Talking about facts – Stage 7 Answers

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1.1 Biology facts

1 A joint is a place where two bones meet.

2 fixed, moveable

3a The skull has fixed and moveable joints.

b There are fixed joints in the cranium.

c The cranium protects the brain.

d A moveable joint connects the jawbone and the skull.

4a There is a ball-and-socket joint in the shoulder / hip.

b Facts: A ball-and-socket joint can be moved in all directions. It has a ball on one bone and a socket on the other bone. The ball fits into the socket.

5a (suggested answer) There is a hinge joint in the elbow / knee.

b Facts: A hinge joint can only move in one direction. It moves like a door hinge.

1.2 Chemistry facts

1a Scientists who study rocks are called geologists.

b The layer of rock covering the Earth is called the crust.

c Rocks are made from grains of different materials.

2 sedimentary / metamorphic / igneous

3 Igneous rock **is** made from magma that has cooled. You can usually **see** crystals in these rocks.

Rocks that cool quickly **have** small crystals, rocks that **cool** slowly have large crystals. No crystals **form** when the magma cools very quickly. Granite **is** an igneous rock.

4a Small pieces of rock and mud **collect** at the bottom of the sea. More layers settle on top and the weight **presses** down the layers. This **makes** solid rock. This type of rock **is** called sedimentary rock. You can see small grains in the rock.

Sometimes dead plants and animals fall into the sediment. They **become** part of the rock and form fossils.

Sedimentary rocks **are** porous. Limestone **is** an example of this type of rock.

b This information is about sedimentary rock.

5a Some rocks **are** buried deep underground. Here it **is** very hot and the pressures **are** high.

These conditions **change** the rock into metamorphic rock.

The grains in the rock squash together and this **makes** the rock harder. It **squashes** the gaps out of the rock so it **is** not porous anymore. An example of a metamorphic rock is marble.

b This information is about metamorphic rock.

1.3 Physics facts

1 (example answer) Washing, walking, carrying a bag, climbing the stairs, cycling, [any other activity]

2 We get our energy from the food we eat.

3 We get chemical energy from foods, which we use to move about. Chemical energy is stored in our bodies and then respired to release energy.

4 **For example**

Name of energy	Example	Fact
Chemical	Food, fuel	Chemical energy can be stored for a long time until it's needed.
Electrical	Wires, battery	Electricity is a convenient source of energy.
Thermal (heat)	Sun, hob, fire	Heat energy spreads out from a hot object.
Light	Light bulb, torch, candle	Hot things can give off light. Light spreads out in all directions.

5a latices – elastic
halterm – thermal
incitek – kinetic

b **For example**

- An elastic object, for example a spring, stores elastic potential energy when stretched or squashed. A stretched spring is a store of elastic energy.
- Thermal energy stores release heat energy. Energy spreads out into the surroundings, so that a hot object cools down.
- Kinetic energy is energy that is moving. Any moving object has kinetic energy, for example, wheels turning on a bike, water flowing along a river and people running.

2.1 Biology connections

1a The place where an **organism** lives is called its **habitat**. Each kind of living organism has **adaptations** that help it to live in a particular habitat. Adaptations are the special features that help the organism to live in its habitat.

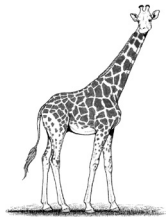
b **dog** **crab** **fish** **polar bear**
giraffe **walrus** **cat** **elephant**

c


polar bear

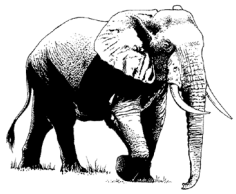

fish


cat


giraffe


walrus


frog


elephant


crab

d

Live in water	Live on land	Live in the Arctic	Live on the African savannah
fish crab walrus	polar bear cat giraffe dog elephant	polar bear walrus	giraffe elephant

e (example answers)
Cats and dogs live on land.
Polar bears and walrus live in very cold places.
Giraffes and elephants live on the African savannah.

f (example answers)
Fish live in water but they don't live on land.
Dogs live on land but they don't live in water.
Polar bears live in the Arctic but they don't live on the African savannah.

g (example answers)
Elephants don't live in water because they don't have gills to breathe under water.
Giraffes live on the African savannah because they can cope with the hot, dry conditions.
Cats don't live in the Arctic because they would be too cold because their fur is not designed to trap enough heat.
Walrus live in the Arctic because their blubber keeps them warm in the very low temperatures.

2.2 Chemistry connections

1a

rino	iron
leest	steel
glod	gold
ceklin	nickel
talboc	cobalt
propec	copper

b **For example**

	Properties				
Metal	**Strong Y/N**	**Malleable Y/N**	**Magnetic Y/N**	**What it's used for**	**Other information**
iron	Y	Y	Y	bridges	it rusts easily
stainless steel	Y	N	Y	pans, bicycle frames	it doesn't rust
gold	N	Y	N	jewellery	shiny
nickel	Y	Y	Y	used in many alloys	hard, doesn't corrode easily
cobalt	Y	Y	Y	used in many alloys	high melting point
copper	N	Y	N	electrical wires, water pipes	good conductor

c Iron is used to build bridges **because** it is strong. Iron is magnetic **and** malleable. It is a good conductor of heat **but** it rusts when in contact with oxygen and water.

d (example answers)
Stainless steel is strong and magnetic.
Stainless steel doesn't rust but it isn't malleable.
Stainless steel is good for making saucepans because it conducts heat well.
Gold is malleable and shiny.
Gold is malleable but it isn't magnetic.
Gold is used for jewellery because it is shiny.
Copper is a good conductor and it is malleable.
Copper is a good conductor but it isn't magnetic.
Copper is used for electrical wires because it's a good conductor.

2.3 Physics connections

1 On a clear (cloudless) night, we can see the stars **and** the moon. We cannot see the stars in the daytime **because** light from the Sun makes the sky too bright.

A constellation is when a pattern is formed by the brightest stars in the sky. These constellations look close together in the sky, **but** they are not.

We see different constellations at different times in the year. Orion is easy to see from November to February **but** it cannot be seen from May to July. This is **because** of the movement of the Earth. The Earth is in orbit around the Sun. It follows a path through space **and** this path is called its orbit.

2 You can see different stars in January and July because of the movement of the Earth. The Earth is in orbit around the Sun and it takes one year to travel all the way round. The Earth is in a different position at different times of the year.

3 (example answers)
Earth and Mars are rocky planets.
Mercury is a rocky planet but Jupiter is a gas giant.
Venus is called a rocky planet because it is made of rock.
Saturn and Uranus are far from the Sun.
Mercury is a warm planet but Neptune is cold.
Gas giants are cold because they are made of frozen carbon dioxide.
Venus and Earth are made of rock.
Mars is made of rock but Jupiter is made of frozen carbon dioxide.
Rocky planets are warm because they are close to the Sun.
Rocky planets and gas giants are all planets.
Mars is close to the Sun but Saturn is far from the Sun.
Gas giants are cold because they are far from the Sun.

Talking about differences and extremes – Stage 7 Answers

3.1 Comparing leaves

1a Sentences 1, 2, 3, and 4 include comparative adjectives.

b Sentences 5, 6, 7 and 8 include superlative adjectives.

2a

Feature	Adjectives	Comparative adjectives
length	long, short	longer, shorter
shape	round, oval	rounder, more oval
surface	furry, smooth, shiny	furrier, smoother, shinier
edge	spiky, flat	spikier, flatter
pattern of veins	straight, wavy	straighter, wavier

b (example answers)
Leaf A is wider than leaf F.
Leaf B is spikier than leaf C.

c (student's own answers)

3a

Feature	Adjectives	Superlative adjectives
length	long, short	the longest, the shortest
size	big, small	the biggest, the smallest
shape	star-shaped, round	the most star-shaped, the roundest

b Flower A is the longest flower.

Flower B is the most star-shaped flower.

c (student's own answers)

4 Crossword answers

Down

1 longer
2 smallest
3 dullest
5 spikier
6 shinier
7 spikiest

Across

4 longest
7 straightest
8 bigger
9 rounder
10 straighter

3.2 Changes of state

1 Ice-cream is a solid. When ice-cream gets **hotter,** it becomes liquid.

2 As a liquid gets **hotter**, it becomes a gas.

3 As steam gets **colder**, it becomes a liquid.

4 As the Sun shines on a puddle, the water gets **hotter** and becomes a gas.

5 As water gets colder, it becomes a solid / ice.

6a The higher the temperature, the faster the water evaporates.

b The lower the temperature, the slower the water evaporates.

c The higher the temperature, the faster the ice melts.

d The lower the temperature, the slower the ice melts.

7a The water in puddle C will evaporate the most quickly because the temperature is the highest.

b Puddle A will freeze the most quickly because the temperature is the lowest.

3.3 Comparing planets

1 **Venus and Mercury** are closer to the Sun than the Earth.

2 **Mercury** is the closest to the Sun.

3 **Jupiter, Saturn, Uranus and Neptune** are bigger than the Earth.

4 **Jupiter** is the biggest planet.

5a Venus has a **greater** diameter than Mercury and/or Mars.

b The Earth spins **faster** than Mars, Jupiter, Saturn, Uranus, Neptune.

c Jupiter has a **hotter** surface than Saturn, Uranus, Neptune.

d Jupiter has the **greatest** diameter.

e Mercury spins the **fastest.**

f Venus has the **hottest** surface.

g (student's own answers)

Helping verbs – Stage 7 Answers

4.1 Environmental predictions and advice

1a We share the Earth with millions of other organisms. Human activities **can** make it difficult for them to survive. There are many things that we **can** do to make sure that other species have suitable habitats to live in. We **must** look after our environment if we want other species to survive.

b Farming, fishing, introducing new species, pollution

c Conservation

d

Should	Shouldn't
Burn less fuel (student's own advice)	Use fossil fuels (student's own advice)
(example answer): Use renewable energy resources (student's own advice)	(example answer): Cut down too many trees (student's own advice)
(example answer): Reduce water / air pollution (student's own advice)	(example answer): Take too many fish from the sea (student's own advice)
(example answer): Make nature reserves (student's own advice)	(example answer): Dispose of rubbish irresponsibly (student's own advice)

2a If humans use too much land for farming, plants and animals **will** not be able to survive because their habitat will be destroyed.

b If humans take too many fish from the sea, other animals that live in the sea **will** not have enough food to eat and they **will** die out.

c If we reduce pollution, water and air **will** be cleaner.

d If we use renewable energy resources, we **will** have clean energy that **will** not run out.

