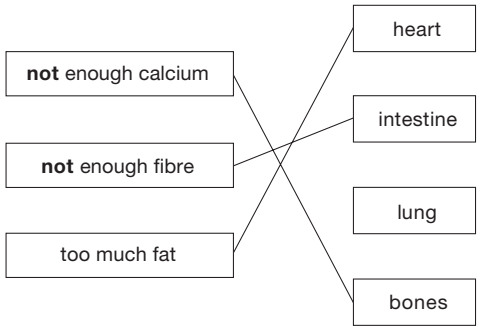
Tier 3–6	Q No 1	4/2e that forces can cause objects to turn about a pivot 4/2f the principle of moments and its application to situations involving one pivot	Tier 3–6	Q No 1

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* down		
(b)	1	* Ellie and Maggy		names may be in either order **both** names are required for the mark do ***not*** accept '540 and 540' this rules out the same person being used twice
(c)	1	* A: up; B: down		award the mark if only one of these correct responses is given provided an incorrect response is not written in the other box
(d)	1	any **one** from * Rosie * Jack * Rosie or Jack		*do **not** accept* '490' *do **not** accept* '510' *do **not** accept* '490 **or** 510' *do **not** accept* 'Rosie and Jack'
Total	**4**			

Tier 3–6	Q No 2	4/2b 4/4a	that the weight of an object on Earth is the result of the gravitational attraction between its mass and that of the Earth how the movement of the Earth causes the apparent daily and annual movement of the Sun and other stars	Tier 3–6	Q No 2

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* four arrows, all towards the centre of the Earth  		**all four** arrows, correctly drawn, are required for the mark the arrows may be drawn outside the Earth
(ii)	1	* ball hanging towards the centre of the Earth at B, C and D		**all three** positions, B, C and D, are required for the mark
(b) (i)	1	* 365 days	accept '365'	
(ii)	1	* 24 hours	accept '24'	
Total	**4**			

Tier 3–6	Q No 3			Tier 3–6	Q No 3
		4/5a	about the variety of energy resources, including oil, gas, coal, biomass, food, wind, waves and batteries, and the distinction between renewable and non-renewable resources		
		4/5c	that electricity is generated by means of a variety of energy resources		

Part	Mark	Answer	Accept	Additional guidance
(a)	1 1	* oil * natural gas	 accept 'gas'	answers may be in either order
(b) (i)	2	any **two** from * wind * solar * tidal * biomass * geothermal		answers may be in either order
(ii)	2	* C E A B D		if all three letters are correct, award two marks if one letter is correct, award one mark
Total	**6**			

Tier 3–6	Q No 4			Tier 3–6	Q No 4
		1/1b	that it is important to test explanations by using them to make predictions and by seeing if evidence matches the predictions		
		1/2a	use scientific knowledge and understanding to turn ideas into a form that can be investigated, and to decide on an appropriate approach		
		1/2c	carry out preliminary work and to make predictions, where appropriate		
		1/2d	consider key factors that need to be taken into account when collecting evidence, and how evidence may be collected in contexts, *for example, fieldwork*, *surveys*, in which the variables cannot readily be controlled		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* Glossy **or** it would have more **or** higher bubbles than the others	accept 'more bubbles'	*do **not** accept* 'lots of bubbles'
(b)	1	any **one** from * to make the test fair * if they use different amounts it will be unfair	accept 'it is a controlled experiment'	
(c)	1	any **one** from * they could not compare the amounts of bubbles * they could not compare them * they could not tell which was better * they could not tell the difference * they could not know which made the most bubbles	accept 'they were all the same' accept an appropriate practical problem which would prevent the collection of valid results such as 'the bung stops the bubbles' **or** 'the test-tubes are not long enough' **or** 'they used too much washing-up liquid'	*do **not** accept* 'the bubbles all went to the top' *do **not** accept* 'they could not see how many bubbles there were'
(d)	1	any **one** from * Shine will have most bubbles * Shine will make most froth	accept 'Shine made the most bubbles' accept 'Shine would produce more bubbles than glossy'	
Total	**4**			

