen inside cells/cells are living.
- A protist (algae). It has a chloroplast so could be a plant cell or a protist. It does not have a

cell wall so it cannot be a plant cell.

- They are long. They carry messages.
- a) A cell wall b) A nucleus, mitochondria.
- a) They both have a cell wall, cell membrane, cytoplasm, nucleus, mitochondria, ribosomes and a vacuole. b) The leaf cells have chloroplasts, but the root cells do not.
- $1 \text{ mm}/20 = 0.05 \text{ mm}$

Apply (page 27)

- No proteins will be made [1]. Cells need proteins to grow and repair itself [1], so without them the cell will not be able to carry out life processes. [1]
- a) Cell is sketched shorter and fatter [1]. b) When the muscle cells contract [1] the stomach will get smaller [1], which squeezes the food inside.
- The vacuoles in the plant stem cells have lost water [1], so there is less pressure pushing out on the cell walls [1]. This results in the stem cells going floppy [1].
- If a cell takes in too much water, it will swell up [1]. In an animal cell the cell membrane will burst [1]. A plant cell has a cell wall, which is strong and will not break [1].

Balanced & unbalanced

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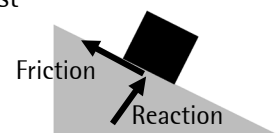
- a) False b) False
- Speeding things up, slowing things down, changing direction, changing shape.
- 3.



- The forward force keeps acting so it keeps changing the motion of the bike.
- a) Z b) Y c) X
- a) There is a force from the racket that changes its shape. b) The force from the racket also changes its direction.

Page 31

- a) Compression b) Lift c) Friction d) Reaction/normal contact
- a) Reaction/normal contact b) Air resistance c) Drag d) Upthrust
- 3.

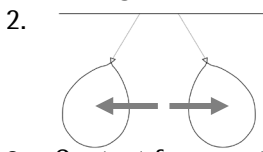


- They are caused by objects touching.

- The force would be bigger, because the surface will push back with more force.
- To increase friction and stop them from slipping. The chalk increases the roughness of their hands, so the bumps catch on each other and cause resistance.

Page 33

- a) Gravitational force (gravity) b) Electric force
c) Magnetic force



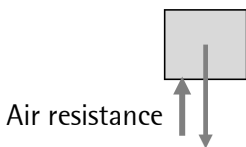
- Contact forces act when objects touch. Non-contact forces act even if objects aren't touching.

Force	Non-contact	It can repel	It can attract
Gravitational	✓	X	✓
Magnetic	✓	✓	✓

- The gravitational force from Earth is acting on it. That is what keeps it in orbit around Earth.
- Use a magnet. There is an attractive magnetic force between the magnet and the iron in the slime.

Page 35

- a) Newton (N) b) Newton meter
- a) $20\text{ N} - 10\text{ N} = 10\text{ N}$ to the right
b) $7\text{ N} - 5\text{ N} = 2\text{ N}$ downwards
-



- There is a net force of 50 N to the right.
- $110\text{ N} - 25\text{ N} = 85\text{ N}$
- a) Team B b) They increase friction.

Page 37

- a) Not moving b) Speed not changing
- When forces are balanced the opposite forces are the same size. When forces are unbalanced one force is bigger than the other.
- A goes at a steady speed. The arrows are the same length, so the forces on the ball are balanced and there is no net force. B speeds up. The forward arrow is longer than the backwards arrow, so the forces are unbalanced and there is a net force forwards.
- The total of the forward and backwards forces are the same so there is no net force.
Forward force (thrust): 4000 N .

Backwards forces: $3000\text{ N} + 500\text{ N} + 500\text{ N} = 4000\text{ N}$

- 850 N
- When the card is removed, there is a net force acting downwards. This happens because the gravitational force acting downwards is bigger than the air resistance acting up on the coin.

Friction

Page 39

- a) True b) True
- a) Increases b) No effect c) Decreases
- Diagram of a newton meter pulling a shoe along a surface.
- Bumps on the surfaces of the objects in contact catch against each other.
- a) e.g. brakes on a bike, shoes when rock-climbing. b) e.g. skiing, ice-skating.
- It will be a draw because the only thing that is different between the two blocks is the area in contact with the ramp, and area has no effect on friction.

Page 41

- The top speed of an object. It happens when the forces acting on it are balanced.
- a) Air resistance is caused by an object colliding with *air particles*. b) Increasing an object's area makes air resistance *increase*. c) Decreasing an object's speed makes air resistance *decrease*.
- Arrow pointing down labelled 'gravity/gravitational force'. Arrow pointing up labelled 'air resistance'. Both arrows are the same length.
- X, because the front of it has a larger surface area so it will collide with more air particles.
- a) T b) U c) R
- As you fall your speed increases (because gravity is acting on you). As your speed increases the air resistance acting on you also increases because the air particles hit you with more force. Eventually, air resistance balances gravity so your speed cannot increase any more. This is called terminal speed.

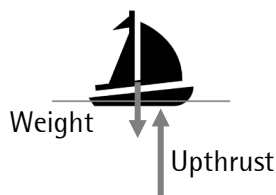
Page 43

- a) How much substance there is in an object.
b) How much space an object takes up.
c) The mass of 1 cm^3 of material.
- c)
- Brick (1.84 g/cm^3), graphene (2.3 g/cm^3), aluminium (2.7 g/cm^3), gold (19.3 g/cm^3)
- $3\text{ cm} \times 2\text{ cm} \times 8\text{ cm} = 48\text{ cm}^3$
- $50\text{ g} / 100\text{ cm}^3 = 0.5\text{ g/cm}^3$

6. They have different densities. The smaller block must have a higher density than the bigger block, so it has more mass for its volume.

Page 45

1. An object floats when its *weight* is equal to, or less than, the force of *upthrust* from the surrounding liquid.
2. a) Sinks b) Floats above c) Floats below
- 3.




