



GCSE

Science A (Route 2)

SCA2FP

Mark scheme

4406

June 2016

Version 1.0: Final Mark Scheme

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 / ; eg allow smooth / free movement.
- 2.4** Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students 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 errors / 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)

Student	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)

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

3.2 Use of chemical symbols / formulae

If a student 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 is 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 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 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.

4. Quality of Communication and levels marking

In Question 13 students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

Students 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 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	(Group 1) Animals	allow vertebrates	1	AO1 B1.8.1d
	(Group 2) Plants		1	
	(Group 3) Microorganisms	allow microbes / bacteria / protists / protoctists ignore fungi / viruses	1	
1(b)(i)	any one from: <ul style="list-style-type: none"> • five toes / digits • pads on ends of toes • nails on ends of toes 		1	AO2 B1.8.1d
1(b)(ii)	any one from: <ul style="list-style-type: none"> • grasp / hold things • use tools 	allow to balance	1	AO3 B1.8.1d
1(b)(iii)	D		1	AO3 B1.8.1d
Total			6	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	taking cuttings.		1	AO1 B1.7.2a,b
	asexual reproduction.		1	
	genes.		1	
2(b)(i)	9.7 (cm)		1	AO2 B1.7.1d
2(b)(ii)	any one from: <ul style="list-style-type: none"> • more light • more water • more mineral ions • warmer 		1	AO3 B1.7.1d
Total			5	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	Sulfur dioxide		1	AO1 B1.4.2c
3(b)(i)	Zone B		1	AO3 B1.4.2c
3(b)(ii)	Lichen Z		1	AO3 B1.4.2c
3(c)	Fewer pollutant gases are released today.		1	AO3 B1.4.2c
Total			4	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	Temperature		1	AO2 B1.6.1a,b
4(b)(i)	1.1 (g)		1	AO2 B1.6.1a,b
4(b)(ii)	any one from: <ul style="list-style-type: none"> rate / decay was fastest at 30 °C rate / decay was slowest at 40 °C rate / decay increases with temperature up to 30 °C rate / decay decreases above 30 °C 		1	AO3 B1.6.1a,b
4(c)	any three from: <ul style="list-style-type: none"> oxygen (in) carbon dioxide (out) water (in or out) nutrients / products of decay (out) worms / detritivores microorganisms 	allow other named detritivores	3	AO1, AO2 B1.6.1a,b, c,d B1.6.2a
Total			6	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	carbon hydrogen		1	AO2 C1.5.2a
			1	
5(a)(ii)	poly(eth <u>e</u> ne)	allow poly(th <u>e</u> ne) do not allow poly(ethane)	1	AO1 C1.5.2a
5(b)(i)	any two from: <ul style="list-style-type: none"> • large(r) molecules • break down • to produce small(er) molecules / alkanes / alkenes 	ignore to form useful products allow to produce an unsaturated compound / molecule allow to produce a compound / molecule containing a double bond ignore to form ethene	2	AO1 C1.5.1a,b
5(b)(ii)	C_nH_{2n}		1	AO1 C1.5.1b
5(b)(iii)	(carbon-carbon) double bond	ignore unsaturation	1	AO1 C1.5.1c
5(c)	any one from: <ul style="list-style-type: none"> • less space used in landfill • conserves oil stocks • broken down (by bacteria) 	ignore renewable / reused / recycled / biodegradable / cost	1	AO1 C1.5.2c,d
Total			8	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	(in atmosphere of Earth) less carbon dioxide more nitrogen more oxygen	accept converse answers in terms of Mars ignore figures	1 1 1	AO2 C1.7.2a,c
6(b)			1 1 1	AO1 C1.7.2a,b, f,g
6(c)	any one from: <ul style="list-style-type: none"> • no / insufficient evidence • other scientists have own theories 	ignore references to religion allow no / insufficient proof	1	AO3 C1.7.2d
Total			7	

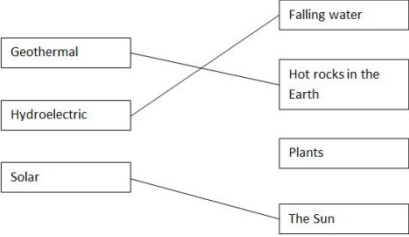
Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)(i)	filtration	allow decant / centrifugation	1	AO2 C1.5.3b
7(a)(ii)	yeast		1	AO1 C1.5.3b
7(b)	No crude oil is used.		1	AO1 C1.5.1e
Total			3	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	centimetres		1	AO1 C1.7.1c
8(b)	earthquakes and / or volcanos occur near plate boundaries		1	AO1, AO3 C1.7.1b, c,d
	where plates are moving in different directions	allow moving towards each other	1	
Total			3	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9(a)	10 (%)		1	AO2 P1.4.1a,b
9(b)	<p>Power station</p> <p>Source of energy</p>  <pre> graph LR subgraph Power_station [Power station] G[Geothermal] H[Hydroelectric] S[Solar] end subgraph Source_of_energy [Source of energy] FW[Falling water] HRE[Hot rocks in the Earth] P[Plants] TS[The Sun] end G --- HRE H --- FW S --- TS </pre>	extra line from the power station negates the mark	1 1 1	AO1 P1.4.1b,c, d
9(c)	The wind does not produce polluting gases		1	AO3 P1.4.1b,f
Total			5	

