Sc

KEY STAGE 3

LEVELS 3–7

2003

Science tests

Mark scheme for Papers 1 and 2

2003

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Introduction

The test papers will be marked by external markers. The markers will follow the mark scheme in this booklet, which is provided here to inform teachers.

This booklet includes the mark scheme for paper 1 and paper 2 in both tiers.

The structure of the mark scheme for tiers 3–6 and 5–7

The mark scheme for each question shows:

- the teaching points from the key stage 3 programme of study;
- the marks available for each part of the question;
- the total marks available for the question;
- the answer or answers expected, indicated by an asterisk;
- acceptable alternatives to the given answer;
- additional guidance to assist markers in making professional judgements.

When a question appears in an identical form in both tiers, the answers to the question are given only once in the mark scheme. For clarity, both question numbers are given. The following example, from tier 3–6 paper 1 question 12 and from tier 5–7 paper 1 question 2, illustrates this.

Tier	**Q No**			**Tier**	**Q No**
3–6	**12**	1/2k	use observations, measurements and other data to draw conclusions	**3–6**	**12**
5–7	**2**	2/2i	the role of lung structure in gas exchange, including the effect of smoking	**5–7**	**2**
		3/2i	about possible effects of burning fossil fuels on the environment, *for example, production of acid rain, carbon dioxide and solid particles*, and how these effects can be minimised		

Part	**Mark**	**Answer**	**Accept**	**Additional guidance**
(a) (i)				answers may be in either order
	1	*Amy *and* Kisham		**both** answers are required for the mark
(ii)	1	any **one** from *traffic pollution **or** air pollution *passive smoking *faulty gas fires **or** faulty gas heaters		'pollution' is insufficient

Where more than one answer is acceptable, this is indicated in the mark scheme by 'any **one** from'. Each possible correct answer is marked with an asterisk. In some cases, alternative answers are indicated by '**or**'.

In the following example from part (b) of tier 3–6 paper 2 question 8, an answer giving 'water' and 'minerals' will be awarded two marks. However, an answer which gives 'minerals' and 'nitrates' will be given only one mark, as both points are correct answers for the same mark.

Part	Mark	Answer	Accept	Additional guidance
(b)	2	any **two** from *oxygen *water *minerals **or** nutrients	accept a named mineral such as 'nitrate' accept two named minerals such as 'nitrates' and 'phosphates' for two marks	

In the following example, from part (b) of tier 3–6 paper 1 question 2, the statement in **bold type** in the '**Additional guidance**' column is given in order to indicate the general requirements of that part of the question.

Part	Mark	Answer	Accept	Additional guidance
(b)	1	any **one** from * how many seeds germinated at different temperatures? * how many seeds grew **or** started to grow at different temperatures? *how long does it take seeds to grow **or** germinate at different temperatures?	accept 'which seeds grow at different temperatures?' accept 'how does temperature affect germination?' accept 'which is the best temperature for seeds to grow?' accept statements which are not framed as questions such as 'the number of seeds germinating at different temperatures'	**the answer must include both a dependent and an independent variable** award one mark for identifying temperature as the independent variable and either the number of seeds germinating **or** the time taken to germinate as the dependent variable *do **not** accept* a conclusion such as 'more seeds grew at higher temperatures' *do **not** accept* 'how long does it take for lettuce seeds to germinate?' as there is no reference to temperature

In the '**Accept**' column there may be:

- examples of answers which are acceptable, although they do not correspond exactly to the expected answers;
- some examples of higher level answers, which could be given by higher attaining pupils answering questions on the lower levels in the tier.

In the '**Additional guidance**' column there may be:

- examples of answers which are not acceptable;

- a reminder, in questions involving calculations, that consequential marking may be used;
- instructions on action in the event of consequential marking (see below);
- guidance to markers where pupils have not followed the instructions on the question.

Marking

The number of marks available for each part of a question and the maximum number of marks for the question as a whole are shown on the test paper. Every part of a question which has been attempted by a pupil will be marked and an indication given where every mark has been awarded. Half marks will not be given in any question.

The total number of marks awarded for all the parts of questions on a double page will be written in the box at the bottom of the right-hand page. This is the only number that markers will write on a pair of facing pages. In many instances, this will be the sum of marks awarded for two questions. The total number of marks obtained on the paper will be recorded on the front of the test paper.

The total number of marks available is 180 in tier 3–6 and 150 in tier 5–7.

Using professional judgement in marking

The instructions given in the mark scheme will enable the markers to decide whether pupils have correctly answered a particular question. However, there will be instances where an answer given by a pupil does not correspond to any of the possible responses shown in the mark scheme. In such cases, markers will apply their professional judgement to decide if credit should be given. They will consider whether the response:

- is equivalent to those listed;
- conveys the ideas underlying the question as outlined in the statement in the '**Additional guidance**' column in the mark scheme, if one is given.

If any doubt persists, markers will consult with their supervisors for guidance.

Marking misspellings of words

If a pupil misspells a word, markers will apply the following procedures:

- if it is clear that the pupil has made a simple error, eg 'tow' for 'two' or 'Son' for 'Sun', then the incorrect spelling will be accepted and the mark awarded;
- if a pupil misspells a word copied from the text of the question or from a selection given, and the new word does not have any inappropriate meaning, the incorrect spelling will be accepted and the mark awarded;
- if specific scientific vocabulary is required in the answer, a creditworthy misspelling must be a phonetic equivalent of the required word, with the major syllables of the correct word represented in the answer.

Marking lists of alternative answers

In some instances, pupils give more than one answer to a single question. If any of the answers given is incorrect, the mark will not be awarded, irrespective of the order in which the answers are given. In some cases, a correct answer is given alongside other answers which, while correct, would be insufficient for the mark. In these cases, the mark will be given for the correct answer.

Marking questions containing calculations

Some questions require pupils to perform calculations. Where two marks are available, they are advised to show their working. Pupils who do not show their working but give the correct answer will be awarded full marks.

The result of one calculation may be required in order to carry out further calculations. In such instances:

- the term 'consequential marking' appears in the '**Additional guidance**' column;
- a pupil's result for the first calculation is treated as the starting point for the second;
- the pupil is awarded full credit for the second calculation if it is carried out correctly, even if the result of the first calculation was wrong.