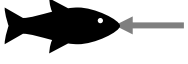
4. Their density is less than the surrounding water so the upthrust from the water supports the weight of the iceberg.
5. Put some water in a measuring cylinder and measure its volume. Add the marble into the water and measure the volume again. Find the difference between the two volumes. This is the volume of the marble.
6. They all have different densities. Milk has a lower density than honey, so it floats on it. Oil has a lower density than milk, so it floats on it.

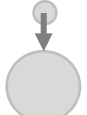

Mixed-up questions

Recall (Page 46)

1. a) True b) False c) False d) False e) False
2. a) Density = mass/volume b) g/cm^3 (or kg/m^3)
3. Newton meter. It measures forces (in newtons).
4. a) NC b) C c) C d) C e) NC f) C g) NC
5. a) Unbalanced b) Unbalanced c) Balanced
6. Its density is less than water (which is 1 g/cm^3)
7. a) Gravitational force (gravity) b) Friction
c) Magnetic force d) Lift e) Reaction/normal contact f) Compression
8. a) 40 N to the left b) 0 N c) 0.8 N downwards
d) 600 N to the left
9. a) Reaction/normal contact b) Air resistance
c) Gravitational force/gravity/weight
d) Upthrust
10. a) Balanced b) Unbalanced c) Unbalanced

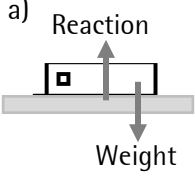
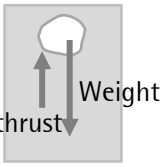
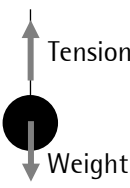
Describe & explain (page 47)

1. a) Speeding up (net force acting forwards)
b) Slowing down (net force acting backwards)
2. a)  b) 

3. a)  b) 

4. The bumps on each surface are more pushed together and so catch on each other more.
5. a) $8 \text{ cm} \times 3 \text{ cm} \times 5 \text{ cm} = 120 \text{ cm}^3$
b) $90/120 = 0.75 \text{ g/cm}^3$
6. a) X, because the forces on it are balanced so there is no net force causing it to speed up.
b) Z, because there is a net force acting forwards.
7. It collides with air particles with a large force, so they push back on it with a large force.
8. Floating in between the syrup and the milk. Its density is less than syrup, so will float on it. But its density is more than milk, so it will sink in it.

Apply (page 47)

1. a)  b)  c) 
2. Air particles will start to hit it and push back on it with a force (called air resistance) [1], which is greater than the force of gravity pulling it down [1]. So, there is now a net force acting backwards [1].
3. Volume of the car: $60 \text{ cm}^3 - 25 \text{ cm}^3 = 35 \text{ cm}^3$
[1] Density = $66.5 \text{ g}/35 \text{ cm}^3$ [1] = 1.9 g/cm^3 [1].
4. Diagram shows potato sinking [1], ice cube and cork on top of the water [1], wood floating just under the surface [1].

Particle model

Page 49

1. a) Solid b) Liquid c) Gas
2. Gas
3. Orange gas will start to come out of the bottle and fill the room.

State	Does it have a fixed shape?	Can objects move through it?	Can it be squashed?
Gas	X	✓	✓
Liquid	X	✓	X
Solid	✓	X	X

5. A sponge is a solid because it has a fixed shape and you can hold it. You can squash it because it has air inside, which is a gas.
6. Solid and liquid. Solid because it is hard if you hit it and liquid because it flows if you press gently.

Page 51

1. a) We model particles as solid spheres
b) Particles can move c) Everything is made of particles
2. Acharya Kanad – materials are made up of particles – it is the smallest bit of the material that can exist. Epicurus – air contains moving particles that we can't see. John Dalton – Particles are like balls. Each substance is made up of one type of particle. Robert Brown – pollen grains move on water. Albert Einstein – pollen grains move because they are being hit by water particles. Albert Crewe – I can see particles using an electron microscope.
3. Everything is made up of particles. We can imagine particles as being tiny solid spheres. Particles are always moving.
4. Arrows are pointing in all different directions. Arrows are all different lengths.
5. No, living things are made of particles because cells are made of particles.
6. Lots of particles moving around in different directions at different speeds.

Page 53

1. b) They sometimes hit each other.
2. Particles are spread out throughout the square. An arrow coming from each particle pointing in different directions and different lengths (to show movement).
3. a) They are spaced far apart b) They are moving quickly in all directions.
4. The particles are moving fast in all directions, so they quickly spread out.
5. Gases can be compressed because there is space in between the particles.
6. The gas will diffuse. The particles can move quickly. They bounce off each other and the objects in the room. This movement takes them to all parts of the room.

Page 55

1. c) They are touching.
2. Particles are close together with small gaps in between some. An arrow coming from each particle pointing in different directions and different lengths (to show movement). The arrows are shorter than the ones for the gas (page 53 Q2).
3. a) They are touching with some empty space in between. b) They are moving slowly past each other.
4. a) Liquids can be poured because *electric forces keep the particles together*. b) Liquids are hard to compress because *they are all*

touching with not much space in between.

- c) Diffusion happens slowly in liquids because *the particles are moving slowly*.
5. The same: they are moving in different directions and at different speeds. Different: In a gas the particles are far apart, in a liquid they are touching. In a liquid there are attractive electric forces between the particles, in a gas there aren't.
6. The smaller water particles fill the gaps in between the larger alcohol particles.

Page 57

1. a) They are close together. b) They move.
2. Particles are close together. Arrows inside each particle show they are moving back and forth (vibrating).
3. a) They are close with very little space between them. b) They cannot move around – only vibrate.
4. a) Solids have a fixed shape because *the particles cannot move past each other*.
b) Solids cannot be compressed because *there is no space in between the particles*.
5. The particles cannot move past each other.
6. a) Sand is a solid, so if the grains are close together, they cannot be compressed. Also, the grains have a fixed shape that do not change when the elephant steps on them. b) If the grains are separate, they can move past each other.

Page 59

1. X – Sublimation Y – Melting Z – Freezing
2. Solid
3. The marbles start to move away from each other, just like particles in a solid do when a solid melts.
4. Sublimation – the iodine is changing from a solid directly into a gas.
5. The liquid is cooled, and the particles move less and less. At the melting point, liquid particles cannot move around and become locked in position. Particles are now vibrating – the liquid has frozen into a solid.
6. The air temperature has increased to a temperature above the melting point of ice (0°C). So, the ice in the glacier has melted to form liquid water.

