
GCSE SCIENCE A

SCA2HP
Mark scheme

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from aqa.org.uk

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

- 2.1** In a list of acceptable answers where more than one mark is available ‘any **two** from’ is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.
- 2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.
- 2.3** Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that ‘right + wrong = wrong’.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Ignore / Insufficient / Do **not** allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Quality of Written Communication and levels marking

In Question 9 candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

question	answers	extra information	mark	AOs/Spec Refs
1 E	(small leaves) reduce water loss	<i>do not accept stops water loss ignore references to photosynthesis / heat loss / surface area</i>	1	A02 B1.4.1 a,b,d,f,g
	(deep roots) anchor plant into ground or absorb more water / nutrients	allow less chance of being blown away / uprooted <i>allow absorb a lot of water / nutrients allow can get water / nutrients from deep(er) under ground ignore stores / processes more water / nutrients ignore absorbs water / nutrients faster</i>	1	
	(roots that produce a chemical that stops the growth of seeds of other plants) reduces competition	<i>allow stops competition allow a description of competition with reference to preventing growth of other plants</i>	1	
Total			3	

question	answers	extra information	mark	AOs/Spec Refs
2(a)(i) G	the Sun	allow (Sun) light	1	A01 B1.5.1a
2(a)(ii) E View with Figure 3	bar width 80 (kg) drawn centrally between the other two bars all three bars correctly labelled 	anywhere on diagram ignore height of bar allow mark if labels are in the correct positions but no bar is drawn ignore numbers	1 1 1	A02 B1.5.1b
2(b)(i) Clip with 2(b)(ii) E	any one from: <ul style="list-style-type: none"> to keep warm for movement in waste materials / urine / faeces 	allow as thermal energy / heat ignore exercise accept excretion allow not all the organism is eaten ignore references to size / numbers of organisms / biomass / respiration / reproduction / growth	1	A01 B1.5.1c
2(b)(ii) Clip with 2(b)(i) E	any one from: <ul style="list-style-type: none"> not all of the organism is eaten / digested (materials lost in) faeces / urine / carbon dioxide 	must be a different reason from that given in 2(b)(i) accept excretion allow lost in waste materials ignore references to energy / size / numbers of organisms / reproduction / sweat	1	A01 B1.5.1b,c
Total			6	

question	answers	extra information	mark	AOs/Spec Refs
3(a)(i) E	damp / wet / moist	<i>ignore rainy</i>	1	A03 B1.4.2a,b
	dark	<i>allow in the shade</i> <i>ignore all references to temperature</i>	1	
3(a)(ii) view with 3(a)(i) E	Possible answers: humidity / moisture sensor light sensor thermometer temperature sensor	must match one of the conditions given in 3(a)(i) allow ecf <i>allow for sensor: meter / detector / probe</i> <i>allow rain gauge only if rain given in 3(a)(i)</i>	1	A01 B1.4.2d
3(a)(iii) E	any one from: <ul style="list-style-type: none"> • not enough data • sample size too small • no control(s) in place 	<i>ignore not a fair test</i> <i>ignore references to anomalies</i>	1	A03 B1.4.2a,b
Total			4	

question	answers	extra information	mark	AOs/Spec Refs
4(a)(i) View with Table 2 G	470 (s / seconds)	<i>if no answer given on answer line refer to the table</i>	1	A02 C1.6.2a
4(a)(ii) E	as volume of (egg) yolk / <i>emulsifier</i> increases, the emulsion remains stable for longer	allow as volume of (egg) yolk / <i>emulsifier</i> increases, the time (for the mixture) to separate increases	1	A03 C1.6.2a
4(b) G	1 <u>cm</u> ³	<i>accept 1 ml</i>	1	A02 C1.6.2a
4(c) E	any two from: <ul style="list-style-type: none"> • thicker • better texture • better appearance 	<i>ignore shelf life</i> accept better coating ability allow better / different taste / flavour	2	A01 C1.6.2a
Total			5	

question	answers	extra information	mark	AOs/Spec Refs
5(a) E	magnesium + nitrogen (→)	<i>allow Mg for magnesium</i> <i>allow N₂ for nitrogen</i>	1	A02 C1.7.2a
	(→) magnesium nitride	<i>allow Mg₃N₂ for magnesium nitride</i> <i>maximum of one mark if arrow not represented correctly</i>	1	
5(b) E	noble gas	<i>allow argon / neon / helium / krypton / xenon / radon</i> <i>ignore inert gases</i>	1	A01 C1.7.2a
5(c) E	no evidence / no proof	<i>allow insufficient evidence</i> <i>allow couldn't identify the gas</i>	1	A03 C1.7.2a
Total			4	