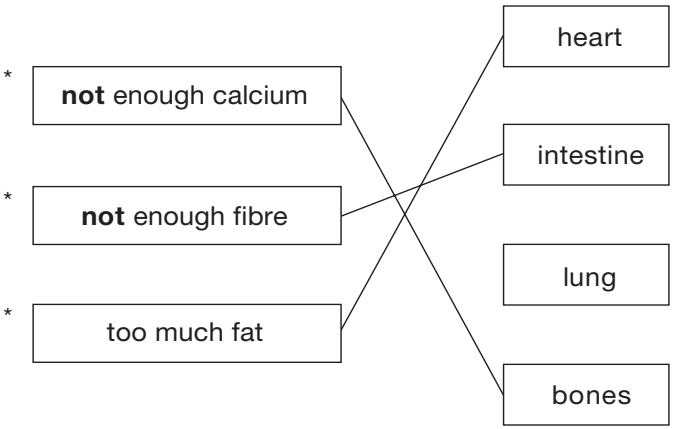
Tier 3–6	Q No 5	1/2j 3/3d	use diagrams, tables, charts and graphs, including lines of best fit, to identify and describe patterns or relationships in data to use indicators to classify solutions as acidic, neutral or alkaline, and to use the pH scale as a measure of the acidity of a solution	Tier 3–6	Q No 5

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* 7		*do **not** accept* 'neutral'
(ii)	1	* it was neutral ✓		if more than one box is ticked, award no mark consequential marking applies accept 'it was acidic' if the answer to part (i) was less than 7 accept 'it was alkaline' if the answer to part (i) was greater than 7 and up to 14
(b)	1	any **one** from * it decreased **or** went down * it became acidic **or** more acidic	accept 'it dropped to 5'	
(c)	1	* an alkali ✓		if more than one box is ticked, award no mark
Total	**4**			

Tier 3–6	Q No 6			Tier 3–6	Q No 6
		3/2c	to relate changes of state to energy transfers		
		3/2e	about the formation of rocks by processes that take place over different timescales, and that the mode of formation determines their texture and the minerals they contain		
		3/2f	how igneous rocks are formed by the cooling of magma, sedimentary rocks by processes including the deposition of rock fragments or organic material, or as a result of evaporation, and metamorphic rocks by the action of heat and pressure on existing rocks		
		3/2h	that virtually all materials, including those in living systems, are made through chemical reactions, and to recognise the importance of chemical change in everyday situations, *for example, ripening fruit, setting superglue, cooking food*		

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* C		
(ii)	1	* A		
(iii)	1	* D		
(b)	1	* igneous rock ✓		if more than one box is ticked, award no mark
(c)	1	* water is heated to form water vapour ✓		if more than one box is ticked, award no mark
(d) (i)	1	* skeleton **or** bones	accept 'spine' **or** 'backbone' **or** 'ribs' **or** 'skull' accept 'scales'	
(ii)	1	* fossils		
Total	**7**			

Tier 3–6	Q No 7	1/2j 1/2k 2/2d	use diagrams, tables, charts and graphs, including lines of best fit, to identify and describe patterns or relationships in data use observations, measurements and other data to draw conclusions that food is used as a fuel during respiration to maintain the body's activity and as a raw material for growth and repair	Tier 3–6	Q No 7

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* water		
(ii)	1	* skin **or** peel		
(b)	1	* 18 28		answers must be in the correct order **both** answers are required for the mark
(c)	1 1 1	* **not** enough calcium * **not** enough fibre * too much fat  		if more than one line is drawn from any fact about the diet, award no mark for that fact
Total	**6**			

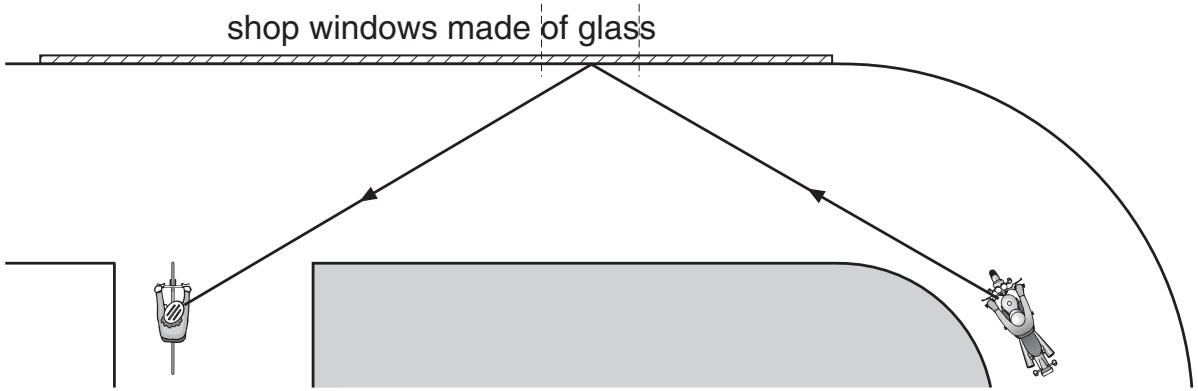
Tier 3–6	Q No 8	2/3a 2/3d	that plants need carbon dioxide, water and light for photosynthesis, and produce biomass and oxygen the role of root hairs in absorbing water and minerals from the soil	Tier 3–6	Q No 8