4.2 Acids and alkalis

1a Because acids **can** be very dangerous, we **must** be very careful when using them. If you get acid on your skin, you **should** rinse your skin with lots of water.

2 You **can** find **alkalis** in many cleaning products.

Common alkalis in a laboratory are sodium hydroxide, potassium hydroxide and calcium hydroxide.

Strong alkalis are dangerous because they are **corrosive**. **If** strong alkali gets on your skin, it **will** dissolve it. Alkalis **can** be diluted in water. This makes them less dangerous.

Because acids and alkalis **can** be very dangerous, we **must** be very careful when using them.

3

Must	Must not
Wash skin with lots of water Wear goggles Read the labels carefully Stand up to work with acids / alkalis Put the bottle top back on as soon as you finish using it	Leave the bottle top off Put the bottle top face down on the work surface

4 (student's own answers)

4.3 Talking about the sky, space and planets

1a You **can** see the Sun in the sky in the daytime.

b You **cannot** see stars in the sky in the daytime.

c A spacecraft **must** have supplies of oxygen on board for the astronauts to breathe.

d You **can** see the moon in the sky at night.

e You **cannot** see the constellation called Orion from May to July.

f To see the stars, you **must** be on the dark side of the Earth.

2a You **must not** look directly at the Sun because it is very dangerous!

b You should make a safe viewing device by putting a piece of black paper with a small hole in it over one end of a tube and a piece of greaseproof paper over the other end to make a safe viewing screen.

3 India will see the sunrise first.

4a If you go into space above the Earth's atmosphere, the air is so thin that you **will** not be able to breathe.

b The leaf and a bottle full of water will fall at the same speed.

5 Some example answers:

- I will need to take water, food, washing equipment.
- I will need oxygen to breathe and a spacesuit when I land on Mars.
- I will need satellite equipment to communicate with people on Earth.

Words and phrases – Stage 7 Answers

5.1 Using words and phrases in science

1

Examples of words	Meaning of the word
reproduction	making again – making new offspring
renewable recycle reflect	it doesn't get used up fully, there will be more available to use again to send light off in another direction
transparent	something you can see through
transfer translucent	send to another place allowing light to pass through
chlorine	a green gas
chlorophyll chloroplast	a green pigment found in some plant cells green structures inside plant cells which contain chlorophyll and in which photosynthesis takes place
thermal energy	heat energy
thermometer	an instrument for measuring temperature
photograph	an image made using light
photosynthesis	a chemical reaction that takes place in plant leaves using energy from light
astronaut	a person who is trained to travel in a spacecraft
astronomer	an expert in astronomy
geocentric	showing the Earth at the centre of the solar system
geological geologist	relating to the study of the Earth's physical structure and substance an expert in the Earth's physical structure and substance
organ	a part of an organism
organism organic	an individual animal, plant, or single-celled life form relating to or derived from living matter
variable	it can change
variation	a difference between individuals belonging to the same species

2

Area of science or medicine	The person who does this job	Example sentence
science	scient**ist**	A scientist is a person who knows about science.
anatomy	anatom**ist**	An anatomist studies the structure of the body.
biology	biolog**ist**	A biologist studies living organisms.
genetics	genetic**ist**	A geneticist studies heredity and the variation of inherited characteristics.
neuroscience	neuroscient**ist**	A neuroscientist studies how the brain and the rest of the nervous system work.
nutrition	nutrition**ist**	A nutritionist is a person who is an expert in nutrition.
osteology	osteolog**ist**	An osteologist is a person who studies bones.
physiology	physiolog**ist**	A physiologist studies the normal functions of living organisms and their parts.
psychology	psycholog**ist**	A psychologist is a person who studies the human mind and its functions affecting behaviour.

3

Ending	Meaning	Example	Example sentence
-able / -ible	can be done	renew**able**	Wind power is a renewable energy resource.
		flex**ible**	A thin sheet of plastic is flexible.
		malle**able**	Metals are malleable because they can be hammered into shape.

4a Verbs

b

Ending -tion		
Verb	**Noun**	**Example sentence**
adapt	adaptation	Adaptation is a feature of an organism that helps it to survive in its habitat.
excrete	excretion	Excretion occurs when living organisms expel waste materials.
pollute	pollution	Pollution occurs when people add harmful things to the environment.
deplete	depletion	Using CFC gases leads to the depletion of the ozone layer.
conserve	conservation	A conservation area is a protected place when animals can live safely.
vary	variation	There is variation between dogs. They are not all the same.

5

Word	Everyday meaning	Meaning in science
consumer	customer / user	Herbivores are called primary consumers because they eat green plants.
producer	somebody who makes a film	A producer is an organism in the first level of the food chain.
space	area, room	Outer space
conductor	a person who leads an orchestra	A material or an object that conducts heat, electricity, light, or sound.
force	to use physical strength	In physics, force is something that causes a change in the motion of an object.

6 'Cell' in biology means the tiny structure that all living things are made of.

'Cell' in physics means an energy store, for example a battery.

7a and **b**

Phrase	Meaning	Example sentence
fill in	complete	Fill in the table.
find out	discover	Find out how metals react with acid.
carry out	do	Carry out an experiment.
match up	put together	Match up the symbol to the element.

Planning experiments – Stage 7 Answers

6.1 Investigating growth of chilli plants

1 the number of hours the plants are in the light each day

2 how many leaves there are on each plant

3 Three statements should be underlined: the size of pot; the volume of water given to each plant; the temperature.

4 In Jon's experiment, the independent variable is **the number of hours the plants are in the light each day**.

The dependent variable is **how many leaves there are on each plant.**

Three variables that Jon controls are **the size of pot, the volume of water given to each plant** and **the temperature.**

6.2 Investigating how quickly water boils

1 the volume of water

2 the volume of water

3 time taken for the water to boil

4 Four statements should be underlined: the temperature of the beaker, tripod and gauze at the start of the experiment; the size of the beaker; the size of the Bunsen flame; the distance of the flame from the beaker.

6.3 Investigating how fast objects fall through different liquids

1 the type of liquid

2 the time it takes for the ball to fall

3 the size of the ball, the depth of the liquid

Results tables – Stage 7 Answers

7.1 Constructing a table to show information about mammals

1–4

Mammal	Number of pairs of ribs
cat	13
fox	13
horse	18
African elephant	21
whale	9
human	12

It is important that the full headings are included, and that nothing other than numbers is written in the entries in the right-hand column.

7.2 Testing pH using Universal Indicator

1–5

Substance	Colour with Universal Indicator	pH
lemon juice	orange	4
tap water	green	7
vinegar	red	1 or 2
cleaning fluid	purple	9 or 10
fizzy drink	orange-red	3
sea water	blue-green	7 or 8

7.3 Investigating friction

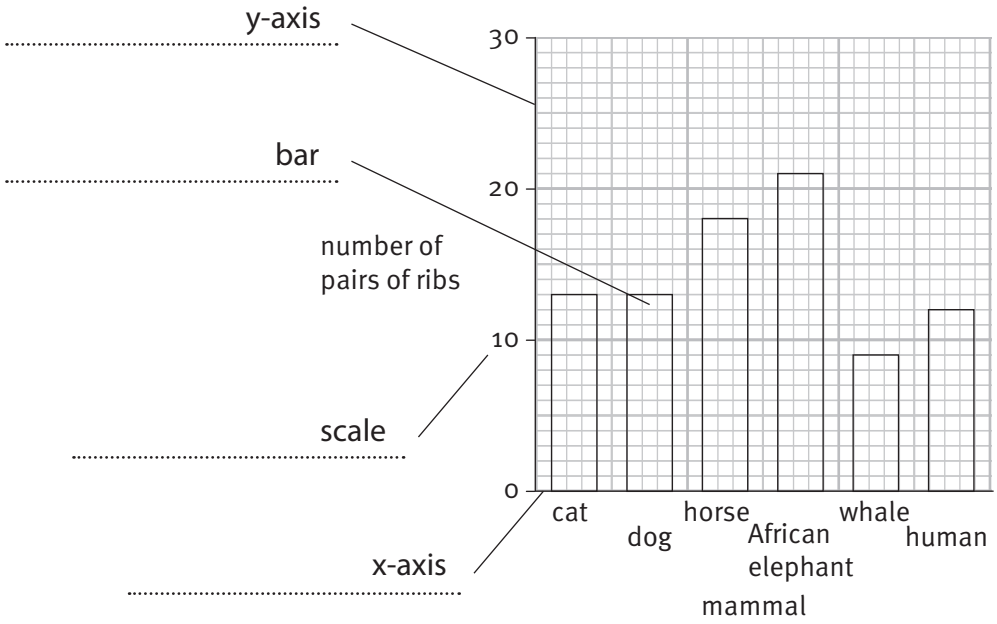
1–4

Surface	Force in newtons
plastic	8.8
cloth	9.9
glass	7.6
sandpaper	15.2
wood	8.9
carpet	9.7

Nothing other than numbers should be written in the right-hand column.

8.1 Drawing a graph to show information about mammals

1



2 Yes, Amal is right. A bar chart is used when there are several different things on the *x*-axis. The *x*-axis shows different mammals, not numbers going up in a steady sequence.

8.2 Drawing a graph to show changes in pH

1 Anna's graph has numbers going up in a steady sequence on the *x*-axis. She would only use a bar chart if there were separate things on the *x*-axis.

