

GCSE SCIENCE A

SCA2FP
Mark scheme

4406
June 2014

Version: 1.0 Final

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(a) A	categoric	extra words circled negates mark	1	A03 B1.7
1(b)(i) View with b(ii) G	11		1	A02 B1.7
1(b)(ii) View with b(i) E	25	allow ecf from 1(b)(i) <i>ie 1(b)(i) +14</i>	1	A02 B1.7
1(b)(iii) E	any one from: <ul style="list-style-type: none"> blue is the most common eye colour green is the least common eye colour 	<i>ignore figures</i> <i>allow mode / modal</i> <i>allow more have blue eyes</i>	1	A03 B1.7
1(c)(i) G	a gene		1	A01 B1.7.1 a,c,d
1(c)(ii) G	sex cells		1	A01 B1.7.1a
Total			6	

question	answers	extra information	mark	AOs/Spec Refs
3(a) A	Dark Wet		2	A03 B1.4.2a,b
3(b) view with 3(a) E	Possible answers: humidity / moisture sensor light sensor thermometer temperature sensor	must match one of the conditions given in 3(a) allow ecf <i>allow for sensor: meter / detector / probe</i>	1	A01 B1.4.2d
Total			3	

question	answers	extra information	mark	AOs/Spec Refs
4 G	variation natural selection (sexual) reproduction	must be in correct order	1 1 1	A01 B1.8.1e
Total			3	

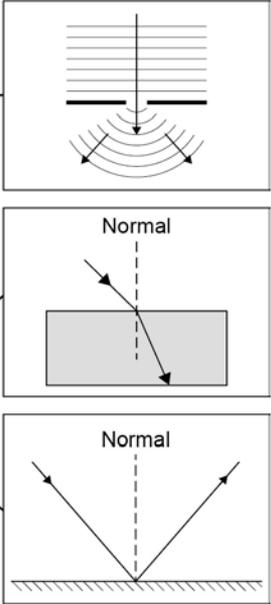
question	answers	extra information	mark	AOs/Spec Refs
5(a) A	an enzyme		1	A01 B1.7.2d
5(b) E	egg (cell) skin cell (an electric) shock	accept chemical(s)	1 1 1	A01/A02 B1.7.2c,e
Total			4	

question	answers	extra information	mark	AOs/Spec Refs
6(a) E	any one from: <ul style="list-style-type: none"> less (saturated) fat vegetable oil is unsaturated 	accept less risk of heart disease <i>allow less cholesterol</i> ignore refs to energy content or weight gain / loss / <i>taste / vitamins / nutrients</i>	1	A03 C1.6
6(b) A	nutrients		1	A01 C1.6.1b
6(c) E	any two from: <ul style="list-style-type: none"> (different) taste (different) appearance (different) texture more energy released / <i>higher energy content</i> when cooked in oil 	<i>ignore</i> sausages cooked in water will be healthier allow cook faster in oil allow cook at higher temperature in oil <i>ignore references to nutrients</i>	2	A01 C1.6.1c
Total			4	

question	answers	extra information	mark	AOs/Spec Refs
7(a) G	monomer		1	A01 C1.5.2a
7(b) G	colourless	<i>ignore clear</i>	1	A01 C1.5.1b,d
7(c)(i) E	$ \begin{array}{ccccccc} & & \text{H} & & \text{H} & & \text{H} \\ & & & & & & \\ \text{H} & - & \text{C} & - & \text{C} & = & \text{C} \\ & & & & & & \\ & & \text{H} & & & & \text{H} \end{array} $		1	A02 C1.5.1c
7(c)(ii) E	C_3H_6	<i>allow H_6C_3</i>	1	A02 C1.5.1c
Total			4	

question	answers	extra information	mark	AOs/Spec Refs
8(a)(i) E	any two 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>e.g. 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>	2	A02 C1.7.1b
8(a)(ii) E	insufficient evidence or scientists cannot test the theories	<p>allow can't prove which theory is correct / <i>no proof</i></p> <p><i>allow can't predict future</i></p>	1	A03 C1.7
8(b)(i) G	year		1	A01 C1.7.1c
8(b)(ii) G	convection mantle heat radioactive	<i>must be in correct order</i>	1 1 1 1	A01 C1.7.1c
Total			8	