Page 61

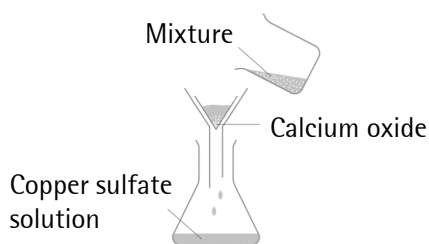
1. a) Boiling b) Evaporating/evaporation
c) Condensing/condensation
2. Shake them enough so the marbles are moving around the jar.

- It evaporated. Particles at the surface of the perfume were moving faster than the rest and managed to break away from the liquid as a gas. This continued to happen until all the perfume had become a gas.
- The particles start to move around more. At 100°C, the water boils. The particles are moving so much they can overcome the electric forces holding them together. The particles break free from each other and form a gas.
- The gas is cooled and the particles move less quickly. At the boiling point, liquid particles are moving slowly enough that they come together. The particles are now very close – the gas has condensed into a liquid.
- a) Evaporating/evaporation b) Heat from your skin moves to the hand sanitiser particles, which causes them to move more. They manage to break away from each other and move away from your skin as a gas.

Mixtures

Page 63

- Seawater, air, lemonade.
- Mixtures are made up of *any combination of solids, liquids, and gases*. Separating a mixture means *unmixing so you end up with individual substances*.
- a) Sieving b) Filtering/filtration
c) Evaporating/evaporation
-



- a) Both orange juice and lemonade contain water, so if you evaporate the mixture, you will just remove the water from both of them.
b) Salt dissolves in water so it will just go through the filter paper with the water.
- Use sieving. If she uses a sieve where the holes are bigger than the salt grains but smaller than the rice grains the salt will go through the sieve and leave the rice behind. Or, she could add water to the rice to dissolve the salt and then use filtration. The salt water will go through the filter paper, leaving the rice behind.

Page 65

- a) True b) False

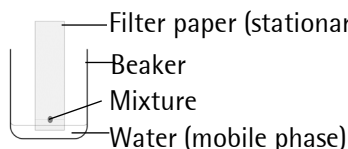
- Dissolve – add water to dissolve the soluble solid. Filter – to remove the insoluble solid. Evaporate – to remove the water so you are left with the soluble solid.
- Picture shows an evaporating dish full of potassium permanganate being heated. The water particles leave, leaving behind the potassium permanganate particles.
- A mixture contains two or more different substances. A pure substance is just one individual substance.
- Large clumps of particles are too big to pass through the holes in the filter paper, but small particles (like water and dissolved substances) are small enough to go through the holes.
- Add water to dissolve the salt. Filter the mixture to remove the sand. Evaporate the mixture to remove the water. You will be left with pure salt.

Page 67

- Their boiling point.
- Q – Thermometer R – Condenser S – Boiling flask T – Collecting flask U – Bunsen burner
- Selective boiling – S – To boil one of the substances in the mixture so it forms a gas and leaves the boiling flask. Condensation – R – To cool the substance so it turns into a liquid and can be collected in the collecting flask.
- If she uses evaporation the water would evaporate into the air and be lost. If she uses distillation, she can collect the water.
- At temperatures above 106°C substance A will boil and can be collected in the collecting flask leaving flask B behind in the boiling flask. If she lets the temperature get to 117°C then substance B will also start to boil and enter the collecting flask, and the mixture will not be separated.
- Put the urine into the boiling flask of the distillation equipment. Heat the mixture until it reaches a temperature of 100°C. At this temperature the water will boil, the vapour will move into the condenser and condense to form pure liquid water. It will collect in the collecting flask. The other substances will stay in the boiling flask.

Page 69

- Dyes in paint, food dyes in a fizzy drink.
- To separate coloured dyes in a mixture.
-



- It contains three different dyes (red, blue and yellow). It contains the most red dye.
- They are attracted to the filter paper by different amounts. Some dyes are more attracted to the paper, so they move up slowly. Other dyes are less attracted to the paper, so they are pulled up more quickly.
- Use chromatography on the food colouring. Measure the R_f values of each of the dyes. Check to see if any have a R_f value of 0.3.

Solutions

Page 71

- a) Salt b) Alcohol
- The maximum mass of a solute that dissolves in 100 cm^3 of solvent.
- Diagram shows individual sweet particles breaking off and filling the spaces in between the water particles.
- Work out the maximum mass of each solid that will dissolve in a certain volume of water. The one that you can dissolve the most has the highest solubility.
- $32 \text{ g} \times 2 = 64 \text{ g}$.
- a) They are soluble in acetone, so are forming a solution. b) Eventually you will make a saturated solution, when no more packing peanuts will dissolve.

Page 73



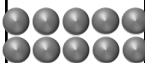
- a) False (it dissolves) b) False c) True
- a) As the temperature of water increases, the solubility of most solids *increases*. b) As the temperature of water increases, the solubility of gases *decreases*.
- 0.15 g
- C. Because as the temperature increases, its solubility decreases.
- At this temperature they have the same solubility, so the maximum mass of solute that will dissolve in 100 cm^3 of water is the same.
- In the summer, the temperature of the water increases. This reduces the solubility of oxygen in the water, so there is less oxygen dissolved in it. Fish do not have enough oxygen, so they swim to the surface, where there is normally more.

Mixed-up questions

Recall (page 74)

- a) False b) True c) False d) False e) False f) False
- a) T b) S c) R d) U
- Diffusion
- 1D 2C 3A 4B

- a) Carbon dioxide dissolves in water to form a *solution*. b) Carbon dioxide is a *solute* that dissolves in water. c) Water is a *solvent* that dissolves carbon dioxide.