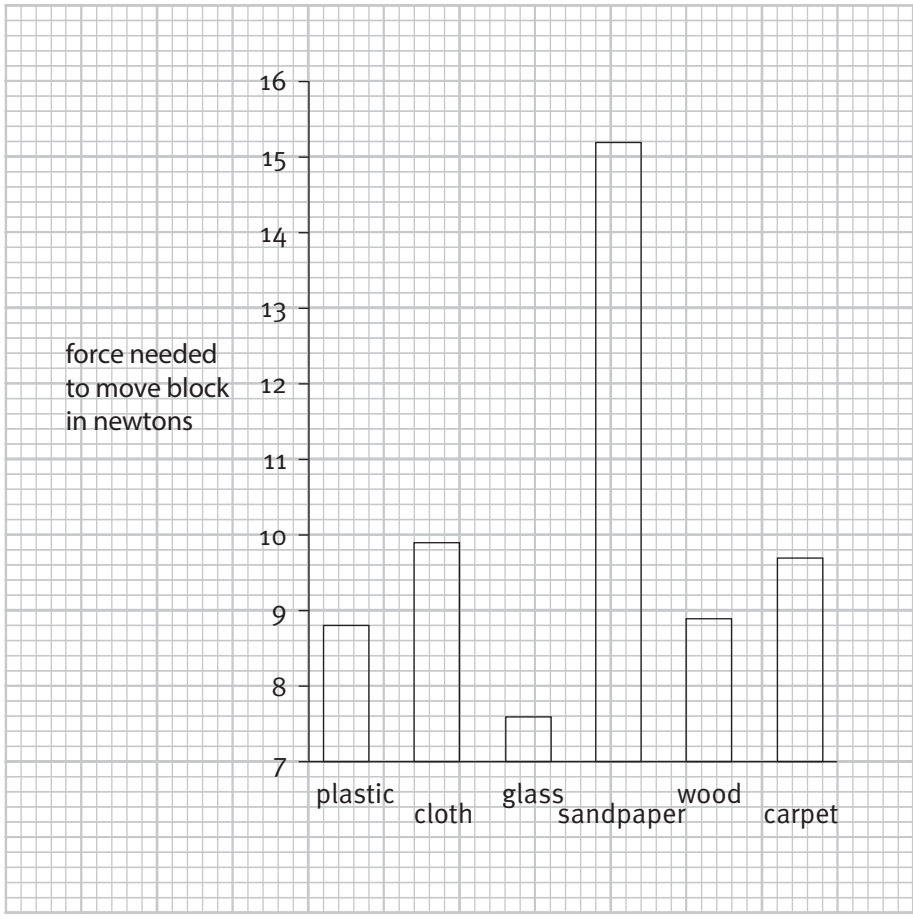
2 25 cm^3. This is how much is needed to make the pH 7.

3 Yes. Anna's independent variable (the one that she changes) is the volume of sodium hydroxide added to the acid. This is on the *x*-axis of her graph.

The dependent variable is the pH. This is the *y*-axis of her graph.

8.3 Investigating friction

1–4



5 The x-axis lists different surfaces, which are all separate from one another. We draw a line graph only when there is a continuous sequence of numbers on the x-axis.

Making conclusions – Stage 7 Answers

9.1 Investigating decay of an orange

1 Temperature – whether the orange is left in a warm place or a cold place.

2 The area covered by mould.

3 Any two from: the size of the orange; the freshness or age of the orange; the variety of orange; the humidity (how much water there is in the air).

4 She could use a piece of transparent paper or film, place it over the orange, and draw around the mouldy area. Then she can place it over a piece of paper with millimetre squares on it (e.g. graph paper) and count up the number of mm^2 squares covered by her drawing.

5 Mould grows faster when it is warm than when it is cold.

9.2 Which rocks are limestone?

1

Rock sample	What happens when hydrochloric acid is added	Is the rock limestone?
A	fizzes a little	yes
B	nothing happens	no
C	fizzes a lot	yes
D	nothing happens	no

2 The second column.

3 The last column.

9.3 Energy transfer from hot water

1 Yes. The quantity on the x-axis goes up steadily and continuously – it is not a number of separate things.

2 Energy spreads out faster from hot water in a large beaker than from the same amount of hot water in a small beaker.

10.1 Answering questions about cells, tissues and organs

1

Questions	Answers
What is the name for a group of cells of the same kind?	A tissue
Describe what is meant by the word tissue.	It is a group of cells of the same kind.
Name one example of a tissue.	The layer of cells covering the surfaces inside an onion
How does an organ differ from a tissue?	An organ is made up of many different tissues.

2a Name

red blood cell

b Describe

They absorb water from the soil.

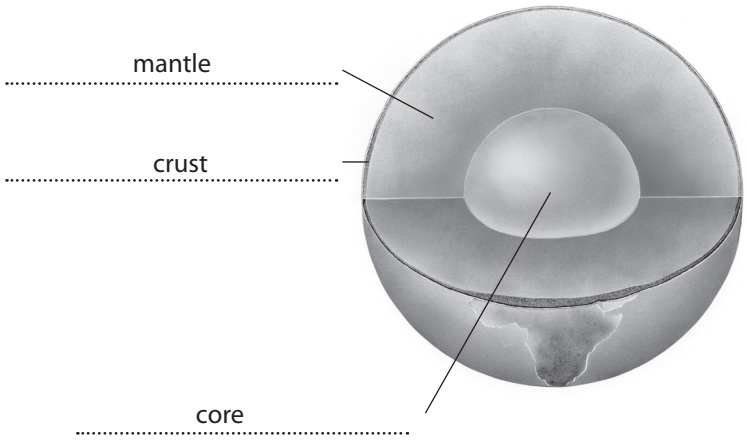
c Complete, Choose

Nerve cells carry **electrical** signals from one part of the body to another.

d Ticks for: Root hair cells have cell walls. Root hair cells absorb water from the soil.

10.2 The structure and age of the Earth

1



2 Tick for: The fossil in the deep layer of rock is older than the fossil found near the surface.

3 The three mistakes are (in any order):

Jon has written one of the answers (meteorite) instead of drawing a line linking to this word.

His answer to 'Which came first in the history of the Earth – fish or reptiles?' is wrong. The correct answer is fish.

He has drawn two lines from: 'What is a fossil?' Only one is correct. The wrong answer cancels out the right answer.

10.3 Energy changing form

1 gravitational potential

2 kinetic

3 friction

4 kinetic to thermal (heat)

Talking about facts – Stage 8 Answers

1.1 Human circulatory system

1 A **pulse** is caused by a **heartbeat**. A pulse is blood pumping through your **arteries**.

2 Example sentences:

Blood vessels include arteries, veins and capillaries. Blood vessels carry blood around the body.

The circulatory system is made up of the heart and blood vessels. The heart pumps blood through the circulatory system.

3

Blood vessel	What they do	What they don't do
Arteries	carry blood from the heart	don't carry blood back into the heart
Veins	take blood back to the heart	don't take blood away from the heart

4a Blood is red.

b Plasma is the liquid part of blood. It is mainly water.

c Red blood cells are red because they contain a red pigment called haemoglobin.

d White blood cells help to defend the body against bacteria and viruses.

1.2 Atoms, elements, compounds and mixtures

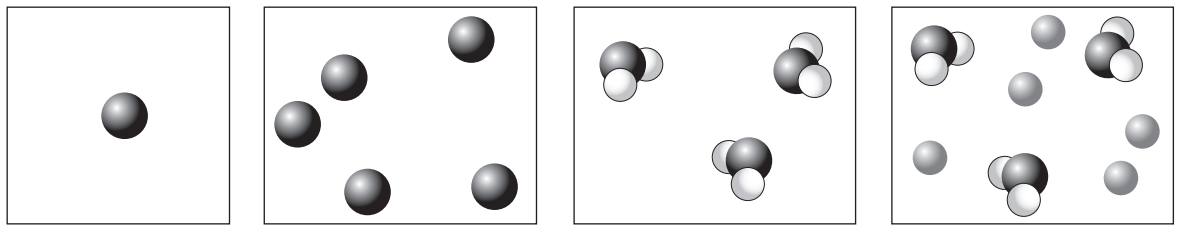
1a An atom is the smallest particle of a chemical element that can exist.

b An element is a substance that is made of only one kind of atom. It cannot be broken down.

c A compound is made of two or more different elements. It can be broken down by a chemical reaction.

d A mixture is made of two or more different elements or compounds that are mixed together, without a chemical bond. They can be separated.

e



atom element compound mixture

2a

Elements	Mixtures	Compounds
oxygen	fruit salad	water
tin	bronze	salt
sodium	fizzy drink	sugar
chlorine	air	carbon dioxide
copper	seawater	limestone

2b Bronze

c Bronze is useful because it is harder than tin or copper.

d Salt

e Salt is useful because you can't eat sodium or chlorine, but you can eat salt.

1.3 Light

1a Example answers: torch, light bulb, match, candle …

b A light source is an object that emits its own light.

2a Straight line ticked

b Light travels **in a straight line**. We know this is true because of the way that shadows are cast (or because we cannot see around corners).

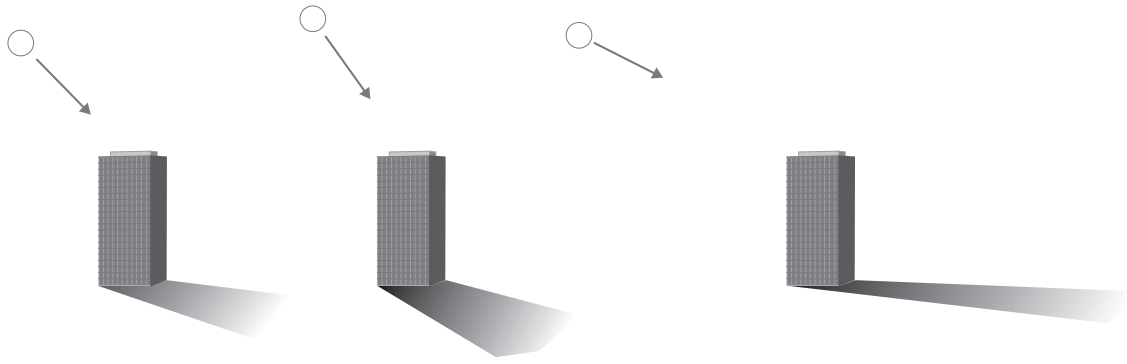
3

Luminous	Non-luminous
the Sun	the Earth
a lightbulb	a table
a lit match	a flower

4a A luminous object is a source of light.

b A non-luminous object is not a source of light. Non-luminous objects reflect light.

5a



b A shadow forms when an (opaque) object blocks the light.

2.1 Early life

1a Gametes

Your body is made of millions of cells **but** you began life as a single cell. The single cell was made when two very special cells were joined together. The special cells were an egg cell **and** a sperm cell. Egg cells and sperm cells are called gametes **and** these cells are adapted for reproduction.

b Chromosomes

Every cell has chromosomes in its nucleus. They are made up of genetic material **and** contain information about how the cell will develop. You have 46 chromosomes in every cell in your body **but** gametes only have 23 chromosomes.

c Egg cells and sperm cells

Egg cells are the female gametes **and** are bigger than most other cells. Egg cells store food in their cytoplasm, **so** they need to be quite large.

Sperm cells are the male gametes **and** are smaller than most other cells. They only have a tiny amount of cytoplasm. They have a long tail, **so** that they can swim.