Marking answers given in the wrong place

In some cases, pupils may write correct answers in the wrong part of the question. Markers will use professional judgement to decide whether a pupil has correctly understood the question and simply written the answer in the wrong place. Similarly, if pupils identify an answer by a cross or other indication when a tick is required, they will be given credit for their responses.

Awarding levels

The sum of the marks gained on both papers determines the level awarded. A copy of the level threshold tables which show the mark ranges for the award of different levels will be sent to each school by QCA in July 2003.

Schools will be notified of pupils' results by means of a marksheet, which will be returned to schools by the External Marking Agency with the pupils' marked scripts. The marksheet will include pupils' scores on the test papers and the levels awarded.

The 2003 key stage 3 science tests and mark schemes were developed by the University of Cambridge Local Examinations Syndicate and the Centre for Research into Primary Science and Technology (CRIPSAT) on behalf of QCA.

Mark Allocation Grid: Tier 3–6

TIER 3–6 Paper 1

Q	Sc1		Sc2		Sc3		Sc4	
1				6				
2		4						
3				4				
4						5		
5						6		
6		1				3		1
7		1						2
8		4						
9		3						1
10								4
11				6				
12		1		2		1		
13				7				
14						6		
15						7		
16						1		4
17								6
18		4						
Total		18		25		29		18

TIER 3–6 Paper 2

Q	Sc1		Sc2		Sc3		Sc4	
1								4
2								4
3								6
4		4						
5		2				2		
6						7		
7		3		3				
8				5				
9				5				
10		1						4
11								5
12								6
13		5						
14		1				4		
15		4						
16				6				
17				5				
18						4		
Total		20		24		17		29

Total P1 + 2		38		49		46		47	Overall
									180

Mark Allocation Grid: Tier 5–7

TIER 5–7 Paper 1

Q	Sc1	Sc2	Sc3	Sc4
1		6		
2	1	2	1	
3		7		
4			6	
5			7	
6			1	4
7				6
8	4			
9		5		
10		4		
11	2		4	
12			5	
13	2			4
14				4
Total	**9**	**24**	**24**	**18**

TIER 5–7 Paper 2

Q	Sc1	Sc2	Sc3	Sc4
1	1			4
2				5
3				6
4	5			
5	1		4	
6	4			
7		6		
8		5		
9			4	
10	5			
11				5
12	4			
13			6	
14		6		
15	4			
Total	**24**	**17**	**14**	**20**

Total P1 + 2	Sc1	Sc2	Sc3	Sc4	Overall
	33	**41**	**38**	**38**	**150**

The requirements of the Introduction to the Programme of Study apply across Sc1, Sc2, Sc3 and Sc4.

The Mark Allocation Grids on this pair of pages show the context of these questions in relation to Sc1, Sc2, Sc3 and Sc4.

Tier 3–6	Q No 1	2/4a about environmental and inherited causes of variation within a species 2/4c that selective breeding can lead to new varieties	Tier 3–6	Q No 1

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* *feature:* strong muscles	accept 'muscles'	features may be in either order
	1	* *reason:* to pull a sledge **or** to carry a load		each reason must correspond to the correct feature
	1	* *feature:* thick fur	accept 'fur'	
	1	* *reason:* to keep them warm **or** to trap air	accept 'to insulate them'	*do **not** accept* 'to keep the cold out'
(b) (i)	1	* variation ✓		if more than one box is ticked, award no mark
(ii)	1	* information passed from the mother in an egg ✓		if more than one box is ticked, award no mark
Total	**6**			

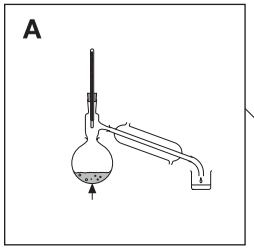
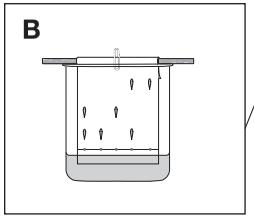
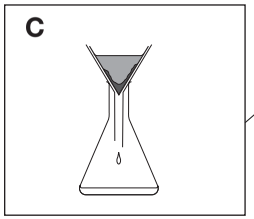
Tier 3–6	Q No 2			Tier 3–6	Q No 2
		1/2a	use scientific knowledge and understanding to turn ideas into a form that can be investigated, and to decide on an appropriate approach		
		1/2i	use a wide range of methods, including diagrams, tables, charts, graphs and ICT, to represent and communicate qualitative and quantitative data		
		1/2k	use observations, measurements and other data to draw conclusions		
		1/2o	consider whether the evidence is sufficient to support any conclusions or interpretations made		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* 0	accept the correct answer written outside the table	
(b)	1	any **one** from * how many seeds germinated at different temperatures? * how many seeds grew or started to grow at different temperatures? * how long does it take seeds to grow **or** germinate at different temperatures?	accept 'which seeds grow at different temperatures?' accept 'how does temperature affect germination?' accept 'which is the best temperature for seeds to grow?' accept statements which are not framed as questions such as 'the number of seeds germinating at different temperatures'	**the answer must include both a dependent and an independent variable** award one mark for identifying temperature as the independent variable and either the number of seeds germinating **or** the time taken to germinate as the dependent variable *do **not*** accept a conclusion such as 'more seeds grew at higher temperatures' *do **not*** accept 'how long does it take for lettuce seeds to germinate?' as there is no reference to temperature
(c)	2	* true ✓ cannot tell ✓ false ✓ false ✓		if **all four** answers are correct, award two marks if three **or** two answers are correct, award one mark if more than one box is ticked in any row, award no mark for that row
Total	**4**			

Tier 3–6	Q No 3			Tier 3–6	Q No 3
		2/1a	that animal and plant cells can form tissues, and tissues can form organs		
		2/1c	ways in which some cells, including ciliated epithelial cells, sperm, ova, and root hair cells, are adapted to their functions		
		2/1d	that fertilisation in humans and flowering plants is the fusion of a male and female cell		
		2/2g	about the human reproductive system, including the menstrual cycle and fertilisation		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* cells ✓		if more than one box is ticked, award no mark
(b)	1	* tail		
(c)	1	* testis **or** testicle	accept plurals	
(d)	1	* fertilisation ✓		if more than one box is ticked, award no mark
Total	**4**			

Tier 3–6	Q No 4	3/1h how to separate mixtures into their constituents using distillation, chromatography and other appropriate methods	Tier 3–6	Q No 4