State	Particle diagram	Arrangement of particles	Movement of particles
Gas		Lots of spaces in between	Moving quickly in all directions
Liquid		Touching but with spaces in between	Slowly moving past each other
Solid		Touching with very little spaces in between	Cannot move around, only vibrate

- a) Mixture b) Pure c) Mixture d) Pure e) Pure f) Mixture
- Put a dot of mixture onto the filter paper. Put the filter paper into the solvent. Wait for the solvent to rise up the filter paper. Calculate the R_f values.
- a) Melting b) Freezing c) Evaporating/evaporation d) Condensing/condensation e) Sublimation
- Solvent* particles are constantly moving around. The *solvent* particles bump into the *solute* particles. The *solute* particles break apart. They spread out in between the *solvent* particles.

Describe & explain (page 75)

- There are large spaces in between the particles in a gas, so when the gas is compressed, the particles can move into the spaces. There is very little space between the particles in a solid and liquid.
- 60-70 g
- a) 35 g b) 140 g
- a) 3 b) Blue
- a) Jelly is a solid because it has a fixed shape. b) Each grain of flour is a solid (although flour can be poured like a liquid)
- Z, Y, X
- Nail polish is insoluble in water so it will not dissolve, but it is soluble in acetone so will dissolve to form a solution.
- $5/10 = 0.5$

Apply (page 75)

- First filter, to remove the sand [1]. Then use

distillation to separate the salt and water. Heat the salt solution to 100°C so the water boils, turns into a gas and condenses in the condenser [1]. Pure water will collect in the collecting flask and pure salt will be left in the boiling flask. [1]

- In the second diagram there are the same number of particles [1] but arrows coming from them are longer in the second diagram [1] and pointing in all different directions [1].
- a) Liquid b) Solid c) Gas
- Sugar is less soluble at 20°C [1] so less sugar can dissolve to form a saturated solution [1]. This means that some of the sugar that was dissolved in the water at 80°C comes out of solution [1].

Sexual & asexual

Page 77

- a) False b) True c) True
- Producing new versions of an organism.
- To replace organisms that die.
- a) Any one from: The adult organism reproduces, offspring are formed. b) Any one from: In animals a baby is formed, in plants a seed is formed, germination is a stage in plant reproduction but not in animal reproduction.
- Student's own answer.
- The fish in the water eat the mosquito larva, so they cannot grow into adults and reproduce. This stops the life cycle.

Page 79

- a) True b) False c) True
- One parent, Offspring have the same DNA as the parent, Offspring are identical to each other.
- U, R, S, T
- Student's own answer.
- Sexual reproduction. Egg and sperm will meet and fertilisation happens.
- Starfish use asexual reproduction, where a part of one starfish can grow to form a whole new organism. So, cutting up the starfish produced lots of bits of starfish that each grew into a new organism.

Page 81

- a) Testes b) Vagina c) Uterus
- Sperm are released from the testes. Sperm travel along the sperm tubes. Sperm are mixed with a sugary liquid. Semen travels along the urethra.
- Fertilisation-B, Embryo settles into the lining-C, Sperm are released-D, Egg is released-A

- Man: Testes – make sperm. Sperm tubes – carries sperm to the penis. Glands – make a sugary liquid to mix with sperm to form semen. Urethra – carries sperm out of the penis. Penis – transfers semen into the woman. Woman: Vagina – where sperm is placed. Ovaries – releases eggs. Oviduct – where fertilisation happens, carries embryo to the uterus. Uterus – where embryo develops into a baby.
- Both eggs could be fertilised to form two embryos.
- The sperm cannot reach an egg to fertilise it.

Page 83

- In a plant, the male gamete is called *pollen*. This is made in the *anther* (stamen). The female gamete is called the *egg*. It is found inside the *ovary*.
- Pollination – transfer of pollen from anther to stigma. Fertilisation – joining of pollen and egg nucleus to form a seed. Seed dispersal – movement of seeds away from the parent plant so parent and offspring do not have to share water and light.
- Student's own diagram.
- During pollination to carry pollen from anther to stigma. For seed dispersal, to carry seeds away from the parent plant.
- It catches the pollen so the pollen can grow a tube and the nucleus can move down into the ovary to fertilise the egg.
- It helps with pollination. The bee thinks the flower is a female bee so tries to mate with it and gets covered in pollen. It then moves to another flower and tries to mate with it. The pollen on its body goes onto the stigma of the other flower.

Page 85

- a) The breakdown of the uterus lining, which produces blood that leaves the body from the vagina. b) The release of an egg from an ovary.
-

Days	Event	Why it happens then
1-5	<i>Menstruation</i>	To remove old lining
6-13	Lining grows back	<i>So an embryo can attach to it</i>
14	<i>Ovulation</i>	<i>So a sperm can fertilise the egg</i>
10-15	Fertilisation could happen	<i>Both egg and sperm in the oviduct</i>
14-28	Lining thickens	So the embryo can settle in and grow

- Day 6. The lining has been lost during menstruation.
- To prepare the uterus to receive an embryo, so it can grow into a baby.
- The lining has not broken down because an embryo has attached to it.
- June 10th – June 15th. This is day 10-15 so having sex then will result in live sperm and egg being in the oviduct at the same time.

Page 87

- a) A foetus gets oxygen from its mother through its umbilical cord. b) All a foetus' features are fully developed. c) Food passes from the mother to the foetus/Waste passes from the foetus to the mother.
- X – oxygen/food Y – waste/carbon dioxide
- a) The amniotic fluid is like a cushion because *it cushions the foetus against bumps and knocks*. b) The placenta is like a sieve because *it has tiny gaps which only allows some substances to pass through*. c) The umbilical cord is like a road because *it carries substances between the mother and foetus*.
- It gets oxygen and food from its mother. The oxygen and food in the mother's blood moves into the foetus' blood in the placenta. It then travels down the umbilical cord to the foetus. The foetus produces waste, which travels along the umbilical cord to the placenta, where it passes into the mother's blood.
- Harmful substances in the smoke enter her blood e.g. nicotine and can then cross the placenta into the foetus' blood.
- a) They supply food and oxygen to the lamb (they act like the umbilical cord). b) It protects the lamb against bumps and also gives it space to move its limbs, so its muscles and bones develop.