question	answers	extra information	mark	AOs/Spec Refs
9(a) G	burning fossil fuels		1	A01 C1.7.2i
9(b) E	point correctly plotted at 2020, 430	allow $\pm \frac{1}{2}$ square	1	A02 C1.7
	suitable curve drawn through <i>most of</i> the points	allow ecf for plotted point	1	
9(c) E	amount of carbon dioxide increases (so) amount of coral decreases	<i>ignore references to figures unqualified</i>	1	A03 C1.7.2h
		<i>if carbon dioxide is given as CO₂ it must be written correctly</i>		
		<i>accept coral is killed</i>	1	
		<i>ignore references to other organisms</i>		
Total			5	

question	answers	extra information	mark	AOs/Spec Refs
<p>10(a) G</p>	<p>Property</p> <p>Diffraction</p> <p>Reflection</p> <p>Refraction</p>	<p>Diagram</p>  <p>1 or 2 correct = 1 mark 3 correct = 2 marks <i>any extra line negates mark</i></p>	<p>2</p>	<p>A01 P1.5.1g</p>
<p>10(b) G</p>	<p>Part</p> <p>Microwaves</p> <p>Radio</p> <p>Visible light</p>	<p>Use</p> <p>Photography</p> <p>Remote controls</p> <p>Mobile phones</p> <p>TV broadcasts</p> <p><i>any extra line negates mark</i></p>	<p>3</p>	<p>A01 P1.5.1k</p>
<p>Total</p>			<p>5</p>	

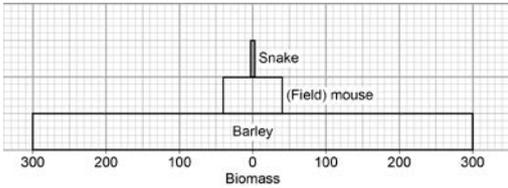
question	answers	extra information	mark	AOs/Spec Refs
11(a) G	2(dB)		1	A02 P1.5.3b
11(b) G	5500(Hz)		1	A02 P1.5.3b
11(c) E	340(m/s)	allow 1 mark for correct substitution (20 x 17) <i>provided no subsequent step</i>	2	A02 P1.5.1j
11(d) G	echo(es)		1	A01 P1.5.3c
Total			5	

question	answers	extra information	mark	AOs/Spec Refs
12(a) E	data / distance is continuous	accept data is not categoric <i>allow so can see if there is a correlation</i>	1	A03 P1.5.4b
12(b) A	More galaxies have been plotted on the graph. More distant galaxies also follow the same trend.		1 1	A03 P1.5.4c
12(c) A	Electromagnetic radiation Radiation that fills the Universe		1 1	A01 P1.5.4d
Total			5	

question	answers	extra information	mark	AOs/Spec Refs
<p>13(a) E Clip with Figure 13</p>	<p><i>straight line continued through glass block to meet edge of the block</i></p> <p>straight line drawn through crosses <i>to meet the edge of block</i></p>	<p><i>do not allow dotted / dashed lines</i></p> <p><i>judge by eye</i></p> <p><i>judge by eye</i></p> <p><i>ignore reflection within the block</i> <i>ignore 'normal' line</i></p>	<p>1</p> <p>1</p>	<p>A02 P1.5.1g</p>
<p>13(b) E</p>	<p><i>any one from</i></p> <ul style="list-style-type: none"> • safety / dark glasses • <i>safety / dark goggles</i> • don't look at laser (directly) 	<p><i>ignore goggles / glasses unqualified</i></p> <p><i>ignore special goggles / glasses</i> <i>ignore sunglasses / eye protection</i></p> <p>allow don't shine laser into someone's eyes</p>	<p>1</p>	<p>A03 P1.5.1k</p>
<p>13(c)(i) E</p>	<p>any one from:</p> <ul style="list-style-type: none"> • too many points above line • no points below the line • line should be curved 	<p><i>allow line of best fit only goes through 2 points</i></p> <p><i>allow line doesn't go through most points</i></p> <p><i>allow line should go through more / most points</i></p> <p><i>allow 3 points have been ignored</i></p> <p><i>allow there should be equal numbers of points on both sides of line</i></p>	<p>1</p>	<p>A03 P1.5.1g</p>