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	any **one** from * to make food **or** glucose **or** sugar **or** starch * photosynthesis	 accept 'for growth'	
(ii)	1	any **one** from * there is not enough light * there is less light	 accept 'no light' **or** 'no Sun' accept 'light cannot reach them'	 *do **not** accept* 'because plants need light'
(b)	2	any **two** from * oxygen * water * minerals **or** nutrients	 accept a named mineral such as 'nitrate' accept for two marks two named minerals such as 'nitrates' and 'phosphates'	
(c)	1	* B ✓		if more than one box is ticked, award no mark
Total	**5**			

Tier 3–6	Q No 9	2/4b 2/5b 2/5e	to classify living things into the major taxonomic groups that habitats support a diversity of plants and animals that are interdependent about food webs composed of several food chains, and how food chains can be quantified using pyramids of numbers	Tier 3–6	Q No 9

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* producer		
(ii)	1	* predator		
(iii)	1	any **one** from * prey * herbivore		
(b)	1	any **one** from * they had less food * they would decrease	accept 'no food' **or** 'they died out' **or** 'they died'	
(c)	1	* reptiles ✓		if more than one box is ticked, award no mark
Total	**5**			

Tier	Q No			Tier	Q No
3–6	10	4/3a	that light travels in a straight line at a finite speed in a uniform medium	3–6	10
5–7	1	4/3c	how light is reflected at plane surfaces	5–7	1
		BS/1a	a range of domestic, industrial and environmental contexts		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* B ✓		if more than one box is ticked, award no mark
(b) (i)				
	1	* a continuous straight line from Joan's motor bike to the glass, and then from the glass to Nadia's head		the incident ray and the reflected ray must touch the glass at the same point
	1	* angle of incidence must be approximately equal to the angle of reflection		the incident ray must hit the mirror within the tolerance shown
	1	* an arrow pointing away from Joan's motor bike on either section of the ray		
(ii)	1	any **one** from * traffic coming round the bend **or** at the junction will be seen * Nadia **or** Joan **or** you can see round the bend		
Total	**5**			

Tier 3–6 5–7	**Q No 11 2**	4/3k 4/5e	the relationship between the pitch of a sound and the frequency of the vibration causing it ways in which energy can be usefully transferred and stored	**Tier 3–6 5–7**	**Q No 11 2**

Part	**Mark**	**Answer**	**Accept**	**Additional guidance**
(a) (i)	1	* electrical to chemical ✓		if more than one box is ticked, award no mark
(ii)	1	* chemical to electrical to sound ✓		if more than one box is ticked, award no mark
(b)	1 1 1	* Q * R * P		
Total	**5**			

Tier 3–6 5–7	Q No 12 3	4/2c	that unbalanced forces change the speed or direction of movement of objects and that balanced forces produce no change in the movement of an object	Tier 3–6 5–7	Q No 12 3
		4/2d	ways in which frictional forces, including air resistance, affect motion, *for example, streamlining cars, friction between tyre and road*		

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	2	any **two** from * gravity **or** weight * friction * reaction * air resistance	 accept 'upthrust' accept 'drag'	 *do **not** accept* 'centrifugal force' **or** 'centripetal force' **or** 'g-force'
(ii)	1	any **one** from * constant speed * steady speed * it stays the same	 accept 'it is the same' **or** 'it does not change'	
(b)	1	* friction is less		'it is smoother' **or** 'it is slippery' are insufficient
(c)	1 1	* it increases * because there is less air resistance **or** friction	accept 'he goes more quickly' accept 'he is streamlined **or** aerodynamic'	
Total	**6**			