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* A  chromatography		if more than one line is drawn from a diagram, award no mark for that diagram
	1	* B  distillation		
	1	* C  filtration		
		crystallisation		
(b) (i)	1	* C	accept 'filtration'	
(ii)	1	* A	accept 'distillation'	
Total	**5**			

Tier 3–6	Q No 5			Tier 3–6	Q No 5
		3/1d	how elements vary widely in their physical properties, including appearance, state at room temperature, magnetic properties and thermal and electrical conductivity, and how these properties can be used to classify elements as metals or non-metals		
		3/1h	how to separate mixtures into their constituents using distillation, chromatography and other appropriate methods		
		3/3a	how metals react with oxygen, water, acids and oxides of other metals, and what the products of these reactions are		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* an element ✓		if more than one box is ticked, award no mark
(b) (i)	1	* it stays shiny		
(ii)	1	* it conducts electricity		answers may be in either order
	1	* it conducts heat	accept 'it conducts' for one mark if neither of the fully correct answers is given accept 'it stays shiny'	
(c)	1	* water		
(d)	1	any **one** from * a magnet * an electromagnet		
Total	**6**			

Tier 3–6	Q No 6			Tier 3–6	Q No 6
		1/2j	use diagrams, tables, charts and graphs, including lines of best fit, to identify and describe patterns or relationships in data		
		3/1b	how the particle theory of matter can be used to explain the properties of solids, liquids and gases, including changes of state, gas pressure and diffusion		
		3/1e	how elements combine through chemical reactions to form compounds, *for example, water, carbon dioxide, magnesium oxide, sodium chloride, most minerals*, with a definite composition		
		3/2i	about possible effects of burning fossil fuels on the environment, *for example, production of acid rain, carbon dioxide and solid particles*, and how these effects can be minimised		
		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		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* ethanol **or** alcohol		if more than one box is ticked, award no mark
(b)	1	any **one** from * burning hydrogen does not produce carbon monoxide * burning hydrogen does not produce sulphur dioxide * burning hydrogen only produces water * burning petrol causes acid rain	 accept 'petrol **or** ethanol **or** alcohol produces carbon monoxide' accept 'petrol produces sulphur dioxide' accept 'hydrogen **or** ethanol **or** alcohol does not cause acid rain'	
(c)	1	* hydrogen	accept 'H_2' accept 'gas'	
(d)	1	* oxygen ✓		if more than one box is ticked, award no mark
(e)	1	any **one** from * it can be grown * it can be replanted * it is renewable * it can be reproduced	 accept 'it does not take long to grow' accept 'it can be replaced' accept 'it produces seeds'	
Total	**5**			

Tier 3–6	**Q No 7**	1/2k 4/4b 4/5g	use observations, measurements and other data to draw conclusions the relative positions of the Earth, Sun and planets in the solar system that although energy is always conserved, it may be dissipated, reducing its availability as a resource	**Tier 3–6**	**Q No 7**

Part	**Mark**	**Answer**	**Accept**	**Additional guidance**
(a)	1	* The Moon is nearer to the Earth than the Sun is. ✓		if more than one box is ticked, award no mark
(b) (i)	1	* 11.16	accept any number from 11.15 to 11.17	
(ii)	1	* it decreased **or** went down		**both** the answer and the reason are required for the mark
		because the Moon blocked the Sun's heat **or** rays **or** radiation	accept 'there was no sunlight to give heat' accept 'there was no Sun to make it warm' accept 'there was no heat from the Sun' accept 'there was no Sun'	*do **not** accept* 'it blocked the Sun's light'
Total	**3**			

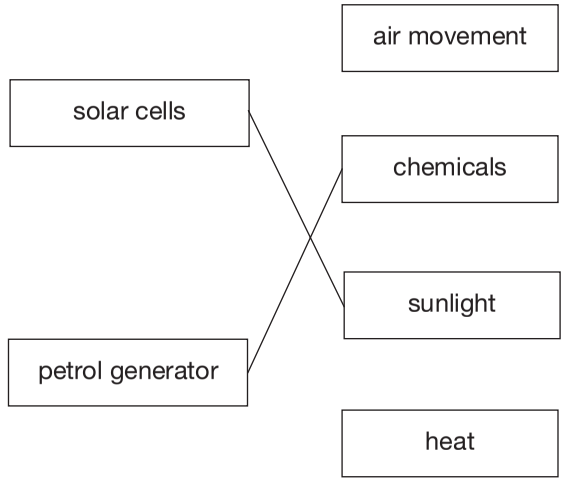
Tier 3–6	Q No 8			Tier 3–6	Q No 8
		1/2c	carry out preliminary work and to make predictions, where appropriate		
		1/2d	consider key factors that need to be taken into account when collecting evidence, and how evidence may be collected in contexts, *for example, fieldwork, surveys*, in which the variables cannot readily be controlled		
		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*		
		1/2k	use observations, measurements and other data to draw conclusions		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* ruler ✓		if more than one box is ticked, award no mark
(b)	1	any **one** from * tubes had different widths * the tubes had different bores * he blew in different ways * different thickness of paper * different paper	accept 'tubes had different shapes' accept 'tubes were different sizes' accept 'tubes are one big, one medium, one little'	*do **not** accept* 'different lengths'
(c)	1	* the longer tube will make a lower sound ✓		if more than one box is ticked, award no mark
(d)	1	* 5		
Total	**4**			