2a It is larger, it has food stores in its cytoplasm and it has only 23 chromosomes.

b It is smaller, it has a long tail, it can swim, it does not have much cytoplasm and it has only 23 chromosomes.

c The egg cell **and** sperm cell join together, **so** the zygote has the normal number of chromosomes at the end of the process.

d Fertilisation

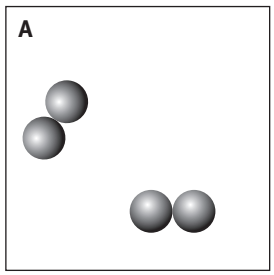
When a sperm cell **and** an egg cell meet, the head of the sperm cell goes into the egg cell. **So**, the nucleus of the sperm cell **and** the nucleus of the egg cell join together. This is called fertilisation **and** the new cell that is produced is called a zygote.

e When the egg cell and sperm cell join together, they make a new cell containing 46 chromosomes. A new human needs 46 chromosomes in their cells.

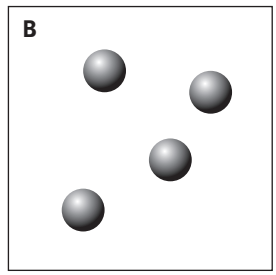
2.2 Atoms and elements

1 There are many different types of atom. Most of the atoms occur naturally, **but** there are some that are made in laboratories. Some substances are made of just one type of atom **and** these are called elements. For example, carbon is made of only carbon atoms, gold is made of only gold atoms **and** silver is made of only silver atoms. **So**, carbon, gold **and** silver are examples of elements.

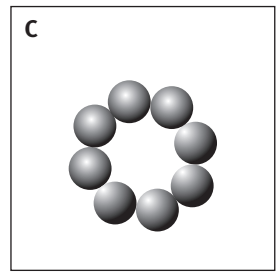
2



Molecules



Atoms



Molecule

3 An atom is the smallest part of an element, but an element is made of lots of atoms of one type.

4 It's a quick (shorthand) way to name an element.

5 Some of the symbols come from English words and some come from other languages.

6 Any three metals from: lithium, sodium, potassium, beryllium, magnesium, calcium, aluminium

7 Any three non-metals from: hydrogen, boron, carbon, silicon, nitrogen, phosphorus, oxygen, sulfur, fluorine, chlorine, helium, neon, argon.

2.3 Magnets and magnetism

1 You can use magnets in: doors, electric motors, speakers, magnetic letters, compasses, door bells, recycling machines and vending machines.

2 Some materials are magnetic, for example: iron, steel, nickel **and** cobalt. **But**, materials like aluminium, silver, plastic **and** wood are not magnetic.

3 Aluminium is non-magnetic so those cans stay on the belt. Steel is magnetic, so the electromagnet will pick these cans up.

4 The cobalt coin, steel spoon, iron nail **and** the nickel knife are magnetic.

5 The silver earrings, plastic bottle, wooden spoon and the aluminium foil are non-magnetic.

6 Objects made from plastic **and** wood are non-magnetic.

Objects made from steel are magnetic **but** objects made from aluminium are non-magnetic.

The knife is magnetic **because** it is made from nickel.

The spoon is made from steel, **so** it is magnetic.

7 Example sentences:

The steel horseshoe **and** the iron key are magnetic.

The steel horseshoe is magnetic **but** the plastic bag is non-magnetic.

The wooden clothes peg is non-magnetic **because** it is made of wood.

The steel horseshoe is made of steel, **so** it is magnetic.

Talking about differences and extremes – Stage 8 Answers

3.1 Growth and development

1a (example answers)

The toddler is **smaller** than the child.

The child has **longer legs** than the toddler.

The man is **more mature** than the child and the toddler.

The toddler is **younger** than the child.

The child is **taller** than the toddler.

The man is **older** and **heavier** than the child and the toddler.

b The man is the tallest.

The toddler is the youngest.

The man is the oldest.

c (students' own sentences)

2 The time when people change from childhood to adulthood is called **adolescence**.

Feature	Boys	Girls
body shape	**shoulders get broad (wide)**	breasts develop, hips widen
hair	on face, armpits and other parts of the body	in armpits and other parts of the body
voice	deeper	
brain function	better at making decisions and planning ahead, learn more quickly	better at making decisions and planning ahead, learn more quickly
emotions	become stronger, worry more, develop romantic feelings, become more self-aware, need for approval	become stronger, worry more, develop romantic feelings, become more self-aware, need for approval

3 (example answers)

Boys' voices get deeper.

Girls' hips get wider.

Boys and girls become more self-aware.

Boys and girls are more worried.

Girls' armpits become hairier.

Boys' faces become hairier.

3.2 Comparing metals and non-metals, elements and compounds

1

Metals	Non-metals
iron	**plastic**
steel	ceramic
gold	fibres
copper	glass
nickel	paper

2 (example answers)

Metals are more ductile than non-metals.

Non-metals are less conductive than metals.

Metals are more shiny than non-metals.

3 (example answers)

Silver is the most conductive metal.

Iron is the least ductile metal.

Gold is the most malleable metal.

4

Question	Beginning of answer	Complete the answer
What is an element?	An element is …	a substance that is made up of only one kind of atom.
What is a compound?	A compound is …	a substance that is made from more than one kind of atom. The atoms are tightly joined together.
What is a mixture?	A mixture is …	a substance that contains different elements and/or compounds that are not tightly joined together.

5 (student's own sentences)

3.3 Loudness and pitch

1 The greater the amplitude, the louder the **sound**.

The smaller the amplitude, **the quieter the sound**.

2 (student's own sentences)

3 The higher the frequency, the higher the **pitch**.

The lower the frequency, **the lower the pitch**.

4 (student's own sentences)

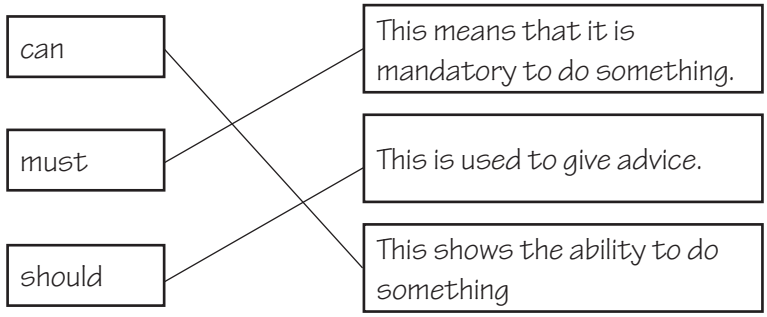
Examples:

A whistle makes a higher pitch than a lion roaring.

A double bass makes a lower pitch than a mouse.

Helping verbs – Stage 8 Answers

Grammar check



4.1 Diet

1 A balanced diet

2a If a person does not have enough vitamin C, their body may **not have strong skin**.

b If a person doesn't have enough vitamin D, **they may not have strong bones and teeth**.

c If a person doesn't have enough iron, **they may develop anaemia**.

d If a person doesn't have enough calcium, **their bones and teeth may become weak.**

3 Example answers:

You shouldn't eat too much sugar because it can make your teeth decay.

You shouldn't eat too much fat because you may develop heart disease.

You shouldn't eat too much fat and carbohydrates because you may take in more energy than you use.

4.2 States of matter

1 (example answers)

a Particles in a **solid** are arranged **in regular rows with the particles touching each other.**

b Particles in a **liquid** are arranged **with the particles touching each other but not in a pattern of rows.**

c Particles in a **gas** are arranged **in a random order and the particles do not touch each other.**

2a The particles in solids are held firmly in place by forces of attraction. The particles **can** only vibrate, they **cannot** move or change places.

b The particles in liquids are held together by weaker forces of attraction. The particles **can** move past each other.

c The particles in gas are not attracted to each other and they **can** move freely.

d Particles **must** have energy to allow them to move or vibrate. The more energy they have, the more they **can** move or vibrate.

e Solids and liquids **can't** be compressed (squashed into a smaller volume).

f Liquids and gases **can** flow.

g A solid **can** become a liquid.

h A gas **can** become a liquid.

3 (example answers)

a If you put a raw egg in a pan and add heat, it will become a solid.

b If you burn a candle, the wax will become a liquid.

c If you freeze cream, it will become a solid.

d If you boil water, it becomes a gas.

e If steam hits a cold surface, it becomes a liquid.

4.3 Light

1 (example answer)

A chair can't emit light, but a light bulb can. / A light bulb can emit light, but a chair can't.

2a In the experiment above, Elsa **can** see the light.

b If Elsa moves one of the cards sideways, she **can't** see the light.

c For Elsa to see the light, she **should / must** arrange the holes in the card in a straight line.

3a For a surface to **reflect** light so we see a reflected image, it **must** be completely smooth. We **cannot** see a reflection in a rough surface.

b (example answers)

Can reflect light	Can't reflect light
mirror	a sheet of paper
water	wool
glass	wood
metal	fabric

c You can see a perfect reflection of the bird in the water because the water has a flat, smooth surface and reflects light.

d You can't see a reflection in a sheet of paper because paper has a rough surface and scatters in all directions.

Words and phrases – Stage 8 Answers

5.1 Words and meanings

1a

Verb	Noun
attract	attraction
direct	direction
equate	equation
reflect	reflection
refract	refraction
vibrate	vibration

b If you put your fingers on your throat when you talk, you can feel the **vibration**.

When you look in a mirror, you can see your **reflection**.

The change in **direction** of a light ray when it enters or leaves a transparent material is called **refraction**.

Opposite poles of a magnet create an **attraction** to each other.

2

Word	Everyday meaning	Meaning in science
normal	something that is standard or usual	a line drawn at 90 degrees to a surface at the point where a ray of light strikes it
inspiration	to give motivation	to breathe in
canal	an artificial waterway for boats to transport things	a tube in a plant or animal that contains food, liquid, or air
vessel	a ship or boat	a tube containing moving blood or other fluid
compound	an area enclosed by a fence (around a factory, prison, etc.)	a substance in which atoms of two or more different elements are bonded together
solution	the answer to a problem	a mixture in which particles of a substance are mixed with particles of a liquid
pitch	a football pitch is where the game is played	how high or low a sound is

3a 'Conservation' in biology means trying to stop species becoming rare or extinct.

'Conservation' in physics means conservation of energy; the principle that energy can be neither created nor destroyed. Also, the conservation of mass, which states that mass can be neither created nor destroyed.

b 'Reaction' in biology means an action taken by an organism in response to a stimulus.

'Reaction' in chemistry means a change involving the production of a new substance

4

Phrase ending 'out'	Meaning of phrase	Example sentence
carry out	do	Leaves are the organs that carry out photosynthesis
dry out	dehydrate	If a leaf doesn't get enough water, it will dry out.
run out	use it all so there is nothing left	Fossil fuels will eventually run out.
give out	release	Plants give out oxygen during the daytime.
die out	become extinct	If the habitat is destroyed, the animals will die out.
spread out	disperse (move from being close together in a group to being spread across a larger area)	Particles in a gas spread out and move anywhere.
cancel (each other) out	to be equal to each other	Two equal forces acting in opposite directions cancel each other out.