Tier 3–6 5–7	Q No 13 4			Tier 3–6 5–7	Q No 13 4
		1/1a	about the interplay between empirical questions, evidence and scientific explanations using historical and contemporary examples, *for example, Lavoisier's work on burning, the possible causes of global warming*		
		1/1b	that it is important to test explanations by using them to make predictions and by seeing if evidence matches the predictions		
		1/2d	consider key factors that need to be taken into account when collecting evidence, and how evidence may be collected in contexts, *for example, fieldwork, surveys*, in which the variables cannot readily be controlled		
		1/2e	decide the extent and range of data to be collected and the techniques, equipment and materials to use, *for example, appropriate sample size for biological work*		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* No ✓ **and** any **one** from		if more than one box is ticked, award no mark **both** the answer and the explanation are required for the mark
		* sulphuric acid did not cure scurvy	accept 'some acids did not cure scurvy'	
		* not all the sailors recovered	accept 'only pair 5 totally recovered'	
		* only two pairs recovered		
		* only those that had fruit-related additions recovered		
		* some with acid failed to recover		'only those who received vitamin C recovered' is insufficient
		* a week is not long enough to show the effect	accept 'a week is not long enough'	
(b) (i)	1	any **one** from		
		* addition to their diet		*do **not** accept* 'type of food **or** drink'
		* food **or** drink supplements		*do **not** accept* 'kind of meal'
		* type of acid	accept 'the acid' accept 'amount of acid'	
				*do **not** accept* conclusions such as '4 out of 6 pairs of sailors had scurvy'
(ii)	1	any **one** from		
		* whether they recovered		
		* return to health		
		* recovery from scurvy	accept 'scurvy is cured'	
		* effect after one week		*do **not** accept* 'time to recover'

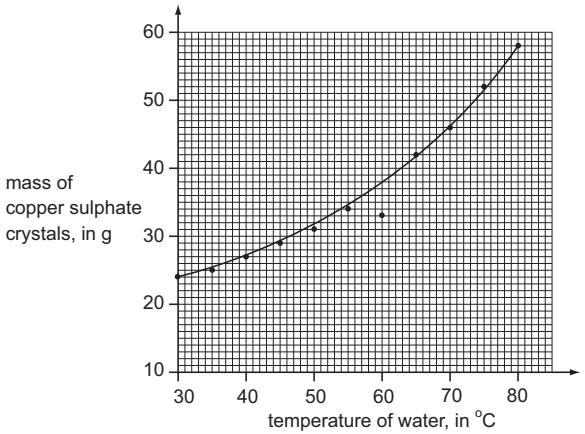
Tier 3–6 5–7	Q No 13 4		Tier 3–6 5–7	Q No 13 4

Part	Mark	Answer	Accept	Additional guidance
(c)	1	any **one** from * there must be a different substance **or** something present in fruits that cures scurvy	accept 'fruits will cure scurvy' accept 'vitamin in the fruit would cure scurvy' accept 'vitamin C will cure scurvy' accept any named vitamin for vitamin C accept 'vitamins would have an effect'	'the acids in oranges and lemons cure scurvy' is insufficient 'oranges and lemons will cure scurvy' is insufficient
(d)	1	any **one** from * effects due to diet may take more than a week to reveal themselves * the body takes time to adjust to the diet * time is needed for the results to reveal themselves * the effects do not take place before a week * the longer the time the more reliable the results	accept 'one week is too short' **or** 'you need to see long term effects' accept 'oranges **or** lemons might be a short term cure'	
Total	**5**			

Tier 3–6 5–7	Q No 14 5	3/1e 3/2d BS/2b	how elements combine through chemical reactions to form compounds, *for example, water, carbon dioxide, magnesium oxide, sodium chloride, most minerals*, with a definite composition how forces generated by expansion, contraction and the freezing of water can lead to the physical weathering of rocks recognise that there are hazards in living things, materials and physical processes, and assess risks and take action to reduce risks to themselves and others	Tier 3–6 5–7	Q No 14 5

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* water	accept 'H_2O'	
(ii)	1	* carbon dioxide	accept 'CO_2'	
(b) (i)	1	* do not use antifreeze **or** methanol near a naked flame and do not swallow	accept 'it catches fire easily and it is poisonous' accept 'wash hands after use' for do not swallow accept 'it is flammable **or** inflammable and it is poisonous'	**both** answers are required for the mark
(ii)	1	any **one** from * water froze * the mixture froze * the contents froze	accept '10% antifreeze is not enough to stop the water freezing'	'not enough antifreeze used' is insufficient *do **not** accept* 'it froze'
	1	* and expanded		
Total	**5**			