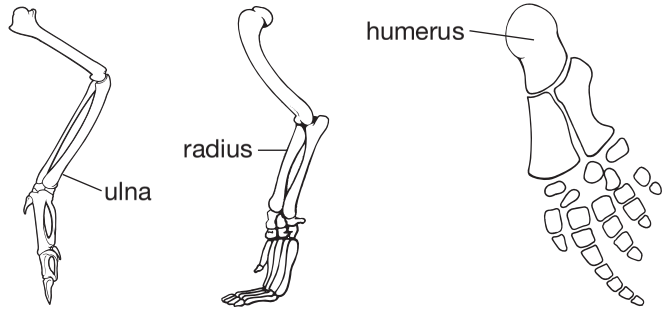
Tier 3–6	Q No 9			Tier 3–6	Q No 9
		1/2i	use a wide range of methods, including diagrams, tables, charts, graphs and ICT, to represent and communicate qualitative and quantitative data		
		1/2j	use diagrams, tables, charts and graphs, including lines of best fit, to identify and describe patterns or relationships in data		
		1/2k	use observations, measurements and other data to draw conclusions		
		4/3i	that light can travel through a vacuum but sound cannot, and that light travels much faster than sound		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	any **one** from * light travels faster than sound * sound travels more slowly than light	 accept 'light travels faster' accept 'sound travels slower' accept 'light is faster than sound'	 *do **not** accept* 'light travels fast' or 'sound travels slow' *do **not** accept* 'light travels before sound'
(b) (i)	1	* a bar halfway between 8 and 10 seconds		the top of the bar must be in the middle third between 8 and 10
(ii)	1	* C	accept '3.0'	
(iii)	1	any **one** from * the storm became closer then moved further away * towards then away from Omar * the distance decreased then increased	 accept 'the storm passed over' **or** 'it passed by' accept 'at flash A Omar was closer and at flash F Omar was further' accept 'it increased' accept 'it went further away'	
Total	**4**			

Tier 3–6	Q No 10	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	Tier 3–6	Q No 10

Part	Mark	Answer	Accept	Additional guidance
(a)	1 1			if more than one line is drawn from either method, award no mark for that method
(b) (i)	1	* no light	accept 'no rays from the Sun' accept 'no sunshine' accept 'not enough light' accept 'it is dark' accept 'they cannot collect the Sun's energy at night' accept 'because they need light to work' accept 'no Sun'	*do **not** accept* 'no heat from the Sun'
(ii)	1	* it might not be windy * the wind might not be strong enough	accept 'no wind' accept 'needs air movement' **or** 'wind' accept 'sometimes the wind is weak' accept 'sometimes the wind is stronger'	
Total	**4**			

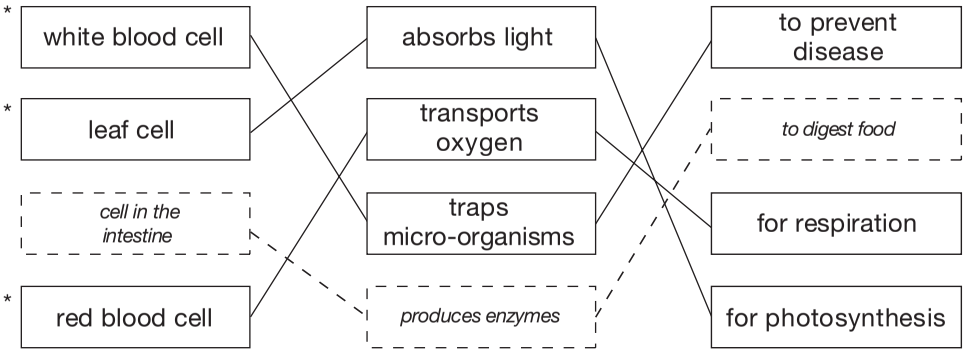
Tier	Q No			Tier	Q No
3–6 5–7	11 1	1/2j 2/2e 2/4b 2/5c	use diagrams, tables, charts and graphs, including lines of best fit, to identify and describe patterns or relationships in data the role of the skeleton and joints and the principle of antagonistic muscle pairs, *for example*, *biceps and triceps*, in movement to classify living things into the major taxonomic groups how some organisms are adapted to survive daily and seasonal changes in their habitats	3–6 5–7	11 1

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* vertebrates	accept 'animals with backbones'	*do **not** accept* 'warm blooded'
(b)	3	* (i) * (ii) * (iii)  		award one mark for each correct label
(c)	1	any **one** from * paddle shaped * fin-like * wide bones * streamlined	accept 'large surface' accept 'it is thick' accept 'it is a big fin' accept 'big bones'	*do **not** accept* 'it is big' **or** 'it is strong' *do **not** accept* 'it can paddle in water' 'it is flexible' is insufficient
(d)	1	* they are light	accept 'they make the bird lighter'	
Total	**6**			

Tier	Q No			Tier	Q No
3–6 5–7	12 2	1/2k 2/2i 3/2i	use observations, measurements and other data to draw conclusions the role of lung structure in gas exchange, including the effect of smoking about possible effects of burning fossil fuels on the environment, *for example, production of acid rain, carbon dioxide and solid particles*, and how these effects can be minimised	3–6 5–7	12 2

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* Amy *and* Kisham		answers may be in either order **both** answers are required for the mark
(ii)	1	any **one** from * traffic pollution **or** air pollution * passive smoking * faulty gas fires **or** faulty gas heaters		'pollution' is insufficient
(b)	2	any **two** from * smokers have a higher concentration of carbon monoxide in the blood * the blood of smokers contains **or** transports less oxygen * smokers breathe more quickly to try to get enough oxygen **or** air	accept 'they have a lot of carbon monoxide in their blood' accept 'not enough oxygen gets to the muscles **or** to other parts of the body **or** to the other cells' accept 'smoke contains carbon monoxide' **or** accept 'smokers breathe in more carbon monoxide'	*do **not** accept* 'stops the blood taking up oxygen' *do **not** accept* 'less oxygen gets into the lungs'
Total	**4**			

Tier	Q No			Tier	Q No
3–6 5–7	13 3	2/1b 2/1e	the functions of chloroplasts and cell walls in plant cells and the functions of the cell membrane, cytoplasm and nucleus in both plant and animal cells to relate cells and cell functions to life processes in a variety of organisms	3–6 5–7	13 3

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1 1	* cell membrane * cytoplasm	accept 'membrane'	answers must be in the correct order
(ii)	2	any **two** from * cell wall * chloroplast * large vacuole	 accept 'chlorophyll' accept 'vacuole'	
(b)	1 1 1			if more than one line is drawn from any cell **or** function, award no mark for those linkages
Total	**7**			

Tier	Q No		
3–6	14	3/1e	how elements combine through chemical reactions to form compounds, *for example, water, carbon dioxide, magnesium oxide, sodium chloride, most minerals*, with a definite composition
5–7	4	3/2a	that when physical changes, for example, changes of state, formation of solutions, take place, mass is conserved
		3/2g	how mass is conserved when chemical reactions take place because the same atoms are present, although combined in different ways
		3/3a	how metals react with oxygen, water, acids and oxides of other metals, and what the products of these reactions are