Mixed-up questions

Recall (page 88)

- a) True b) True c) False d) False e) False f) False g) True
- a) Placenta b) Umbilical cord c) Amniotic fluid
- a) Sexual b) Asexual c) Asexual d) Asexual e) Asexual f) Sexual g) Sexual
- a) During pollination, pollen moves from the anther to the *stigma*. b) During *fertilisation*, the nuclei from the egg and pollen join. c) During *seed dispersal*, seeds move away from the parent plant.
- Alcohol, food, oxygen – mother to foetus.
Red blood cells – does not cross the placenta.
Waste – foetus to mother.

- a) 5 b) 4 c) 2 d) 6 e) 7 f) 1 g) 3
- Plant: Female – egg, Male – pollen
Animal: Female: egg, Male – sperm
- a) Male b) Female c) Male d) Female e) Female
- Menstruation
- a) Egg b) Sperm c) Fertilisation d) Zygote e) Offspring

Describe & explain (page 89)

- The embryo attaches to it so it can grow.
- The tube grows down from the stigma to the ovary (through the style). The nucleus of the pollen grain travels down the tube to reach the egg, so fertilisation can occur.
- a) It allows food and oxygen to move from the mother's blood to the foetus', and waste to move in the opposite direction. b) It is filled with blood vessels and takes food and oxygen to the foetus and returns waste to the mother.
- They have a mix of DNA from both parents. The mother's DNA is in the egg nucleus. The father's DNA is in the sperm nucleus. The nuclei join during fertilisation to form a zygote, which grows into a baby.
- An egg is released from the ovary. The egg travels down the oviduct and fertilisation takes place. The zygote grows into a ball of cells called an embryo. The embryo settles into the uterus lining.
- So they can travel through the woman's reproductive organs to reach the egg in the oviduct and fertilise it.
- Asexual reproduction. There is only one parent.
- 1C 2D 3A 4B

Apply (page 89)

- No egg is released from the ovary [1] into the oviduct. With no egg fertilisation cannot take place [1] so no zygote is formed [1].
- So at least one finds the egg [1] and fertilises it [1]. It is a long journey from where the sperm enter the woman (vagina) to where the egg is (oviduct) so not all sperm will make it [1].
- No [1] because there will not be an egg in the oviduct [1] for the sperm to fertilise [1].
- It disperses the seeds [1] so the offspring grow away from the parent plant [1] so they don't have to share water, light, minerals [1].

Chemical & physical

Page 91

- a) False b) True c) True
- E.g. Reversible changes are easy to reverse and irreversible changes are hard to reverse.

- a) Irreversible b) Reversible c) Reversible
d) Reversible e) Irreversible
- Diagram shows water and steam. Arrow pointing from water to steam, and one in the other direction.
- Melt the necklace so it is a liquid then cool it into a ring shape to form a solid metal ring.
- a) Reversible b) Irreversible c) It is an irreversible change, so the plastic has changed into new substances/it is not plastic anymore.

Page 93

- a) False b) False c) True
- A change when only the appearance of a substance changes/no new substances are made.
- Change in state e.g. *Melting metal, water vapour condensing*. Making a mixture e.g. *Adding metal powder to water. Dissolving – Mixing salt and water*.
- Liquid wax is the same substance as solid wax.
- Shape, size, colour, state of matter.
- The substance (instant snow) does not change, just the form it takes.

Page 95

- During a chemical change *new substances* are made.
- Fizzing, colour change, heat or light, a solid forming in a solution (precipitate).
- Fizzing – *a gas has formed – e.g. adding sodium bicarbonate to vinegar. Colour change – The new substance has a different colour – e.g. rusting. Heat or light – a chemical change sometimes releases heat or light – Burning wood*.
- If a chemical change happened e.g. *Yes, because there are two signs of a chemical change – fizzing and heat being given out. How sure e.g. I cannot be very sure because there are only two pieces of evidence/I am very sure because there are two pieces of evidence out of a possible four*.
- a) Drawing shows a solid has formed (and sunk to the bottom of the tube). b) A precipitate must be a new substance, so this is evidence that a chemical change has happened.
- A chemical change happens and a new yellow substance forms.

Acids & alkalis

Page 97

- a) e.g. citric acid/acetic acid/sulfuric acid/hydrochloric acid
b) e.g. sodium hydroxide/bicarbonate of soda

2.

Substance	pH	What this means
Bleach	13	It is very alkaline
Stomach acid	1	It is very acidic
Pure water	7	It is neutral
Coffee	5	It is slightly acidic
Seawater	8	It is slightly alkaline

- It shows how acidic or alkaline a solution is as a number from 0 to 14.
- Diagram has an equal number of H and OH particles.
- a) Nothing, because the liquid is acidic. Red litmus paper only changes colour when added to an alkali. b) It would go red. Blue litmus paper turns red in an acid.
- Each glass contains a small amount of different pH solutions. The teapot contains red cabbage indicator. When the indicator is poured into the solutions, it changes colour. To get a red colour you use an acidic solution, to get purple you use a neutral solution (or nothing at all), to get blue you use an alkaline solution.

Page 99

- If you mix the right volumes of acid and *alkali* together you make a *neutral* solution. This is a chemical change called *neutralisation*.
-

Substance	Colour with universal indicator	pH
Sodium hydroxide	<i>Purple</i>	14
Pure water	<i>Green</i>	7
Citric acid	<i>Orange</i>	2/3
Hydrochloric acid	<i>Red</i>	1
Toothpaste	<i>Blue</i>	9

- The solution is getting less acidic, because you are adding hydroxide particles.
- Any acidic substance e.g. lemon juice, vinegar.
- Add some acid until the solution turns green.
- It is an alkaline solution. It neutralises the acidic ant venom, so it is no longer harmful.

Mixed-up questions

Recall (page 100)

- a) False b) False c) False d) True
- a) Acidic b) Neutral c) Alkaline d) Indicator
- Cutting up an apple.