5

Phrase ending 'up'	Meaning of phrase	Example sentence
made up of	contain / have inside	Soil is made up of tiny rock particles.
speed up	get faster	Catalysts speed up a process.
heat up	get hotter	The brakes on a bike heat up with the force of friction.
light up	illuminate	Bulbs light up when the circuit is closed.
mix up	mix together	When you add water to fruit syrup, the particles mix up.
soak up	absorb liquid	Plants soak up the water from the soil.

6

Phrases ending 'down'	
Example sentence	**Meaning of phrase**
Saliva in the mouth **breaks down** starch to sugar.	breaks into small pieces
Air resistance **slows down** parachutes.	gets slower
When steam **cools down**, it turns to water.	gets cooler

6.1 Investigating how colour of light affects photosynthesis

1 The colour of light affects the rate of photosynthesis of a plant.

2 the colour of light

3 the number of bubbles the plant produces in 1 minute

4 Any three of: the temperature of the water; the kind of plant; the size of the plant; the intensity of light (the distance of the lamp from the plant)

6.2 Investigating rusting

1 Iron nails rust faster when water is present.

2 whether or not water is present

3 how much, or how quickly, the nails rust

4 Any three of: the type of nail; the volume of water; how clean the surface of the nails are; access to air (so there is the same quantity of oxygen in each tube)

6.3 Investigating reflection

1 The angle of incidence, **i,** is the same as the angle of reflection, **r**.

2 the angle of incidence

3 the angle of reflection

Results tables – Stage 8 Answers

7.1 Functions of the organs in the respiratory system

1 **a** and **b**

Part of respiratory system	Function
lungs	organs where gas exchange takes place
trachea (windpipe)	carries air down through the neck
bronchus	carries air from the trachea into the lungs
larynx	makes sounds when air passes through it
air sacs (alveoli)	where oxygen diffuses into the blood

7.2 Reactions of acids with metals

1

Substances reacting together	Salt formed
hydrochloric acid and zinc	zinc chloride
hydrochloric acid and magnesium	magnesium chloride
sulfuric acid and magnesium	magnesium sulfate
sulfuric acid and lead	lead sulfate
sulfuric acid and iron	iron sulfate

7.3 Measuring time and calculating speed

1

Distance travelled in metres	Time taken in seconds
0	0
20	6
40	11
60	16
80	22
100	30

2 Total time to travel 100 m = 30 s

average speed = distance ÷ time

= 100 ÷ 30 = 3.3 metres per second

Describing and interpreting graphs – Stage 8 Answers

8.1 Growth of a human fetus

1 As the age of the fetus increases, its mass increases.

There is a correlation between the age of the fetus and its mass.

The mass of the fetus increases from just above 0 at 0 weeks to 2800 g at 32 weeks.

2 It is not correct to say that as the mass of the fetus increases its age increases, because this suggests that the dependent variable (mass of the fetus) affects the independent variable) its age. Always word the answer starting with what is on the *x*-axis, which is the independent variable.

The fetus does not reach a mass of 2800 kg – if it did it would be the size of a small elephant. The mass is 2800 g.

8.2 Solubility of sugar

1 As the temperature **increases**, the mass of sugar dissolved **increases**.

2 There is a correlation between **the temperature of the water** and **the mass of sugar that dissolves.**

3 At a temperature of 50 °C, **260** g of sugar can dissolve in 100 cm^3 of water.

4 At a temperature of 20 °C, **404** g of sugar can dissolve in 200 cm^3 of water. (Find the value for 100 cm^3 of water and then multiply by 2.)

8.3 Walking to the shops

1 All of them: A, B and C.

2 Only B is horizontal.

3 B. This shows that as time increases, distance moved does not change.

4 20 minutes.

5 Sam travels 1000 metres in 20 minutes.

20 minutes is 20 × 60 seconds

Sam's average speed is total distance travelled ÷ time taken

= 1000 m ÷ 1200 s

= 0.85 metres per second. (Remember to round up the answer to one decimal place.)

6 Sam travelled 380 metres in the first 4 minutes.

4 minutes is 4 × 60 s

Sam's speed during this time is 380 ÷ 240

= 1.58 metres per second.

Conclusions and explanations – Stage 8 Answers

9.1 Investigating the effect of exercise on pulse rate

Exercise makes pulse rate increase. C

A pulse is an artery expanding and recoiling when blood is pumped through it. E

So when you measure your pulse, you are measuring how fast your heart is beating. E

Your heart beats faster when you exercise because this sends more blood to your muscles to help them to work harder. E

9.2 Is it a compound or a mixture?

1 Beaker **A** contains a compound of iron and sulfur, and Beaker **B** contains a mixture of iron and sulfur.

2 In an element, there is one kind of atom. When atoms from two different elements join together, they make a **compound**. The properties of the compound are not the same as the properties of either of the **elements** from which it is made.

Iron and sulfur are elements. When their atoms join together, they make a compound called iron **sulfide**. Although iron is attracted to a **magnet**, iron sulfide is not.

A mixture contains two or more different substances. The atoms of the different substances do not **join** together.

A mixture of iron and sulfur contains separate particles of **iron** and sulfur. The iron keeps the properties of iron. The sulfur keeps the properties of sulfur. So when I held the magnet over the mixture of iron and sulfur, the **iron** particles stuck to the magnet.

9.3 How does sound travel?

1 Sound cannot travel in a vacuum.

2 Sound travels through air by making the air particles vibrate. If there are no air particles, then the sound cannot travel. This is why Anna could not hear the sound from the ringing bell. There was no air inside the jar, so the sound could not travel from the bell to outside the jar.

Answering questions – Stage 8 Answers

10.1 Enzymes

1a catalyst

b A noun, because the word before the gap is 'a'.

2a Enzymes

b Plural. It must be plural because it is followed by 'are proteins'.

3a digest

b Verb. It must be a verb because the sentence doesn't have a verb yet.

10.2 The Periodic Table

1 The Periodic Table contains all the 118 known **elements**. The elements on the left hand side of the Periodic Table are **metals**.

All the elements have a shorthand **symbol**, which you can use instead of writing their full names. You have to be careful with these, because sometimes the name doesn't start with the same letter as the symbol. For example, the symbol **Na** stands for sodium. The symbol K stands for **potassium**.

2 **a** and **b** Check:

- that all the sentences have been rewritten, with gaps for single words
- that the gaps can be filled using only words from the list
- that only one word will correctly fill each gap.

10.3 Refraction

1 A beam of white light is shone onto a prism. As the ray of light enters the glass prism, it bends. This is called **refraction**.

When the ray of light comes out on the other side of the prism, it has been split into many **colours**, forming a **spectrum**.

The **red** light is bent least as it passes through the prism, so this colour is at the top of the **spectrum**.

2 Check:

- that at least three sentences have been written
- that the sentences are the learner's own, not simply copied from the book
- that the science is correct
- that the gaps can be filled using only words from the list
- that only one word will correctly fill each gap.

1.1 How do individuals belonging to the same species differ from each other?

1 (example answers)

a A species is **a group of organisms** that **share the same features** and **can breed together**.

b Variation is because we have **different genes** and are **not identical**. Our **environment can affect** how we are.

c Inheritance is when **genes** are **passed on from parents**. Our **environment can affect** how we are.

2 Variation

a Most people measure 150–154 cm.

About 25 people are 135–139 cm tall.

b Nobody measures less than 130 cm.

Nobody measures more than 174 cm.

c (example questions)

How many people measure …?

How many people measure more / less than …?

3 All chickens are members of the same **species** but they do not all look the same. Differences between individuals belonging to the same species are called **variation**. The differences are caused by **environmental** or **inherited** factors.

4a Size, length of feathers, feather pattern.

b Same shape, feather pattern.

c Free-range chickens have space to move around, can eat insects from the ground, are exposed to natural daylight.

They may be cold and wet in the winter, they have to find their own food, they may be in danger from predators.

1.2 Chemical reactions

1

Exothermic process	Endothermic process
making ice cubes rusting iron burning sugar	melting ice cubes cooking an egg evaporation of water

2a

Drawing by student of one exothermic process from the above table.	Explanation of exothermic process drawn by student, e.g. When iron is in contact with oxygen, iron oxide or rust is produced.

b We know this is an exothermic reaction because heat is released.

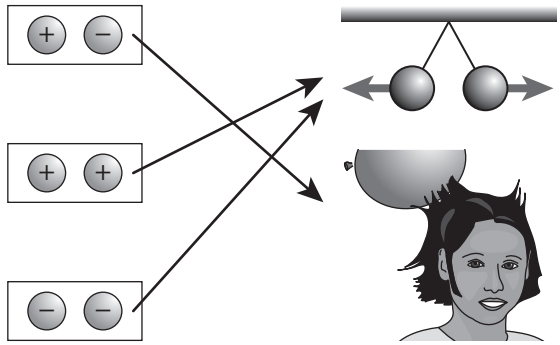
3a

Drawing by student of one endothermic process from the above table.	Explanation of exothermic process drawn by student, e.g. If you put ice into a beaker of warm water, it melts. To melt ice we need heat, which comes from the warm water.

b We know melting ice is an endothermic reaction because if we put a thermometer in a glass of warm water and add an ice cube, we can see the temperature go down as the ice melts.

1.3 Electricity

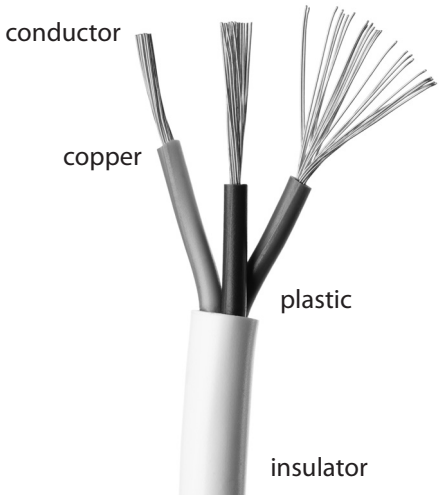
1a



b (example answer)

The balloon has positive and negative electric charge, so the girl's hair is attracted to it. This is static electricity. The balls both have negative or positive electric charge, so they repel each other.

2a



b A conductor allows electricity to flow through it.

c An insulator does not allow electricity to flow through it.

3 Circuit A uses a silver ring to complete the circuit. Silver is a good conductor of electricity and allows the electrical current to flow through it and light up the light bulb.