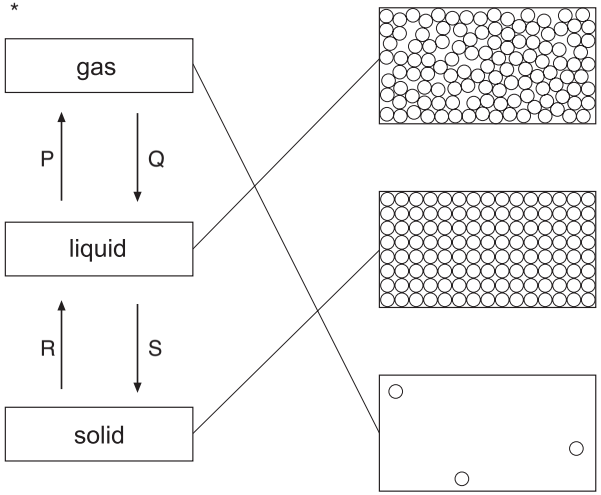
Part	Mark	Answer	Accept	Additional guidance
(a) (i)	2	*magnesium* + * oxygen → * magnesium oxide		*do **not** accept* formulae
(ii)	1	any **one** from		
		* the oxygen had mass		*do **not** accept* 'air' for oxygen
		* oxygen was added to the magnesium	accept 'magnesium has gained an element'	
		* the magnesium has reacted with oxygen	accept 'magnesium is now part of a compound'	
(b)	1	* oxygen	accept 'O_2'	
(c)	1	* zinc oxide	accept 'ZnO'	
(d)	1	*		**all three** ticks are required for the mark

	chemical change	physical change
A	✓	
B	✓	
C		✓

Tier	Q No		
3–6	14		
5–7	4		

Total	6	

Tier	Q No			Tier	Q No
3–6 5–7	15 5	3/1a 3/1b 3/1c 3/2c 3/2i	how materials can be characterised by melting point, boiling point and density how the particle theory of matter can be used to explain the properties of solids, liquids and gases, including changes of state, gas pressure and diffusion that the elements are shown in the periodic table and consist of atoms, which can be represented by symbols to relate changes of state to energy transfers about possible effects of burning fossil fuels on the environment, *for example, production of acid rain, carbon dioxide and solid particles*, and how these effects can be minimised	3–6 5–7	15 5

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* 		**all three** lines must be correct for the mark
(ii)	1 1	* *evaporation*: P * *melting*: R		
(b) (i)	1	* liquid		
(ii)	1 1	* carbon * hydrogen		answers must be in the correct order
(iii)	1	* carbon dioxide	accept 'CO_2' accept 'carbon monoxide' **or** 'CO' accept 'carbon' **or** 'soot'	
Total	**7**			

Tier 3–6 5–7	Q No 16 6			Tier 3–6 5–7	Q No 16 6
		3/1b	how the particle theory of matter can be used to explain the properties of solids, liquids and gases, including changes of state, gas pressure and diffusion		
		4/1a	how to design and construct series and parallel circuits, and how to measure current and voltage		
		4/1b	that the current in a series circuit depends on the number of cells and the number and nature of other components and that current is not 'used up' by components		
		4/5e	ways in which energy can be usefully transferred and stored		

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* *circuit A*: series *circuit B*: parallel		**both** answers are required for the mark
(b) (i)	1	* the circuit **or** heating element will stop working	accept 'it will not work' **or** 'it will be off' accept 'the whole circuit has no current through it' accept 'it becomes cooler'	*do **not** accept* 'it breaks the heater **or** element **or** it'
(ii)	1	any **one** from * the circuit **or** element will continue to work * one wire will not heat the window	accept 'the bottom one has no current through it' accept 'it will work less well' accept 'the bottom wire becomes cooler'	'nothing' **or** 'it will not be affected' are insufficient *do **not** accept* 'it becomes cooler' *do **not** accept* 'it does not work properly'
(c) (i)	1	* thermal	accept 'heat'	
(ii)	1	* *from* solid *to* liquid *to* gas	accept '*from* solid *to* liquid *to* vapour **or** steam' accept '*from* ice *to* water *to* vapour **or** gas'	**all three** states are required for the mark
Total	**5**			

Tier 3–6 5–7	Q No 17 7	4/4c about the movements of planets around the Sun and to relate these to gravitational forces 4/4d that the Sun and other stars are light sources and that the planets and other bodies are seen by reflected light	Tier 3–6 5–7	Q No 17 7

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* gravitational pull of the Sun **or** the Sun's gravity	accept 'gravity' accept 'weight'	
(b)	2	any **two** from * its average speed is lower * for most of its orbit the Sun's gravity is less * its orbit is longer * for most of its orbit it is further from the Sun	 accept 'its speed is slower' **or** 'it travels more slowly' accept 'the pull of the Sun is weaker' **or** 'gravity is less' accept 'it travels further' **or** 'the orbit is bigger' accept 'it is further from the Sun' **or** 'further away'	
(c) (i)	1 1	* light from the Sun * reflects off Pluto and Neptune **or** the planets **or** them	accept for two marks 'sunlight reflects off them'	award the second mark only for 'the Sun reflects off the planets'
(ii)	1	any **one** from * it is smaller * it reflects less light * it absorbs more light	 accept 'it is small' accept 'it is darker and smaller'	 *do **not** accept* 'it is further away (from the Earth)' **or** 'it is further from the Sun' *do **not** accept* 'it is darker'
Total	**6**			

Tier	Q No			Tier	Q No
3–6	18	1/2k	use observations, measurements and other data to draw conclusions	3–6	18
5–7	8	1/2l	decide to what extent these conclusions support a prediction or enable further predictions to be made	5–7	8
		1/2o	consider whether the evidence is sufficient to support any conclusions or interpretations made		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* A *and* B		answers may be in either order **both** answers are required for the mark
(b) (i)	1	any **one** from * the longer the string, the longer it takes * the longer the string the more time it takes	accept the converse	references to both length and time are required for the mark
(ii)	1	* A *and* C *and* D	accept 'B *and* C *and* D' if part (a) is correct	answers may be in any order **all three** answers are required for the mark
(c)	1	* *E*: 10.0 *F*: from 18 to 25	accept '10'	**both** answers are required for the mark
Total	**4**			