- a) Alkaline b) Acidic c) Alkaline d) Alkaline
e) Acidic f) Neutral
- a) Magnesium b) Magnesium oxide c) Light is given out, a colour change (from grey to white)
- An alkaline solution
- a) Physical b) Chemical c) Physical
d) Chemical e) Chemical f) Chemical
g) Physical

8.

Solution	Colour in UI	pH	What the solution is
A	Red	0-1	<i>Very acidic</i>
B	<i>Yellow</i>	4	<i>Slightly acidic</i>
C	Purple	13-14	<i>Very alkaline</i>
D	<i>Green</i>	7	Neutral

- a) X b) Z c) Y
- It is alkaline.

Describe & explain (page 101)

- It went cloudy because a precipitate (a solid) formed. The precipitate is a new substance, so this is evidence for a chemical change.
- a) 14 b) 9
- a) Light is given out. This is evidence for a chemical change. b) This is only one piece of evidence; more are needed before we can be sure it is a chemical change. Some physical changes also give out light.
- Her soil is slightly acidic so she should add alkali to the soil to neutralise it.
- The wax particles do not change. Instead, the amount of energy they have/their movement changes because it is a physical change.
- It decreases, because you are adding hydrogen particles. This makes the mixture acidic.
- The pH starts at 5 (slightly acidic). Over time it increases to 7.5 (very slightly alkaline).
- Red cabbage water only shows if a solution is acidic, alkaline or neutral. It changes to red in acids and blue in alkalis. Universal indicator goes a different colour in each pH.

Apply (page 101)

- Physical [1]. No new substance has formed [1] because the colour changes back again [1].
- a) Red [1] b) Add some acid [1]. He knows when it is neutral because the colour will be green [1].
- a) It goes blue [1] b) Yes [1] because there is a colour change, colour change is evidence for a chemical reaction [1].
- a) The pH is between 5 and 14 [1]

- Bromothymol blue [1]. It is the only indicator that goes a different colour at pH 7 (green) [1].

Energy transfer

Page 103

- a) True b) True c) False
- a) The unit of energy is the *joule*. b) A good source of energy is *bread*. c) You need the most energy while *running*.
- a) The food he eats. b) To move his muscles.
- Zumba: $1000/25 = 40$ minutes.
Water aerobics: $1000/20 = 50$ minutes.
Yoga: $1000/10 = 100$ minutes.
- $1600/2 = 800$ kJ
- $400/40 = 10$ minutes

Page 105

- There are lots of different energy stores.
- a) Thermal b) Elastic c) Chemical
d) Gravitational e) Kinetic
- E.g. it lets you buy things, like energy lets you do things. The more money you have, the more you can buy, like the more energy you have the more you can do. Money can be stored in different ways like energy.
- Relaxed elastic band bar is lower than stretched elastic band bar. New battery bar is higher than flat battery bar.
- a) Lift up the book b) Charge the battery
c) Heat the bread d) Throw the paper plane
- The spring stores energy in its elastic store when it is compressed. This energy is released when the spring is relaxed, which makes you jump high.

Page 107

- Energy moves from one *store* to another. This is called energy *transfer*. The amount of energy is *conserved*. This means the amount does not *change*.
- a) Chemical → Kinetic/thermal/gravitational
b) Kinetic → Elastic
c) Chemical → Thermal/kinetic
- a) Full energy bar labelled 'gravitational store'.
Empty energy bar labelled 'kinetic store'.
b) Full energy bar labelled 'kinetic store'.
Empty energy bar labelled 'gravitational store'.
- Student's own response.
- a) Gravitational → Kinetic.
b) The total amount of energy at the start of the transfer cannot be more than the total amount at the end – energy is conserved. So, the yo-yo cannot have more energy in its gravitational store than it did originally.

- It is not possible for the car to gain energy, because energy is conserved. So, the car will not have enough energy in its kinetic store to transfer to its gravitational store in order to reach the top of the second loop because it is higher than the first.

Wasted energy

Page 109

- In all energy transfers, some energy is wasted.
- c) Energy in the chemical store moves to the thermal store.
- How input energy splits into useful and wasted energy.
- Input – Chemical store, Useful output – Sound pathway, Wasted output – Thermal store.
- a) Chemical → Kinetic b) Sound and thermal
- The input energy is kinetic. The useful output is kinetic (to keep the machine moving) but each time a ball moves it rubs against the machine energy is wasted going to the thermal store. Eventually all the input energy in the kinetic store will have been transferred to the thermal store of the machine and the air. So, the machine will stop moving.

Page 111

- 50%
- Y, because more of the input energy is going to the useful energy store.
- Efficiency is the percentage of input energy that is transferred to a useful store.
- $(50 \text{ J} + 150 \text{ J}) / 250 \text{ J} = 0.8$. $0.8 \times 100 = 80\%$
- A, because the useful output is the kinetic store. Fan A has the most energy going to the kinetic store.
- It is more efficient, so needs less input energy for the same amount of useful energy output.

Heat & temperature

Page 113

- When there is no difference between the temperature of an object and the air. No heat passes between them.
- a) Energy flows as *heat* from objects with a *higher* temperature to objects with a *lower* temperature. b) The greater the *difference* in temperature, the *faster* a warmer object cools down.
- The rule for heating says that the cooler an object is compared to the air around it, the faster it warms up. So, the ice cream is much cooler than the air in the hot garden compared to the air in the cool kitchen.
- A

- It is steeper in section A because the temperature is falling quickly. This is because the object starts much hotter than the air around it. It is shallower in section B because the temperature is falling slowly. This is because the object is not much hotter than the air.
- Add the milk after waiting two minutes. The hotter the tea, the quicker it will cool down. Adding milk will cool the tea down so it is best to wait until adding it.

Page 115

- Ben. A hot object has a lot of energy in its *thermal* store.
- Thermal energy store is the total amount of energy in all the particles. Temperature is the average energy of the particles.
- Each particle has an arrow coming out of it. All arrows are pointing in different directions. The average length of the arrows in the second box is longer.
- The particles in the hair straighteners have more energy than the particles in the cooler hair. Hair straightener particles bump into hair particles and pass on their extra energy.
- a) The same, because they came out of the same fridge. b) Different, because they are different sizes. The larger pot stores more energy in its thermal store.
- The iceberg is much larger, so has more particles. This means that the total energy of the particles is bigger than the total energy of the particles in the sparkler.