Circuit B uses a cotton wool to complete the circuit. Cotton wool is a non-conductor of electricity and does not allow the electrical current to flow through it so the light bulb does not light up.

2.1 Different habitats

1a A habitat is the natural home or environment of an animal, plant, or other organism.

b All living things have adaptations that help them to live in their environment. Some species may not be able to survive **because / as** humans are destroying their habitats. So / **As a result**, these species may become **extinct**. As the human population increases, we are destroying more **and** more habitats. This is **because / as** we need to provide more food, **so / as a result** we need more farming, we need more firewood **and** timber for building, **so / as a result** we need to cut down more trees **and** we need more minerals from the ground **because / as** we need more fuel.

2a Some wetlands are next to the sea, but **some are inland.**

Some wetlands stay wet all year round, but **some dry out at some points of the year.**

Sometimes, people drain the land, so **they can grow crops or build on the land.**

b Rainforests grow in **the tropics** and **in cooler, temperate regions.**

Rainforests have a very high biodiversity because **they have many different species of plants and animals.**

Many animals in the rainforest have become extinct as a result of **humans cutting down trees.**

c Coral reefs are sometimes called 'the rainforests of the sea' as **they have a very high biodiversity.**

Coral reefs are built by tiny animals. They live together in big colonies and **make hard coverings around themselves.**

Some species live their whole lives in the coral reef but **some only visit the reef to feed.**

Coral reefs are under threat as a result of **acidification.**

It is difficult for coral animals to build their skeletons because of **the acidic sea water.**

3a Twenty-one countries signed an agreement in 1975 **because / as they wanted to try and save their wetlands.**

b Many countries signed an agreement about CFCs in 1989 **because / as** they agreed to stop using CFCs.

c The use of CFCs is now banned, so **the amount of CFCs in the atmosphere has decreased.**

4 Countries signed international agreements **because / as** they want to reduce the amount of carbon dioxide they produce. **But** this is very difficult to do. Most countries have not reduced their carbon dioxide levels **because of / as a result of** industry and transport. The Earth is getting warmer **because of / as a result of** carbon dioxide in the atmosphere. **So / as a result**, species that have adapted to live in their habitats may have to move or they may become extinct.

2.2 Metals reacting

1 Metals have some properties in common **and** some properties that are slightly different. For example, iron is hard **and** strong **but** sodium is much softer **and** can be easily cut with a knife.

2 Lithium, sodium and potassium are in Group 1.

3 Lithium, sodium **and** potassium usually have a dull surface **but** when they are cut, they have a shiny surface.

Lithium, sodium **and** potassium usually have a shiny surface when first cut **but** the surface quickly goes dull. It goes dull **because of / as a result of** reacting with the oxygen in the air.

4 (example answers)

The surface usually appears dull, **but** it is shiny when first cut.

The surface usually appears dull **and** becomes dull again soon after it is cut.

The surface is shiny when first cut, **but** soon becomes dull again.

2.3 Energy

1a Our body needs energy because **it allows us to move around, think, stay warm**.

b We use energy in our homes for heating, cooling, cooking, lighting.

2a **Oil, coal** and **gas** are fossil fuels.

b Fossil fuels are useful because they are very concentrated stores of energy.

3 Electricity is a convenient energy resource because you can send energy from place to place easily.

4a Renewable energy resources are wind, water, solar and biofuels.

b An advantage of using renewable energy resources is you can never use them up.

c Fossil fuels are described as non-renewable energy resources because when they are burnt, they are gone forever.

5 Example sentences:

Coal is quite a cheap energy resource, **but** it produces carbon dioxide emissions.

Wind power is renewable **because / as** it uses a resource that keeps providing energy.

Coal is a fossil fuel, **so / as a result**, it produces carbon dioxide emissions.

Talking about differences and extremes – Stage 9 Answers

3.1 Animal adaptation

(example answers)

1 An Arctic hare has white fur so it is harder to see in the snow than the brown hare.

2 Turtles have flatter shells to help them move more easily in the water.
Tortoises have thicker skin to protect them living on land.
Turtles are lighter under their body to make them less visible in the water.

3 Snow leopards have thicker fur to cope with the low temperatures.
Leopards have more sensitive hearing to help them catch prey.
Snow leopards have smaller ears to reduce heat loss.

4 The American Bald Eagle is the smallest eagle.
The Australian Wedge Tail Eagle eats the largest mammals.
The Philippine eagle has the longest life expectancy.

3.2 Measuring rates of reaction

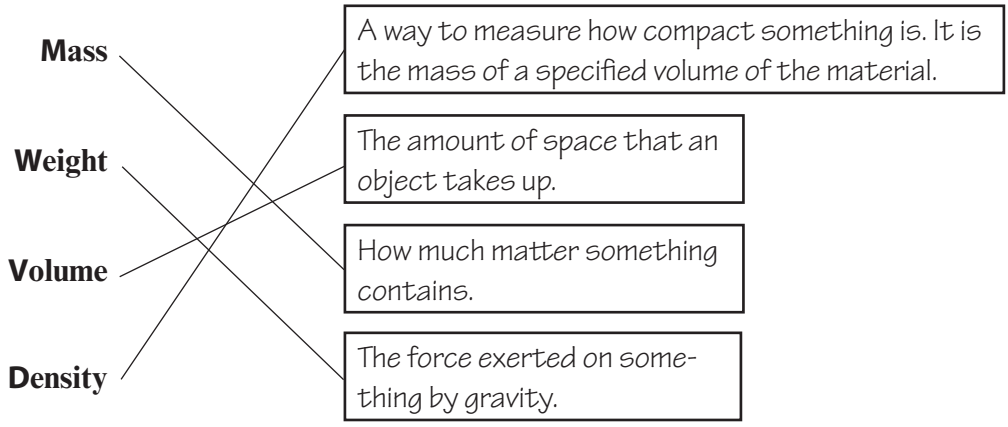
1 As the time increases, the volume of gas increases.

2 Temperature, concentration, size of substance.

3 The small piece of marble has the **larger** surface area.

4 Example sentences:
The larger the surface area, the quicker the reaction.
The largest surface area reacts the quickest.
The smaller the surface area, the slower the reaction.
The smallest surface area reacts the slowest.
The higher the concentration, the quicker the reaction.
The highest concentration reacts the quickest.
The lower the concentration, the slower the reaction.
The lowest concentration reacts the slowest.

3.3 Forces in action



2a (example answers)

Aluminium has a **greater density** than brick.

Brick has a **lower density** than aluminium.

b Gold has **the greatest** density.

Ice has **the lowest** density.

3 Example sentences:

Cork has the lowest density.

Gold has the greatest density.

Concrete has a greater density than nylon.

Silver has a lower density than gold.

4 The adult's snowshoes have a much greater surface area than the child's ice skates, so the pressure exerted is lower. The snowshoes spread the force over a large area of the ground, causing a small pressure so they do not sink into the snow.

The child's ice skates have a lower surface area, so the pressure exerted is higher.

The ice skates have a small surface area, so the force of the child's weight causes high pressure on the ground.

Helping verbs – Stage 9 Answers

4.1 Plant life

1a Photosynthesis is the way that plants make food. Plants **must** have carbon dioxide and water so that they **can** make glucose and oxygen. Photosynthesis is a chemical reaction and it **must** have energy to make it happen.

b Fertilisers help plants to grow. Plants **must** have many different kinds of mineral salts so they **can** grow large and strong. These are called fertilisers. Two of the most important ones are nitrate and magnesium.

c Plants **must** have nitrate so that the plant **can** make proteins. A plant that hasn't got enough proteins **can't** make enough new cells. Without proteins, plants **may not** grow well.

2a Plants **must** have water so that they **can** stand upright.

b If a plant doesn't get enough water, **it will wilt / it won't be able to stand upright.**

4.2 Salts

1 Calcium sulfate can be used **to write on a blackboard**.

Magnesium carbonate can **keep your hands dry when playing sport**.

Aluminium sulfate **can be added to dyes**.

Ammonium nitrate **can be used as a fertiliser**.

Copper sulfate **can stop fungi growing on seeds**.

Sodium chloride **can be used to preserve food**.

2 sulfuric acid

3a He should wear goggles.

b He **must** wait for the solution to stop fizzing.

c It **may** spit and burn Sam.

d Sam **should** remove the heat when he can see crystals forming at the edge.

4.3 Circuits

1

A circuit must …	A circuit must not …
be a closed loop have wires that connect the negative pole to the positive pole have a power source	have a broken path

2a In a series circuit, the electrical charge **can** only follow one path, so the electrical charge moving through a series circuit **must** flow through each part of the circuit.

In a parallel circuit the electrical charge **can** follow more than one path.

b Circuit A is a series circuit.

Circuit B is a parallel circuit.

c In circuit A – all bulbs **must** work for the circuit to work. **If** one bulb doesn't work, none of the bulbs **will** light up.

In circuit B – **if** one of the bulbs is not working, the other bulbs **will** work because the electrical charge has more than one path.

3a series circuit.

b This type of circuit is used on tools such as a lawn mower as a safety feature. You can't accidentally start the machine by pressing one button.

4a To make this circuit work, you must add a component in the gap and close the switch.

b You can use an ammeter to measure the current in a circuit by the first diagram's method.

5.1 Using words and phrases

1

Biology		
Verb	fertilise	To fertilise an egg, the nucleus of a male gamete and female gamete must join together.
Noun	fertilisation	At fertilisation, the chromosomes from the male parent combine with the chromosomes from the female parent.
Verb	pollinate	Birds and insects can help pollinate plants.
Noun	pollination	The transfer of pollen from an anther to a stigma is called pollination.
Verb	populate	Many people populate the Earth.
Noun	population	The populations of rainforests continue to decrease.

Chemistry		
Verb	react	Iron will react when in contact with oxygen and water.
Noun	reaction	Some chemical reactions take heat from the surroundings.
Verb	evaporate	Water will evaporate faster at high temperatures.
Noun	evaporation	Evaporation is when a liquid changes to a gas.

Physics		
Verb	conduct	Copper wire will conduct electricity.
Noun	conduction	Conduction is the process by which heat or electricity is directly transmitted through the material of a substance.
Verb	convect	To transport (heat or material) by convection.
Noun	convection	Convection is the transfer of heat energy from one place to another.
Verb	radiate	Energy radiates from the Sun.
Noun	radiation	Radiation brings us energy from the Sun.

2a


worm


ant


snail


owl


crab


pigeon

b I can tell number two is a snail because it hasn't got any legs, but it has got a shell.