Tier 5–7	Q No 9	2/2d 2/2n	that food is used as a fuel during respiration to maintain the body's activity and as a raw material for growth and repair how the growth and reproduction of bacteria and the replication of viruses can affect health, and how the body's natural defences may be enhanced by immunisation and medicines	Tier 5–7	Q No 9

Part	Mark	Answer	Accept	Additional guidance
(a)	1	any **one** from * for transport **or** for blood **or** plasma * it is needed for sweat **or** for cooling * for tears * it is a solvent * for getting rid of waste * it is needed for gas exchange * it is a lubricant * it is part of the cytoplasm	accept 'it stops cells becoming dehydrated' accept 'allows chemical reactions to take place' accept 'for digestion'	'it stops the body becoming dehydrated' **or** 'it keeps us hydrated' are insufficient
(b)	2	any **two** from * white blood cells * (produce) antibodies **or** antitoxins * prevent further infections **or** destroy the toxin **or** poison	accept 'destroy **or** kill the bacteria'	
(c) (i)	1	any **one** from * so that the patient does not get cholera * so the poison does not prevent the large intestine from absorbing water	accept 'the person might die' accept 'intestine' for large intestine	*do **not** accept* 'small intestine'
(ii)	1	any **one** from * no need for injections * some people are afraid of needles * less **or** no risk of infection	accept 'it does not hurt'	*do **not** accept* 'so they can be vaccinated against several diseases'
Total	**5**			

Tier 5–7	Q No 10	2/4a 2/4c	about environmental and inherited causes of variation within a species that selective breeding can lead to new varieties	Tier 5–7	Q No 10

Part	Mark	Answer	Accept	Additional guidance
(a)	1	any **one** from * in the eggs and sperm * on chromosomes	accept 'gametes' **or** 'sex cells' accept 'DNA' accept 'at fertilisation'	answers must refer to **both** eggs **and** sperm 'by sexual reproduction' is insufficient
(b)	3	any **three** from * choose zebras which look most like quaggas * breed from them **or** cross them * choose the most quagga-like offspring * breed from the offspring * repeat the process	accept for two marks 'mate the zebras with most quagga genes'	
Total	**4**			

Tier 5–7	Q No 11			Tier 5–7	Q No 11
		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		
		1/2k	use observations, measurements and other data to draw conclusions		
		3/2g	how mass is conserved when chemical reactions take place because the same atoms are present, although combined in different ways		
		3/3e	how metals and bases, including carbonates, react with acids, and what the products of these reactions are		
		3/3g	how acids in the environment can lead to corrosion of some metals and chemical weathering of rock, *for example, limestone*		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	* calcium chloride		*do **not** accept* the formula
(b) (i)	1	any **one** from * a gas **or** carbon dioxide **or** CO_2 was given off * water **or** H_2O was formed and drained away **or** evaporated	accept 'the chemicals formed are washed away' accept 'calcium chloride is more soluble than calcium carbonate'	*do **not** accept* 'chemical weathering'
(ii)	1	any **one** from * the soils at B and C contain no acid **or** are not acidic * soil B is neutral and soil C is alkaline * the pH is higher **or** too high		
(iii)	1	* acid rain	accept a recognisable method of lowering the pH of the soil	
(c) (i)	1	* any value greater than 960 but smaller than 984		
(ii)	1	any **one** from * cannot control the environmental variables involved * pH of soil may vary * cannot predict rainfall during this time * cannot predict temperature during this time	accept 'data in the table could be unreliable'	
Total	**6**			

Tier 5–7	Q No 12	3/3c	how a reactivity series of metals can be determined by considering these reactions, and used to make predictions about other reactions	Tier 5–7	Q No 12

Part	Mark	Answer	Accept	Additional guidance
(a)	2	* zinc lead copper silver		award two marks if all four metals are in the correct order award one mark for zinc at the top and silver at the bottom of the list award one mark for lead and copper in the correct order
(b)	1	* zinc		
(c)	1	* no because zinc is more reactive than silver **or** zinc is above silver in the reactivity series	accept the converse	**both** the answer and the reason are required for the mark
(d)	1	* below silver **or** at the bottom because gold is the least reactive **or** gold does not react		**both** the answer and the reason are required for the mark
Total	**5**			

Tier 5–7	Q No 13	1/2j 4/2a 4/2c	use diagrams, tables, charts and graphs, including lines of best fit, to identify and describe patterns or relationships in data how to determine the speed of a moving object and to use the quantitative relationship between speed, distance and time 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 5–7	Q No 13

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1	* constant speed **or** steady speed	accept 'not accelerating'	
(ii)	1	* stationary **or** not moving **or** stopped	accept 'steady speed of zero'	*do **not** accept* 'it has a steady speed'
(b)	1	* 1.8	accept '$\frac{18}{10}$'	
	1	* m/s	accept 'metres per second' **or** 'ms^{-1}'	*do **not** accept* 'mps'
(c) (i)	1	* The forward force was zero and friction was greater than zero. ✓		if more than one box is ticked, award no mark
(ii)	1	* 6	accept answers from 5.8 to 6.2	
Total	**6**			

Tier 5–7	Q No 14	4/2e 4/2f	that forces can cause objects to turn about a pivot the principle of moments and its application to situations involving one pivot	Tier 5–7	Q No 14

Part	Mark	Answer	Accept	Additional guidance
(a)	1 1	* 0.96 * Ncm	accept '0.06 × 16' accept 'cmN' accept for both marks '0.0096 Nm'	*do* ***not*** *accept* lower case n for N the mark for the unit may be given in (b) (i) provided it is not contradicted in part (a)
(b) (i)	1	any **one** from * 0.96 Ncm * the same as the carbon dioxide balloon	accept the same numerical answer given in (a) (the unit is not required) accept 'the same'	consequential marking applies
(ii)	1	* 0.02		accept numerical answer to (b) (i) ÷ 48
Total	**4**			

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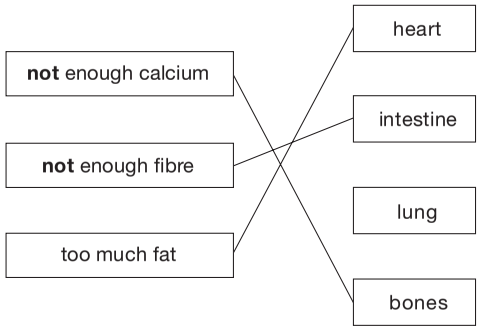
PAPER 2