question	answers	extra information	mark	AOs/Spec Refs
6(a)(i) E	contains a double bond (<i>between the carbon atoms</i>)		1	A01 C1.5.1b,c
6(a)(ii) E	$\left(\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ -\text{C} - \text{C}- \\ \quad \\ \text{H} \quad \text{CH}_3 \end{array} \right)_n$	<p>one mark for single bonds between carbon atoms and <i>between</i> carbon and hydrogen atoms</p> <p>one mark for open ended bonds from carbon atoms</p>	2	A01/A02 C1.5.2a
6(b) E	<p>add bromine water</p> <p>(bromine water changes from orange) to colourless</p>	<p>allow bromine</p> <p>accept decolourised <i>ignore clear</i></p> <p><i>accept iodine (solution) for one mark</i> <i>(iodine solution changes from orange) to colourless for one mark</i></p>	1 1	A01 C1.5.1d
Total			5	

question	answers	extra information	mark	AOs/Spec Refs
7			6	
Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.				A01 P1.4.1a,b
0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)	
No relevant content	There is a brief description of either a difference or <i>an</i> environmental effect.	There is at least one difference and one environmental effect or more than one difference or more than one environmental effect.	Difference(s) and environmental effects are given. <i>Reference to both coal and wind required for environmental effects.</i> For full marks a comparative statement for a difference must be included.	
Differences: Wind – renewable energy resource Wind – no fuel / no fuel cost Wind – no heated water / steam Wind – fewer stages in the process Wind – lower power output (per turbine) Wind – cannot generate electricity continuously Wind – shorter 'start up' time Environmental effects: Wind – no waste gases / air pollution / sulfur dioxide / carbon dioxide / oxides of nitrogen / smoke / particulates Wind – does not produce solid waste / ash Wind – can be situated at sea / well away from habitation Wind – does not contribute to global warming / emit greenhouse gases Wind – does not contribute to acid rain Wind – does not contribute to global dimming		allow converse answers throughout ignore all other references to cost (Q is about generating electricity) <i>ignore no boiler</i> allow would need many turbines <i>allow wind is unreliable</i> allow turbine driven directly by energy source <i>allow no harmful gases</i> <i>ignore carbon neutral</i> allow large area of land needed for both allow noise / visual pollution for both allow wind turbines can result in bird-strike ignore damage to habitats for both ignore wind is difficult to connect to the National Grid		
Total			6	

question	answers	extra information	mark	AOs/Spec Refs
8(a) E	any one from <ul style="list-style-type: none"> no electricity at night time only works during daylight hours amount of electricity generated would be (too) small takes a long time (to charge the phone) 	ignore unreliable unless qualified allow may be insufficient light if cloudy	1	A01 P1.4.1c
8(b) E	any two from: <ul style="list-style-type: none"> uses biofuel (to heat food) no need to take fuel with you when camping carbon neutral no fuel cost 	ignore wood accept uses renewable energy source allow conserves non renewable energy sources / fossil fuels allow more sustainable ignore harmful gases / global warming allow less likely to topple over / more stable allow less chance of explosion	2	A03 P1.4.1e
8(c)(i) E	any two from <ul style="list-style-type: none"> less fuel / wood needed (for the same energy output) less carbon monoxide (emitted) less smoke (emitted) 	answers must be comparative accept wastes less energy accept more efficient allow less carbon dioxide if no reference to pollutants allow one mark for less air pollution ignore less waste products	2	A02 P1.4.1f
8(c)(ii) E	amount of electricity generated is too small uneconomical (to connect to national grid)	accept only a small proportion of the energy is electrical allow only 20 W is generated accept lack of availability of a national grid allow too far away (from national grid)	1 1	A02 P1.4.1e
Total			7	