Mixed-up questions

Recall (page 116)

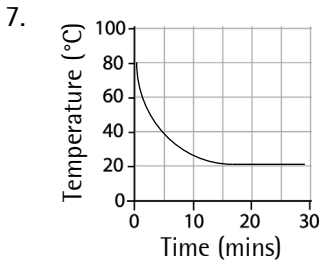
- 1D 2A 3E 4C 5B
- $1514 \text{ kJ} / 2 = 757 \text{ kJ}$
- Energy can't be created or destroyed
- Speed of the particles, energy of the particles, the distance between the particles.
- a) Chemical b) Elastic
- 120 J
- a) Arrow going into the ice-cream. b) Arrow coming out of the pizza.
- Z
- Chemical, Electric, Sound, Light (and Sound), Thermal.
- a) Light b) Electrical c) Heat d) Sound

Describe & explain (page 117)

- The swimming pool of water because it contains most particles.
- Energy out = $40 \text{ kJ} \times 60 \text{ minutes} = 2400 \text{ kJ}$

2400 kJ / 400 kJ = 6 cartons

- Rubber band. It is an elastic store; all the others are chemical stores.
- a) Thermal b) Heat
- Chemical → Thermal
- The total output energy is higher than the input energy. This is impossible because energy cannot be created.



- 80 J / 200 J = 0.4 0.4 x 100 = 40%

Apply (page 117)

- a) 350 kJ [1] b) 350 kJ [1] Half-way down the slope, half of the energy in her gravitational store will have transferred to her kinetic store.
- a) Tea A is hotter than tea B so the temperature difference between the tea and the air is greater, so it will cool down more quickly [1].
b) As they cool down the temperature difference between the tea and the air decreases, so they cool down more slowly [1].
c) They have reached the same temperature as the air (thermal equilibrium), so heat stops moving and the temperature stops decreasing [1].
- B [1]. It has a greater thermal energy store [1] because it contains more water, so more particles [1].
- Useful energy = 150 J - 75 J - 60 J = 15 J [1]
(15/150) x 100 [1] = 15% [1]

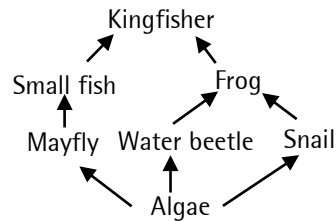
Feeding relationships

Page 119

- The direction nutrients move in when they go from one organism to the next by eating.
- Acacia trees
- a) Mango b) Fruit fly/thrush/eagle
c) Thrush/eagle d) Fruit fly/thrush
- Algae → Tadpole → Perch → Otter
- Grasshoppers eat corn, rats eat grasshoppers, pythons eat rats.
- a) Grass → Rabbit → Buzzard b) Building houses on the fields will decrease the amount of grass, so there is less food for rabbits. Some rabbits will die. With fewer rabbits to eat, there is less food for the buzzards so some of the buzzards will die.

Page 121

- False
- a) Seagull b) Plankton
c) Seal/squid/penguin/blue whale d) Seal
- A change in the population of one organism affects the population of others.
-



- The population of foxes increases. With more plants to eat, the population of rabbits will increase. With more rabbits to eat, the population of foxes will increase.
- If the population of sharks decreases then there will be fewer sharks to eat the cuttlefish, groupers and octopuses so their population will increase. With more of these organisms the population of their prey – shrimp and crabs will decrease. With fewer shrimps and crabs to eat the algae, there will be more algae.

Competition

Page 123

- Oxygen, water, food, heat
- a) Organisms need resources to *live and reproduce*. b) Organisms get resources from *their environment/surroundings*.
- Light – as an energy source for photosynthesis. Water – to make food in photosynthesis (also to fill the cell vacuole and keep the cells rigid so the plant stays upright). Carbon dioxide – to combine with water to make food in photosynthesis. Oxygen – for respiration to release energy from food. Heat – to keep their cells at the right temperature. Pollinators – for reproduction. Minerals – to make new cells.
- They need light to carry out photosynthesis and make food. Plants need food to grow because it is an energy source, plus it supplies the building blocks to build new cells.

Resource	Animal	Plant
Water	✓	✓
Carbon dioxide	X	✓
Oxygen	✓	✓
Food	✓	X
Light	X	✓
Heat	✓	✓

- In the desert there is not much water, so the beetle collects it from the fog (the water droplets run down its back into its mouth.) The beetle needs water for life processes.

Page 125

- a) False b) True c) True
- E.g. Food – Lions and hyenas fight for the same prey. Shelter – Hermit crabs steal a bigger shell from another crab. Mate – A bird performs an elaborate display with its body to attract a female. The most attractive bird wins a mate.
- a) They compete for a chair, like organisms compete for resources. b) The number of chairs are limited – there aren't enough chairs for every player. This is like when resources are limited – there are not enough resources for every organism.
- Organisms compete for resources if there are not enough for all the organisms – the resources are limited.
- c). If there is a high population of prey then this resource is not limited, so the lions and hyenas do not need to compete for food.
- It does not want to have to compete for resources with the other tiger.

Biotic & abiotic

Page 127

- The combination of all the biotic and abiotic factors in an area. E.g. pond, garden, field.
- Biotic factors are to do with living things. Abiotic factors are to do with non-living things.
- Amount of food – Biotic. Disease – Biotic. Pollution – Abiotic.
- a) Amount of food.
b) Sunlight/minerals (in soil)/wind/carbon dioxide/rainfall. c) Oxygen, pH, pollution.
- Some animals will not have enough oxygen. Their cells will not be able to respire and release energy so they will die.
- Global warming increases the temperature of the ocean and fish move away to cooler seas. This decreases the amount of food for the penguins, so their population will decrease. Also, higher temperatures melts the sea ice, so penguins have less space to live on. With less space, they will reproduce less.