Tier 3–6	Q No 1	4/2e 4/2f	that forces can cause objects to turn about a pivot 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**			

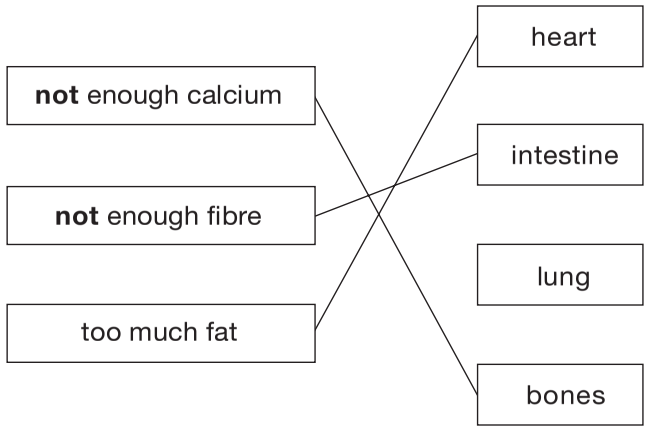
Tier 3–6	Q No 5	1/2j 3/3d	use diagrams, tables, charts and graphs, including lines of best fit, to identify and describe patterns or relationships in data to use indicators to classify solutions as acidic, neutral or alkaline, and to use the pH scale as a measure of the acidity of a solution	Tier 3–6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

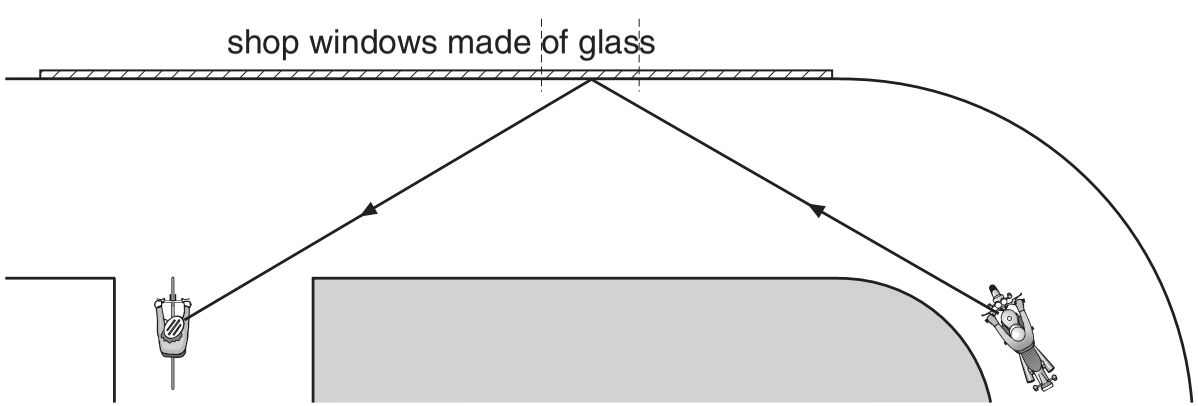
Tier 3–6	Q No 8	2/3a 2/3d	that plants need carbon dioxide, water and light for photosynthesis, and produce biomass and oxygen the role of root hairs in absorbing water and minerals from the soil	Tier 3–6	Q No 8

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
		4/3c	how light is reflected at plane surfaces		
5–7	1	BS/1a	a range of domestic, industrial and environmental contexts	5–7	1

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	**Q No**			**Tier**	**Q No**
3–6	**12**	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	**3–6**	**12**
5–7	**3**	4/2d	ways in which frictional forces, including air resistance, affect motion, *for example, streamlining cars, friction between tyre and road*	**5–7**	**3**

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*		

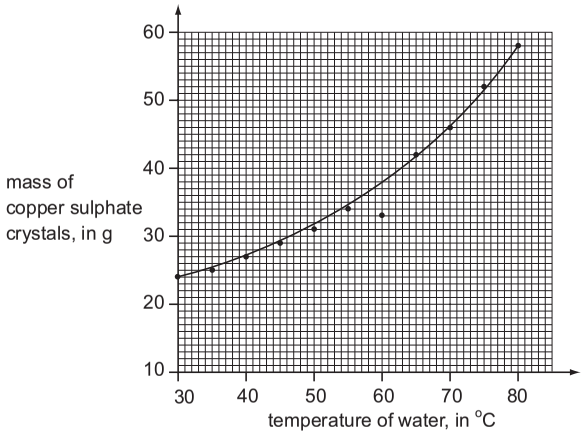
Part	Mark	Answer	Accept	Additional guidance
(a)	1	* No ✓ **and** any **one** from * sulphuric acid did not cure scurvy * not all the sailors recovered * only two pairs recovered * only those that had fruit-related additions recovered * some with acid failed to recover * a week is not long enough to show the effect	 accept 'some acids did not cure scurvy' accept 'only pair 5 totally recovered' accept 'a week is not long enough'	if more than one box is ticked, award no mark **both** the answer and the explanation are required for the mark 'only those who received vitamin C recovered' is insufficient
(b) (i)	1	any **one** from * addition to their diet * food **or** drink supplements * type of acid	 accept 'the acid' accept 'amount of acid'	 *do **not** accept* 'type of food **or** drink' *do **not** accept* 'kind of meal' *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 * effect after one week	 accept 'scurvy is cured'	 *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	Q No			Tier	Q No
3–6 5–7	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	3–6 5–7	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	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	Tier 3–6 5–7	Q No 15 6

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 ways in which some cells, including ciliated epithelial cells, sperm, ova, and root hair cells, are adapted to their functions 2/2i 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**			

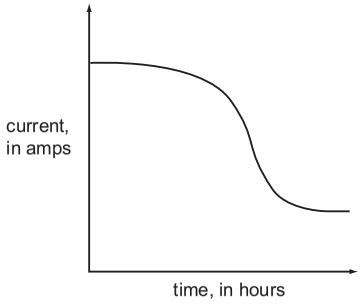
Tier 3–6 5–7	Q No 17 8	2/2g 2/2h	about the human reproductive system, including the menstrual cycle and fertilisation how the foetus develops in the uterus, including the role of the placenta	Tier 3–6 5–7	Q No 17 8