question	answers	extra information	mark	AOs/Spec Refs
9(a) E	genetically identical organisms	allow organisms with identical DNA / <i>genes</i> / <i>chromosomes</i>	1	A01 B1.7.2a
9(b)(i) E	Method A: <u>cutting(s)</u> Method B: <u>tissue culture</u>		1 1	A01 B1.7.2b,c
9(b)(ii) E	any three from: <ul style="list-style-type: none"> • Method A is cheap(er) to use • Method A is quick(er) • Method A doesn't require special equipment / facilities / skilled people • Method B produces many / more plants 	<i>ignore references to reliability / effectiveness</i> <i>allow easy to do or can be done by anyone</i>	3	A01/A02 B1.7.2b,c
Total			6	

question	answers	extra information	mark	AOs/Spec Refs
<p>10 E</p>	<p>any six from:</p> <ul style="list-style-type: none"> • (plants) photosynthesise • (<i>plants</i>) take in carbon dioxide • (<i>plants</i>) produce carbohydrates / fats / proteins • (carbon compounds transferred by) feeding • respiration • breaks down carbon compounds / carbohydrates • releases carbon dioxide • organisms die / produce wastes / <i>excrete</i> • (which are) decomposed / decayed by microorganisms • (which) release carbon dioxide 	<p>only credit release of carbon dioxide once when linked to a correct process <i>ignore references to burning</i></p> <p>accept produce glucose</p> <p>accept glucose</p> <p>allow broken down <i>allow bacteria / fungi / microbes / decomposers</i></p>	6	<p>A01 B1.6.1 a,b,c,d B1.6.2a</p>
<p>Total</p>			<p>6</p>	

question	answers	extra information	mark	AOs/Spec Refs
11(a) E	different numbers of people were surveyed (in each country)	<i>allow difference in number shown using quoted figures</i>	1	A03 B1.7.1 B1.8.1e
11(b)(i) E	62.77(%)	allow 62.8 or 62.771 or 63 allow 1 mark only for 62.7 / 62.78 allow 1 mark for $(145 / 231) \times 100$ or $100 - (9.52 + 8.23 + 19.48)$ or $100 - 37.23$	2	A02 B1.7.1 B1.8.1e
11(b)(ii) View with 11(b)(i) E	any one from: <ul style="list-style-type: none"> blue eye colour is less common in Italy than in other countries brown eye colour is more common in Italy than in other countries green eye colour is the least common in all the countries <i>Ireland has the highest percentage of blue and / or green eyes</i> 	answers should compare the different countries <i>allow ecf from 11(b)(i)</i>	1	A03 B1.7.1 B1.8.1e
11(b)(iii) E	any one from: <ul style="list-style-type: none"> survey more people record the other eye colours separately (rather than group them together) 	<i>ignore survey same number of people from each country</i> <i>ignore survey more countries</i> allow carry out a random survey	1	A03 B1.7.1 B1.8.1e
Total			5	

question	answers	extra information	mark	AOs/Spec Refs
12(a) E	any three from: <ul style="list-style-type: none"> <i>in Theory 1 all the continents are joined together</i> not all continents move in Theory 2 description of new positions of continents different oceans close predictions use different models 	<p><i>allow Antarctica is separate in Theory 2</i></p> <p>accept Antarctica does not move <i>in Theory 2</i></p> <p><i>eg In Theory 1 Australia is in the middle (of the supercontinent)</i> or <i>in Theory 2 Australia is at the bottom (of the supercontinent)</i></p>	3	A02 C1.7
12(b)(i) E	<p>earthquakes</p> <p>volcanoes</p>	<p><i>ignore reference to plate movement / boundaries</i></p> <p>accept tsunamis</p> <p><i>accept mountains / new land formed</i></p>	<p>1</p> <p>1</p>	A01 C1.7.1b,d
12(b)(ii) E	<p>releases heat or forms magma / molten rock</p> <p>which drives / causes convection currents</p> <p>in the mantle</p>	<p><i>accept energy</i></p> <p><i>allow descriptions of convection currents</i></p>	<p>1</p> <p>1</p> <p>1</p>	A01 C1.7.1b,c
12(b)(iii) E	a few centimetres (per year)	<i>accept values up to 20 cm a year</i>	1	A01 C1.7.1c
Total			9	