Tier 3–6 5–7	Q No 15 6			Tier 3–6 5–7	Q No 15 6
		1/2j 1/2n	use diagrams, tables, charts and graphs, including lines of best fit, to identify and describe patterns or relationships in data consider anomalies in observations or measurements and try to explain them		

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* the point at (60,33) circled		
(ii)	1	* a smooth curve touching all points except the anomalous point at 60°C  	accept a reasonable smooth curve	the curve must be near to **or** touching all points except the anomalous point *do **not** accept* a dot to dot drawing *do **not** accept* lines which are thicker than the points if the points are not visible the lines are too thick
(iii)	1	* 38	accept answers from 37 to 39	
(b)	1	any **one** from * they measured mass **or** temperature inaccurately * they failed to make sure the solution was saturated * the solution had cooled	accept 'they counted the mass wrong' accept 'not enough time to dissolve' accept 'they did not stir the solution properly' accept 'they did not use enough water'	*do **not** accept* 'carelessness' **or** 'measured it wrong' *do **not** accept* 'it was not a fair test' *do **not** accept* 'they measured in wrong units' *do **not** accept* 'they wrote it down wrong'
Total	**4**			

Tier 3–6 5–7	Q No 16 7	2/1c 2/2i	ways in which some cells, including ciliated epithelial cells, sperm, ova, and root hair cells, are adapted to their functions the role of lung structure in gas exchange, including the effect of smoking	Tier 3–6 5–7	Q No 16 7

Part	Mark	Answer	Accept	Additional guidance
(a)	1	any **one** from * to prevent it collapsing * to keep it open * for support	accept 'protects against collapse' accept 'for strength' accept 'for flexibility'	'for protection' is insufficient
(b) (i)	1	* *A*: oxygen *B*: carbon dioxide	accept 'O_2' accept 'CO_2'	**both** answers are required for the mark
(ii)	1	any **one** from * it is thin * it is one cell thick * it is close to the blood supply	 accept 'there is a diffusion gradient' accept 'it is moist'	
(c) (i)	1	any **one** from * it moves mucus * it sweeps dust from lungs	 accept 'it moves bacteria'	'to clear **or** clean the airways' is insufficient
(ii)	1	any **one** from * it paralyses the cilia * it stops the cilia working * it clogs the cilia	 accept 'it destroys them'	 *do **not** accept* 'it kills cilia'
(iii)	1	* nicotine		
Total	**6**			

Tier 3–6 5–7	Q No 17 8	2/2g about the human reproductive system, including the menstrual cycle and fertilisation 2/2h how the foetus develops in the uterus, including the role of the placenta	Tier 3–6 5–7	Q No 17 8

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* the nucleus of the egg and the nucleus of the sperm join **or** fuse	accept 'the sperm and the egg join' accept 'a sperm fertilises an egg'	'a sperm meets an egg' is insufficient
(ii)	1	* the oviduct **or** fallopian tube		
(iii)	1	* uterus	accept 'womb'	
(b)	1	any **one** from * the egg cannot pass down the oviduct * the sperm and egg cannot meet * sperm cannot get through		*do **not** accept* 'the egg cannot reach the uterus'
(c)	1	any **one** from * muscles contract * contractions		
Total	**5**			

Tier 3–6 5–7	Q No 18 9			Tier 3–6 5–7	Q No 18 9
		3/1g	that mixtures, *for example, air, sea water and most rocks*, are composed of constituents that are not combined		
		3/1h	how to separate mixtures into their constituents using distillation, chromatography and other appropriate methods		
		3/2f	how igneous rocks are formed by the cooling of magma, sedimentary rocks by processes including the deposition of rock fragments or organic material, or as a result of evaporation, and metamorphic rocks by the action of heat and pressure on existing rocks		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	any **one** from * it contains more than one substance which are not chemically combined * they can be separated by physical means **or** by sedimentation **or** filtration * she sees a red and a brown layer	 accept 'substances are not combined' accept 'they can be separated easily' accept 'there are layers' accept 'it splits into sand and clay'	
(b) (i)	1	any **one** from * heat the liquid * evaporate the water	 accept 'leave it until the water had gone' accept 'leave it on a radiator' accept 'distill it'	mark parts (b) (i) and (b) (ii) together 'leave it' is insufficient
(ii)	1	* a deposit left behind	accept 'a deposit' **or** 'a salt' **or** 'a solid' **or** 'crystals'	
(c)	1	* transported deposited compacted		**all three** processes in the correct order are required for the mark
Total	**4**			