question	answers	extra information	mark	AOs/Spec Refs
13(c)(ii) E	any two from: <ul style="list-style-type: none"> • use smaller interval between readings • take readings at more angles • repeat the experiment / readings <i>and calculate a mean</i> • use a narrower ray of light 	<i>eg allow go up in 10's</i> allow take readings at different angles / named angles <i>allow repeat the experiment to identify anomalies</i> <i>ignore take more readings</i> <i>ignore compare results (with other students)</i>	2	A03 P1.5.1g
Total			6	

question	answers	extra information	mark	AOs/Spec Refs
<p>14 E</p>	(small leaves) reduce water loss	<p><i>do not accept stops water loss</i> <i>ignore references to photosynthesis / heat loss / surface area</i></p>	1	<p>A02 B1.4.1 a,b,d,f,g</p>
	(deep roots) anchor plant into ground	<p>allow less chance of being blown away / uprooted</p>	1	
	<p>or</p> <p>absorb more water / nutrients</p>	<p><i>allow absorb a lot of water / nutrients</i> <i>allow can get water / nutrients from deep(er) under ground</i> <i>ignore stores / processes more water / nutrients</i> <i>ignore absorbs water / nutrients faster</i></p>	1	
<p>Total</p>			<p>3</p>	

question	answers	extra information	mark	AOs/Spec Refs
15(a)(i) G	the Sun	allow (Sun) light	1	A01 B1.5.1a
15(a)(ii) E View with Figure 17	bar width 80 (kg) drawn centrally between the other two bars all three bars correctly labelled 	anywhere on diagram ignore height of bar <i>allow mark if labels are in the correct positions but no bar is drawn</i> ignore numbers	1 1 1	A02 B1.5.1b
15(b)(i) 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 <i>ignore exercise</i> accept excretion <i>allow not all the organism is eaten</i> ignore references to size / numbers of organisms / biomass / respiration / reproduction / growth	1	A01 B1.5.1c
15(b)(ii) View with 15(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 15(b)(i) accept excretion <i>allow lost in waste materials</i> 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
16(a)(i) View with table 4 G	470 (s / seconds)	<i>if no answer given on answer line refer to the table</i>	1	A02 C1.6.2a
16(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
16(b) G	1 <u>cm</u> ³	<i>accept 1 ml</i>	1	A02 C1.6.2a
16(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
17(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	
17(b) E	noble gas	<i>allow argon / neon / helium / krypton / xenon / radon</i> <i>ignore inert gases</i>	1	A01 C1.7.2a
17(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
18			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 <i>for a difference</i> 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 <i>Wind – shorter 'start up' time</i> Environmental effects: Wind – no waste gases / air pollution / sulfur dioxide / carbon dioxide / oxides of nitrogen / smoke / particulates <i>Wind – does not produce solid waste / ash</i> Wind – can be situated at sea / well away from habitation <i>Wind – does not contribute to global warming / emit greenhouse gases</i> <i>Wind – does not contribute to acid rain</i> <i>Wind – does not contribute to global dimming</i>		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
19(a)	any one from <ul style="list-style-type: none"> • no electricity at night time • only works during daylight hours • <i>amount of electricity generated would be (too) small</i> • <i>takes a long time (to charge the phone)</i> 	<i>ignore unreliable unless qualified</i> <i>allow may be insufficient light if cloudy</i>	1	A01 P1.4.1c
19 (b)	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 • <i>no fuel cost</i> 	<i>ignore wood</i> accept uses renewable energy source <i>allow conserves non renewable energy sources / fossil fuels</i> <i>allow more sustainable</i> <i>ignore harmful gases / global warming</i> <i>allow less likely to topple over / more stable</i> <i>allow less chance of explosion</i>	2	A03 P1.4.1e
Total			3	