How can you tell number three is a crab?

c Question: How can you tell number four is an ant?

Answer: I can tell number four is an ant because it hasn't got any wings and it has fewer than eight legs.

Question: How can you tell number five is an owl?

Answer: I can tell number five is an owl because it has got legs and wings and has big eyes.

Question: How can you tell number six is a pigeon?

Answer: I can tell number six is a pigeon because it has got legs and wings but a recognisable feather pattern.

3 A 'moment' in physics means a measure of the turning effect of a force.

4a In biology, a 'nucleus' is part of a cell that contains the chromosomes.

In chemistry, a 'nucleus' of an atom is the centre of an atom formed from protons and neutrons.

5a

… of	Meaning	Example sentence
get rid of	remove / dispose	Breathing gets rid of the waste product of respiration, carbon dioxide
short of	lack	A plant wilts if it is short of water.

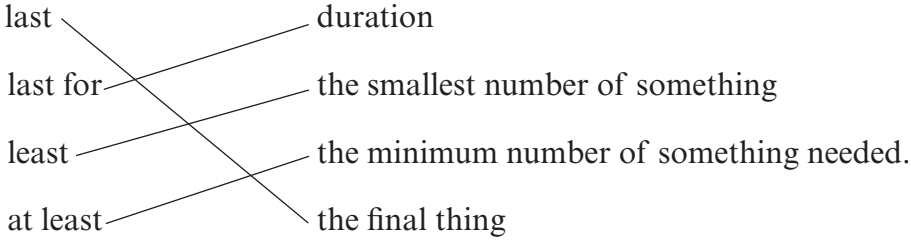
b

… up	Meaning	Example sentence
build up	accumulate / collect	If you don't eat healthily and are unfit, your arteries may get narrower because fat deposits **build up** inside them.
end up	the result (at the end of the process)	Water in the soil around a plant is absorbed and it **ends up** in the air as water vapour.

c

… out	Meaning	Example sentence
go out	stop burning (naturally)	A fire will go out when there is no oxygen.
put out	stop something burning (intentionally)	I put out the fire.
phase out	gradually stop using something over time	CFCs were eventually phased out.

6a



b A permanent magnet will **last for** a long time.

Which metal is the **least** conductive?

c A human is the **last** thing in the food chain.

d A female needs to drink **at least** 8 cups of water per day.

A male needs to drink **at least** 12 cups of water per day.

6.1 What makes pollen grains grow tubes?

1 Nor's prediction must relate the growth of pollen tubes to the presence of sugar. For example: Pollen grains will grow more tubes when they have sugar than when they do not.

2 The kind of liquid the grains are put into – water or a sugar solution.

3 She can count the number of grains that grow pollen tubes.

4 All of these suggestions would be useful preliminary work. The first idea would help Nor to choose pollen from a suitable kind of flower, so that she can be fairly sure that some pollen tubes will grow. The second idea will help Nor to choose a suitable concentration of sugar solution; if it is too dilute or too concentrated, then perhaps no tubes will grow at all. The third idea will help Nor to plan the time she will need for her experiment.

6.2 Investigating the rate of reaction of calcium carbonate with hydrochloric acid

1 The larger the surface area of the pieces of calcium carbonate, the more calcium carbonate particles are in contact with the acid. So the acid will react more quickly with the calcium carbonate. For the same mass of calcium carbonate, many small pieces have a bigger surface area than one or two big pieces.

2 The first two ideas would be very good to check through preliminary work, as they will help Jon to select a suitable volume of acid and mass of calcium carbonate to give him results in a reasonably short period of time. The third idea is not helpful, because Jon has already decided that he is investigating the rate of reaction with hydrochloric acid, so there is no point in looking at other acids too.

3 Jon can observe that the calcium carbonate disappears, the flask becomes hot and a gas is produced during the reaction.

He does not observe that the gas is carbon dioxide. He cannot know, just from his observations, which gas it is. If he tested the gas with limewater, he would be able to conclude that the gas is carbon dioxide.

4 The size of the pieces of calcium carbonate.

5 He could measure the time taken for all the calcium carbonate to disappear. He would need a stopwatch.

Or he could measure the volume of gas given off every minute. He could do this by collecting the gas in an inverted measuring cylinder over water; he would again need a stopwatch.

Or he could stand the reacting mixture on an electronic balance and measure the mass every two minutes; he would again need a stopwatch.

6 Hydrochloric acid is corrosive; he must take care not to spill it or get it on his skin.

6.3 Investigating fuels

1 The type of fuel

2 The temperature (change) of the water

3 Amal will need: thermometer, evaporating dish (in which the fuel can be placed and burnt), tripod, gauze, heatproof mat, a beaker (in which the water can be placed), a measuring cylinder (so that he can use the same volume of water each time, and the same volume of fuel), a stop clock.

4 Amal must take care with the burning fuels. He should wear safety glasses. He should stand up (not sit down) while doing his experiment, so that if a fuel gets spilt he can move away quickly. He should keep the container of burning fuel well away from the edge of the bench, so that it cannot tip over. He should also take care with the water in the beaker, which will get very hot.

5 Useful preliminary work could be:

- Try out different volumes of fuel, to find a suitable volume to provide a measurable temperature rise in the water.
- Try out different volumes of water, to find a suitable volume to provide a measurable temperature rise.
- Try different distances of the burning fuel from the beaker of water, and decide on a good way of supporting it so that he can be sure each fuel is always the same distance underneath the beaker of water.

Results tables – Stage 9 Answers

7.1 Investigating plants in a grassy area

1

Part of the grass	Number of daisy plants in quadrat			
	Quadrat 1	Quadrat 2	Quadrat 3	Mean
where people walk	10	14	8	10.7
where people do not walk	2	6	5	4.3

There are other possible ways of designing this chart. Accept other designs as long it is easy to understand exactly what the numbers are showing. However, this results chart is a good way of showing results where there are repeats, from which a mean is to be calculated.

Note that the mean numbers have been rounded to one decimal place.

7.2 Investigating exothermic and endothermic processes

1 and 2

Substances added together	Temperature at start in °C	Temperature at end in °C	Change in temperature in °C	Type of process
hydrochloric acid and magnesium ribbon	21	45	+24	exothermic
copper sulfate solution and magnesium ribbon	20	28	+8	exothermic
water and potassium chloride	21	19	–2	endothermic
vinegar and baking powder	22	28	+6	exothermic
citric acid and sodium hydrogencarbonate	20	18	–2	endothermic

Students may use two separate columns for the two substances, which is equally acceptable.

They should make clear whether the change in temperature is an increase or a decrease. This could be done as shown here, with a + or – sign, or it could be written in words.

Note that the water and potassium chloride example is not a chemical reaction. The potassium chloride dissolves in the water. This is a physical change, as no new substance is formed.

7.3 Finding the density of different rocks

1

Rock sample	Volume in cm^3	Mass in g	Density in g per cm^3
1	13	35.1	2.7
2	37	85.2	2.3
3	21	52.5	2.5
4	42	84.0	2.0

2 density of rock 1 = 35.1 ÷ 13 = 2.7 g per cm^3

density of rock 2 = 85.2 ÷ 37 = 2.3 g per cm^3

density of rock 3 = 52.5 ÷ 21 = 2.5 g per cm^3

density of rock 4 = 84.0 ÷ 42 = 2.0 g per cm^3

Students may also like to include the volumes in the measuring cylinder before and after adding the rock. If so, these should be in two columns immediately after the rock sample column and before the volume column.

Check that all headings have full units, and that there are no units in the table entries.

Note that all the densities should be written to one decimal place.

Drawing, describing and interpreting graphs – Stage 9 Answers

8.1 Fertilisers and plant growth

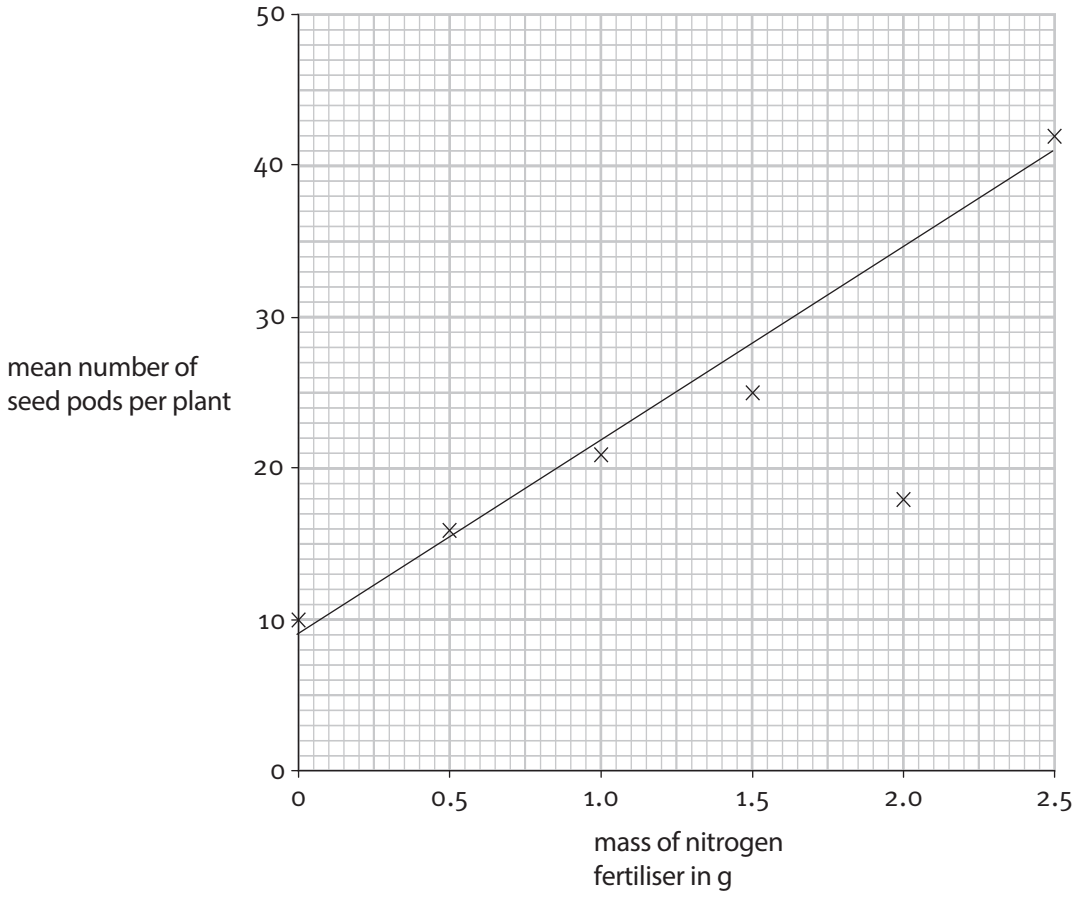
1 The mass of fertiliser given to the plants.