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	Q No			Tier	Q No
3–6 5–7	18 9	3/1g 3/1h 3/2f	that mixtures, *for example, air, sea water and most rocks*, are composed of constituents that are not combined how to separate mixtures into their constituents using distillation, chromatography and other appropriate methods 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	3–6 5–7	18 9

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**			

Tier 5–7	Q No 10			Tier 5–7	Q No 10
		1/2j	use diagrams, tables, charts and graphs, including lines of best fit, to identify and describe patterns or relationships in data		
		1/2l	decide to what extent these conclusions support a prediction or enable further predictions to be made		
		1/2m	use their scientific knowledge and understanding to explain and interpret observations, measurements or other data, and conclusions		
		1/2n	consider anomalies in observations or measurements and try to explain them		

Part	Mark	Answer	Accept	Additional guidance
(a)	2	any **two** from: * manufacturing differences **or** bulbs are different * reading error * dirty contacts * unreliable **or** inaccurate meter	 accept 'different resistances' accept 'different ages' accept 'bulbs were not screwed in properly' accept 'faulty ammeter' accept 'different wires' **or** 'differences in the wires'	
(b)	1	* 0.75		
(c)				
	1	* *Y axis*: current, in amps **or** A **or** milliamps **or** mA *X axis*: time, in hours **or** minutes **or** seconds	accept 'I, in amps' accept 't, in hours'	**both** axes must be labelled correctly with both the variable and the unit
	1	* a line **or** curve from top left to bottom right		
Total	**5**			

Tier 5–7	**Q No 11**	4/3f the effect of colour filters on white light and how coloured objects appear in white light and in other colours of light	**Tier 5–7**	**Q No 11**

Part	**Mark**	**Answer**	**Accept**	**Additional guidance**
(a)	1	any **one** from * white light is a mixture of colours * white light contains green light		
	1	* the green light passes through	accept for two marks 'all the other colours are absorbed **or** filtered out' accept for two marks 'only the green light passes through'	
(b) (i)	1	* red because red light passes through the filter		**both** the colour and explanation are required for the mark
(ii)	1	* black	accept 'she cannot see it'	
	1	any **one** from * because red light will **not** pass through * a green filter absorbs red light	accept 'only green light passes through'	
Total	**5**			

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Tier 5–7	Q No 12			Tier 5–7	Q No 12
		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*		
		1/2d	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		
		1/2g	make observations and measurements, including the use of ICT for datalogging, *for example, variables changing over time*, to an appropriate degree of precision		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	any **one** from * plants subjected to **or** not subjected to acid * pH of the acid * strength of solution * volume of acid	 accept 'concentration of acid' accept 'amount of acid'	 accept any appropriate independent variable
(b) (i)	1	any **one** from * plants live **or** die * plants healthy **or** not healthy * plants **or** leaves change colour * how many seeds grow		mark parts (b) (i) and (b) (ii) together the dependent variable must relate to the independent variable mentioned in part (a)
(ii)	1	any **one** from * number of plants dying **or** ailing * number of leaves falling **or** ailing * mass of plant matter * area of plant leaf growth * height of plant	accept 'count them' accept a reference to appropriate measuring equipment	
(c)	1	any **one** from * soil nutrients * temperature * humidity * light * acidity of soil at the beginning	accept any suitable control relevant to the factors specified in parts (a) and (b)(i)	
Total	**4**			

Tier 5–7	Q No 13	3/1f 3/3a 3/3c	to represent compounds by formulae and to summarise reactions by word equations how metals react with oxygen, water, acids and oxides of other metals, and what the products of these reactions are how a reactivity series of metals can be determined by considering these reactions, and used to make predictions about other reactions	Tier 5–7	Q No 13

Part	Mark	Answer	Accept	Additional guidance
(a) (i)	1 1	* *magnesium* + hydrochloric acid → *magnesium chloride* + * hydrogen		*do* ***not*** *accept* 'hydrogen chloride' *do* ***not*** *accept* formulae
(ii)	1	* magnesium is more reactive than hydrogen **and** copper is less reactive than hydrogen	accept 'magnesium is more reactive than copper' accept 'copper is less reactive than magnesium' accept 'magnesium is higher than copper in the reactivity series' accept 'copper is lower in the reactivity series'	
(b)	1	* sulphuric		
(c)	1 1			

	formula	name
*	$CuSO_4$	copper sulphate
*	$MgCl_2$	magnesium chloride

Total	6			

Tier 5–7	Q No 14			Tier 5–7	Q No 14
		2/2a	about the need for a balanced diet containing carbohydrates, proteins, fats, minerals, vitamins, fibre and water, and about foods that are sources of these		
		2/3a	that plants need carbon dioxide, water and light for photosynthesis, and produce biomass and oxygen		
		2/5a	about ways in which living things and the environment can be protected, and the importance of sustainable development		

Part	Mark	Answer	Accept	Additional guidance
(a)	3	any **three** from * by photosynthesis * carbon dioxide and water used * oxygen produced * chlorophyll **or** chloroplasts absorb solar energy **or** sunlight	accept for two marks the second and third marking points in a word **or** symbol equation, for example 'carbon dioxide + water → *glucose* + oxygen' accept 'solar energy transferred to chemical energy'	
(b)	1	* carbohydrates		
(c) (i)	1	any **one** from * loss of habitat * use of herbicides **or** weedkillers * climate change * competition with other plants	accept 'more buildings' accept 'global warming'	*do **not** accept* 'growing populations' as this answer is too vague
(ii)	1	* it increases because there is more light **or** there is more photosynthesis		**both** the answer and the explanation are required for the mark
Total	**6**			

Tier 5–7	Q No 15			Tier 5–7	Q No 15
		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		
		1/2o	consider whether the evidence is sufficient to support any conclusions or interpretations made		

Part	Mark	Answer	Accept	Additional guidance
(a)	1	any **one** from * only a small sample **or** insufficient evidence * a bigger sample may have boys with green eyes	accept 'they only tested boys in their class'	
(b)	1	any **two** from * armspan * handspan * height * mass		**both** answers are required for the mark
(c)	2	* false * true * true * cannot tell		award two marks if all four answers are correct award one mark for three **or** two correct answers
Total	**4**			

EARLY YEARS

NATIONAL CURRICULUM 5–16

GCSE

GNVQ

GCE A LEVEL

NVQ

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