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10(a)	infrared (radiation)	correct order only allow IR	1	AO1 P1.5.1k
	microwaves		1	
	(visible) light		1	
10(b)(i)	C	if incorrect phone chosen award 0 marks	1	AO3 P1.5.1k
	any one from: <ul style="list-style-type: none"> • lowest SAR • less radiation will be absorbed (into the head) 	allow 0.33 ignore less chance of developing cancer allow microwaves for radiation	1	
10(b)(ii)	So customers can make an informed choice		1	AO3 P1.5.1k
10(c)	transverse	correct order only	1	AO1 P1.5.1b,d, g
	vacuum		1	
	reflected		1	
Total			9	

Question 11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11(a)	Big Bang (theory)		1	AO1 P1.5.4c
11(b)(i)	straight line touching all the points		1	AO2 P1.5.4b
11(b)(ii)	the greater the distance (from Earth) the higher the speed	accept the converse allow ecf from the line of best fit drawn in part (b)(i)	1	AO2 P1.5.4b
11(b)(iii)	460 km/s	allow answers in the range 440 km/s to 480 km/s allow ecf from the line of best fit drawn in part (b)(i)	1	AO2 P1.5.4b
11(c)	wavelength electromagnetic universe	answers must be in the correct order	1 1 1	AO1 P1.5.4b,d
Total			7	

Question 12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
12(a)	(the) Sun	allow light (energy)	1	AO1 B1.5.1a
12(b)(i)	36 (kilograms)	answer line takes precedence if no answer on line, look at Figure 15	1	AO2 B1.5.1b
12(b)(ii)	any one from: <ul style="list-style-type: none"> materials are lost in wastes / faeces not all of the greenfly is eaten / digested (by the ladybird) 	do not allow this mark if linked to energy accept lost as carbon dioxide allow excretion / urine ignore respiration ignore references to energy ignore references to size / numbers of organisms / reproduction ignore sweat / water	1	AO1 B1.5.1b,c
Total			3	

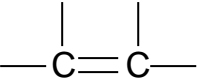
Question 13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
13			6	AO1, AO2 B1.4.1d,f
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.				

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	Adaptations are described or an adaptation with a linked explanation is given	Several adaptations with linked explanations are described	A detailed description of adaptations with linked explanations is given, including adaptation(s) other than simple ideas for reducing energy loss and / or for predation
<p>examples of the points made in the response</p> <p><i>adaptations related to reducing energy loss:</i></p> <ul style="list-style-type: none"> • large body size – reduces energy loss • thick fur – for insulation • thick layer of fat / blubber – for insulation • small ears – to reduce energy loss <p><i>adaptations related to predation:</i></p> <ul style="list-style-type: none"> • strong muscles –to attack (prey) • white fur – for camouflage • sharp / strong claws – to catch prey • forward facing eyes or good eyesight – to see prey • sharp / strong teeth – to catch prey <p><i>other adaptations:</i></p> <ul style="list-style-type: none"> • small surface area: volume ratio – reduces energy loss • thick layer of fat / blubber – as a store of energy • large feet – so they do not sink in snow or so they can walk on ice • webbed / large feet – to swim fast • strong muscles – to run / swim fast • sharp / strong claws – to dig in snow / ice • small eyes – to protect against snow or protect against glare from Sun • strong back / muscles to stand tall – to see prey or other polar bears 		<p>extra information</p> <p>allow 'heat' for energy or radiation</p> <p>accept black skin - to absorb radiation accept white fur to reduce radiation</p> <p>allow good sense of smell – to detect prey</p> <p>accept oily fur – to repel water accept hollow fur - for insulation</p>	

Question 14

Question	Answers	Extra information	Mark	AO / Spec. Ref.
14(a)(i)	6300 (J)	allow 1 mark for temperature change of 15 (°C) or allow 1 mark for an answer of 7980 (J) or 14280 (J) or allow ecf from an incorrect subtraction of 34 – 19 correctly calculated	2	AO2 C1.6.1b
14(a)(ii)	630 (kJ)	allow ecf from part (a)(i)	1	AO2 C1.6.1b
14(a)(iii)	any two from: <ul style="list-style-type: none"> energy loss to the surroundings / apparatus no lid on did not stir water oil contained impurities only one reading taken thermometer had low resolution references to incomplete combustion 	allow 'heat' for energy allow some water evaporated	2	AO3 C1.6.1b
14(b)	any two from <ul style="list-style-type: none"> different flavour potatoes cooked in oil contain more energy / nutrients potatoes cook in oil at a higher temperature. 	ignore references to shape / size / colour / texture / health allow converse for potatoes cooked in water allow potatoes cooked in oil have a higher fat content allow potatoes cooked in oil cook faster	2	AO1 C1.6.1c

14(c)			1	AO1 C1.5.1c,d C1.6.3a
14(d)	any one from: <ul style="list-style-type: none">• to control energy intake• legal requirement• can make informed choice (of what to buy)		1	AO3 C1.6.1b
Total			9	

Question 15

Question	Answers	Extra information	Mark	AO / Spec. Ref.
15(a)	330 (m/s)	allow for 1 mark a correct substitution: speed = 250×1.32	2	AO2 P1.5.1j
15(b)	<p>sound A has a lower pitch</p> <p>(because it) has a lower frequency</p> <p>sound A is louder</p> <p>(because it) has a bigger amplitude</p>	<p>for 2 marks reason must be correctly linked to difference</p> <p>max 2 marks if no comparisons accept the converse for sound B</p> <p>allow sound A has a longer wavelength</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>	AO1, AO2 P1.5.3b
15(c)(i)	0.01 (s)		1	AO2 P1.5.3a
15(c)(ii)	<p>any two from:</p> <ul style="list-style-type: none"> • repeat the measurements and calculate a mean • use different distances • use a greater distance 	<p>do not allow a shorter distance</p> <p>allow a clear description of an electronic method</p>	2	AO3 P1.5.3a
Total			9	