2 The number of seed pods.

3 any three from: volume of water given to each plant; light intensity; temperature; kind of soil they are growing in; variety of canola plant.

4 The anomalous result is 18 seed pods

5



6 Yes. As the mass of fertiliser increases, the number of seed pods increases.

8.2 Effect of temperature on rate of reaction

1 Temperature

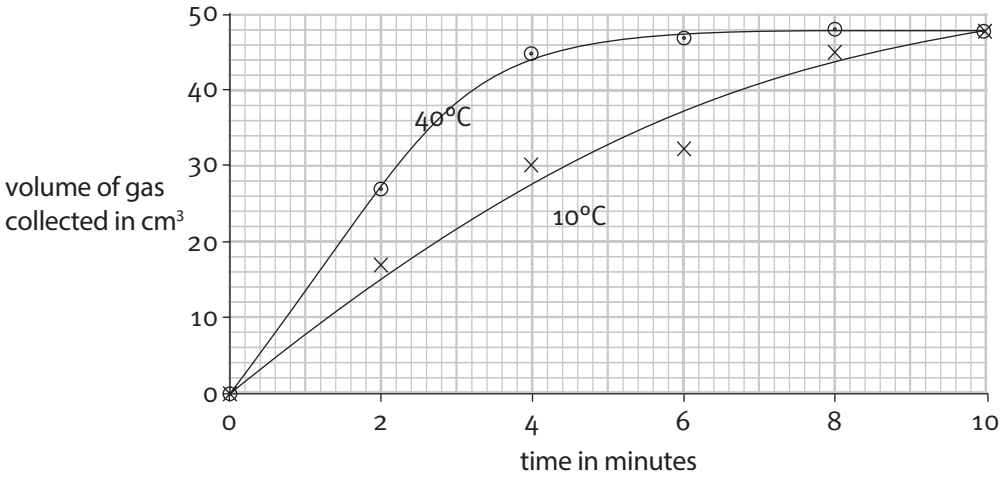
2 Rate of production of carbon dioxide, or volume of gas produced in 10 minutes.

3 Any two from: mass of marble chips; surface area of marble chips; volume of hydrochloric acid; concentration of hydrochloric acid.

4 This gives time for heat transfer between the water in the water bath and the acid and chips, so that they are all at the desired temperature when she starts the reaction.

5 32 cm^3 of gas at six minutes on the 10 °C graph – we would expect the volume to be greater than this.

6



7 As time increases, volume of gas collected increases. The rate of production (or collection) of the gas is greatest at the start and then gradually decreases.

8 Temperature and rate of reaction

8.3 Heat loss from different surfaces

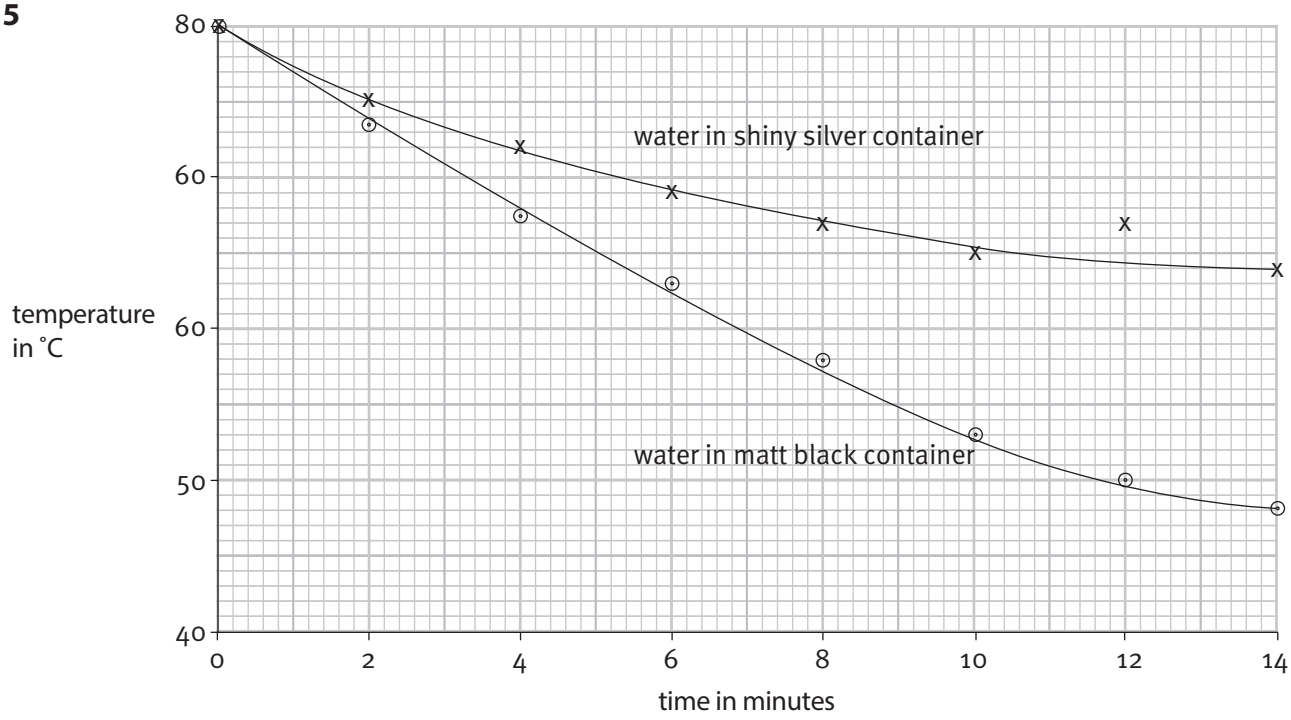
1 The colour of the surface of the container.

2 The rate at which the temperature of the water decreases.

3 Any two from: size of the container; shape of the container; initial temperature of the water; volume of water; temperature of the surroundings.

4 68 at 12 minutes in the shiny silver container

5



6 As time increases, the temperature of the water decreases. The rate of decrease slows down as time goes on.

7 The temperature of the water in the black container decreases faster than the water in the silver container. The final temperature is lower.

8 The temperature of the water in both containers will eventually fall to room temperature, 23 ºC.

Interpreting results and evaluating methods – Stage 9 Answers

9.1 Comparing two varieties of maize

1 The girls used a metre rule, which is not a good choice for accurately measuring lengths of more than 100 cm.

The girls measured only one plant of each variety.

2 They could use a tape measure to measure the plants, as this is more likely to give them the true height than using a metre rule.

They should measure the heights of several plants of each variety (perhaps ten) and then find the mean height. This will take into account any variation between different individual maize plants of the same variety.

9.2 Investigating the effect of concentration on the rate of a reaction

1 This will give Amal useful results, but it would be even better if he used at least five different concentrations. This will give him a clearer picture of the trend or pattern that he can see, when he looks at the different rates of reaction for the different concentrations.

2a A beaker is not an accurate way of measuring volume. First, it is quite wide, so you have to add quite a lot of liquid before you can see a measurable change in the height of the meniscus. Secondly, the scale on a beaker usually has quite large intervals on it.

b He should use a measuring cylinder.

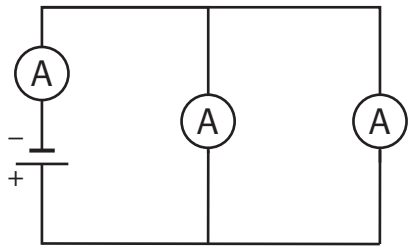
3 If Amal collects the gas over water, some of the carbon dioxide that is produced in the reaction will dissolve in the water and will not go into the measuring cylinder. But if he uses a gas syringe, all of the carbon dioxide should be measured in the gas syringe.

4 Suggestions could include: repeating his experiment several times and calculating mean volumes for each concentration; using a smaller container for the acid and marble chips, so that there is less air to be displaced; he could measure the mass of marble chips, instead of just using one spatula-full.

9.3 Measuring current in parallel circuits

1 The two lamps are not the same as each other.

2



Note that it is fine for the circuit to contain lamps as well.

Jon should set up the circuit as in the diagram. He should read the value of the current on each ammeter. The readings for the two ammeters in the branches should add up to the reading for the ammeter next to the cell.

Jon should repeat his experiment at least three times (and preferably more), using different cells, so that the current is different, to check whether the readings for the two ammeters in the branches **always** adds up to the reading for the ammeter next to the cell.

He could also repeat it with lamps in the circuit, perhaps with different numbers of lamps in each branch of the circuit, to see if the readings for the two ammeters in the branches **always** adds up to the reading for the ammeter next to the cell.

10.1 Inheritance

1a Amal is correct.

b Nor is correct.

2 Look for:

- an answer that is written in complete sentences
- the idea that **genes** from the parents are contained in egg cells and sperm cells, which are **gametes**
- the idea that genes are contained in **chromosomes**
- the idea that gametes fuse together to form a **zygote**, which gives rise to a new organism.

3 Look for:

- an answer that is written in complete sentences
- the idea that Anna inherits half her genes from her father, and the other half from her mother
- the idea that one of the genes that Anna inherits from her father is a gene for dark hair, and that one of the genes that she inherits from her mother is a gene for blue eyes
- more detail about how this inheritance happens – for example, correct reference to gametes, zygote, chromosomes or nucleus.

10.2 Rutherford's discoveries about the atom

1a Sam is correct.

b Elsa is correct.

2a Look for:

- an answer that is written in complete sentences
- Rutherford fired particles that were smaller than atom
- He fired them at gold foil
- He measured how many of the particles were deflected as they passed through the foil.

b Look for:

- an answer that is written in complete sentences
- Rutherford thought that if most particles were not deflected, then the gold atoms must be mostly empty space
- this helped him to come up with the idea of a nucleus with electrons circling around it, with lots of space in between.

10.3 Turning forces

1 Anna can move towards the pivot.

2 Look for:

- an answer written in complete sentences, which follow a sensible sequence
- the idea that each girl exerts a turning force on the seesaw
- the idea that the size of the turning force depends on the force (weight) multiplied by the distance from the pivot
- the idea that Anna's weight is greater than Elsa's, so if they sit at the same distance from the pivot, the turning force produced by Anna is greater than that produced by Elsa
- the idea that if Anna moves towards the pivot then the distance is reduced, so her turning force is reduced.