question	answers	extra information	mark	AOs/Spec Refs
13(a) E	burning of fossil fuels	<i>accept burning of a named fossil fuel</i>	1	A01 C1.7.2i
13(b) E	Change: carbon dioxide dissolves / is absorbed by oceans / water Effect: increases acidity of water	accept ocean acts as a reservoir / store <i>ignore references to acid rain</i> accept as alternative approach: change: global warming / <i>greenhouse gas</i> effect : leads to increase in ocean / water temperature	1 1	A01 C1.7.2h,i
13(c)(i) E	422	allow answers in range of 418-430	1	A03 C1.7
13(c)(ii) View with Fig 19 and part 13(c)(i) E	from 1980 to 2010 carbon dioxide increased by 50ppm and coral decreased by 50% from 2010 to 2020 carbon dioxide increased by 32 ppm, (so) would expect coral to decrease by half again	allow answers in range of 48-52 ppm allow answers in range of 30-40 ppm allow ecf from part 13ci <i>with a tolerance of ± 2 ppm</i> accept increasing rate of change of <i>carbon dioxide / coral</i> or exponential rate of <i>change of carbon dioxide / coral</i>	1 1 1	A02/A03 C1.7.2h,i
Total			7	

question	answers	extra information	mark	AOs/Spec Refs
14(a) E	Group1 Reason: Loudest sound needed for person to notice it.	<i>ignore figures</i> reason only scores if group correct <i>allow louder sound</i> <i>allow exposed to loud noise for longest / longer</i>	1	A03 P1.5.3b
14(b) E	any three from: <ul style="list-style-type: none"> the <i>longer</i> the exposure (to loud sounds) the greater the hearing loss no exposure / <i>Group 3</i> has the best hearing hearing worsens (significantly) for frequencies above 1000Hz (or converse). the first 10 years exposure has more of an effect than the next 10 years 	<i>ignore Group 1 has the worst hearing</i> <i>ignore figures unqualified</i> <i>allow better</i> <i>ignore hearing is worse at high frequencies</i> <i>allow 10 years exposure to loud noise has no effect on hearing at 500 Hz</i>	3	A03 P1.5.3b
Total			4	

question	answers	extra information	mark	AOs/Spec Refs
15(a) E	0.000294 or 2.94×10^{-4} (m)	<p>a correct answer given to an incorrect number of significant figures gains 2 marks eg 2.939×10^{-4} (m) or 2.93×10^{-4} (m) or 0.0002939 (m) or 0.000293 (m) or 2.9×10^{-4} (m) or 0.00029 (m) or 3×10^{-4} (m) or 0.0003 (m)</p> <p>allow 1 mark for correct substitution: $1540 = 5\,240\,000 \times \lambda$</p> <p>or $1540 = 5.24 \times 10^6 \times \lambda$ provided no subsequent step</p> <p>or allow 1 mark for correct substitution and rearrangement</p> $\lambda = \frac{1540}{5.24 \times 10^6}$ <p>or</p> $\lambda = \frac{1540}{5\,240\,000}$ provided no subsequent step <p>an answer of 2.94 gains one mark only</p> <p>an answer given to an incorrect number of s.f. and including a rounding error gains one mark only eg 2.938×10^{-4} (m)</p>	3	A02 P1.5.1j
15(b)(i) E	(Doppler probe) C wavelength is (much) smaller than the <i>diameter</i> of the blood vessel or wavelength of A and B too close to 1 mm diffraction is more likely to happen when the obstacle is the same size as the wavelength	Reasons only score if probe C is chosen allow wavelength is smaller (than A or B)	1 1 1	A01/A02/A03 P1.5.1g
15(b)(ii) A	higher frequency		1	A01 P1.5.4a
Total			7	

question	answers	extra information	mark	AOs/Spec Refs
16(a) E	the further away the galaxy, the larger the red shift		1	A01 P1.5.4b
	(because) they are moving (away) faster	2 nd point dependent on scoring 1 st point <i>accept as alternative approach the further away the galaxy, the faster it is moving (away)</i> <i>(therefore) the larger the red shift 2nd point dependent on scoring 1st point</i>	1	
16(b) E	more galaxies	<i>accept more data / more results / bigger sample</i>	1	A02/A03 P1.5.4b
	pattern continues for galaxies (much) further away (from Earth)	allow better correlation / increased precision / <i>fewer anomalies</i>	1	
16(c) E	<p>any two from</p> <ul style="list-style-type: none"> • <u>electromagnetic</u> radiation / wave • that fills the Universe • that was present shortly after the Big Bang / <i>beginning of Universe</i> 	<p>allow <u>EM</u> radiation / wave</p> <p><i>allow radiation left over from the Big Bang / when Universe began</i></p>	2	A01 P1.5.4d
Total			6	