Mixed-up questions

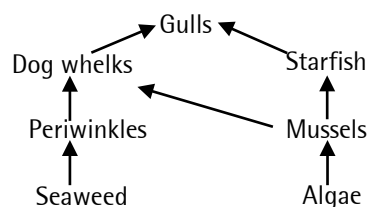
Recall (page 128)

- a) e.g. temperature/oxygen/sunlight/pH of water/pH of soil/wind/minerals in the soil.
b) e.g. amount of food/predator numbers/competition/disease.

- Bacteria
- a) Algae → Fish → Human
b) Grass → Mouse → Owl
- a) False b) True c) False d) True e) True
- a) Blueberry bush b) Rabbit/Deer/Black bear
c) Black bear/Owl/Red fox d) Red fox and rabbit/Owl and rabbit/Black bear and rabbit
- a) Environment b) Ecosystem c) Resources
d) Competition
- Light, carbon dioxide, water
- Light
- It would decrease
- 1C 2D 3B 4A

Describe & explain (page 117)

- The direction nutrients and energy move between organisms.
- A mate. Oxygen and food are not limited resources.



- Penguins compete for food.
- a) Fox b) Decrease. With fewer rabbits to eat foxes will eat more hedgehogs.
- a) More sunlight/carbon dioxide/ /minerals/warmer temperature. b) More animals that eat it/disease/competition.
- They all affect each other e.g. a change in the population of one organism affects another.
- a) R b) U

Apply (page 117)





- It can't get enough light for photosynthesis, so can't make food for growth/it is being outcompeted by the tree for minerals and water so it can't build enough cells for growth.
- Bees are pollinators. They carry pollen from the stamen to the stigma on plants so they can reproduce. With fewer bees, plants are unable to reproduce.
- Decomposers (fungi and bacteria) in the soil cause the decay of fallen leaves and fruits and release minerals into the soil. The tree absorbs the minerals through its roots.
- Kelp is at the bottom of the food chain (it's a producer), so its removal means that primary consumers (sea urchins and small fish) have less food to eat so their population decreases. With fewer animals to eat, the population of animals further up the food web – large crabs and sea otters will also decrease.

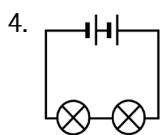
Electric current

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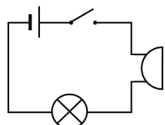
1. a) Circuit b) Buzzer c) Battery d) Wires
2. It is not a complete circuit/there is a gap in the circuit.

3.




Name	Symbol	Function
Bulb		Lights up
Switch		Starts and stops electricity
Battery		Provides the force to move electricity
Wire		Connects different parts of a circuit



5. Add another battery.
6. Battery, switch, bulb and buzzer in a circuit e.g.

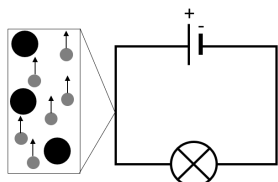


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1. The flow of electricity around a circuit.
 2. a) False b) True c) False
 3. a) Ammeter b) Battery c) Bulb
- 


4. So the current is pushed around in one direction.
 5. A3, because the circuit has two batteries.
 6. Holding the ends forms a complete circuit. Current flows along the wire, through the bulbs (lighting them up), through your body and back to the start. The battery pushes the current around.

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1. a) Electrons b) Battery c) Negative, positive
2. a) Electrons move at the same speed everywhere in a circuit. b) The higher the voltage, the stronger the push on the electrons.
3. They start moving (all at the same speed).
- 4.



5. The electrons stop moving.

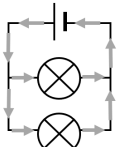
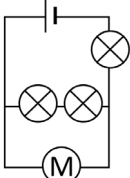
6. They both light at the same time. When the switch is closed, the electrons in the wire all start moving together.

Resistance

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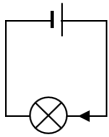
1. a) True b) False
2. Resistance, electrons/current, current, double.
3. Circuit drawn with another device in it e.g. another motor or a bulb.
4. When a device pushes back against the force of the battery.
5. B
6. When the suspect sweats it lowers the resistance in the circuit. A lower resistance means a higher current, so the bulb lights up.

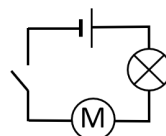
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1. B and C
 - 2.
- 
3. In a series circuit all the devices are in the same loop. In a parallel circuit the devices are on different loops.
 - 4.
- 
5. $1.2\text{ A} + 0.8\text{ A} = 2.0\text{ A}$
 6. The current can still flow through the other loops in the circuit. A gap in one of the parallel loops does not stop the current flowing through the others.

Mixed-up questions

Recall (page 140)

1. a) True b) True c) False d) False e) True f) False
 2. 1C 2E 3F 4A 5D 6B
 3. Current, Amps, Voltage
 - 4.
- 
5. a) Series b) Parallel c) Parallel d) Series
 - 6.



7. X
8. a) Motor b) Switch c) Battery d) Ammeter
e) Wires
9. a) Conductor b) Conductor c) Insulator
d) Insulator
10. Adding a third bulb.

Describe & explain (page 141)

1. a) The hands moving the rope around. b) Move the rope around more quickly.
2. No, current is the same everywhere in a series circuit.
3. Battery. This is a power source, the others are devices.
4. a) One person grips onto the rope to slow it down. b) Get another pair of hands to grip the rope.
5. a) It will double. b) It will get brighter.
6. a) Y b) Y
7. The bulb adds resistance, which decreases current. With less current the buzzer will be quieter.
8. a) It increases the force/push on the electrons, so they move faster. b) It increases the resistance in the circuit, which slows down all the electrons in the circuit.

Apply (page 141)

1. a) 1.5 A b) 0.75 A c) 0.75 A
2. $A_1 = 1.0 \text{ A}$ $A_2 = 1.0 \text{ A}$ $A_3 = 2.0 \text{ A}$ $A_4 = 2.0 \text{ A}$
 $A_5 = 1.0 \text{ A}$
3. $A_1 = 4.0 \text{ A}$ $A_2 = 2.0 \text{ A}$ $A_3 = 1.0 \text{ A}$
4. Series circuit drawn with two batteries, one ammeter and four bulbs.