
GCSE SCIENCE A

SCA1FP
Mark scheme

4406
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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

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.

3.2 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.

3.3 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.

3.4 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.

3.5 Phonetic spelling

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

3.6 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.

3.7 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 13 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 ref area
1(a) G	toxins		1	A01 B1.1.2b
1(b)(i) G	bacteria		1	A01 B1.1.2h
1(b)(ii) G	mutate		1	A01 B1.1.2j
1(b)(iii) E	new / different antibiotic	allow new / different drug do not allow vaccine	1	A01 B1.1.2k
Total			4	

question	answers	extra information	mark	AOs/Spec ref area
2(a)(i) E	any two from: <ul style="list-style-type: none"> • A is taller • A has more leaves • A has smaller leaves • A has a thinner stem 	if no reference to A or B , assume "it" refers to A ignore references to curving / roots / colour / conditions eg light accept converse statements allow A grew quicker	2	A02 B1.2.3a
2(a)(ii) A	auxin		1	A01 B1.2.3b
2(b)(i) G	A		1	A03 B1.2.3a,c
2(b)(ii) E	C grew towards the light	no marks if incorrect plant chosen allow it grew bent	1 1	A03 B1.2.3a,c
Total			6	

question	answers	extra information	mark	AOs/Spec ref area
3(a)(i) G	2.3 (million)		1	A02 B1.3.1e
3(a)(ii) E	any one from: <ul style="list-style-type: none"> • cheaper • easier to get 	ignore references to side effects / harm ignore references to classification of drugs ignore references to use as medicine / legal use allow can be grown at home ignore easier to use allow less addictive ignore not addictive	1	A03 B1.3.1e
3(a)(iii) A	It may cause mental illness in some people.	extra boxes ticked negates the mark	1	A01 B1.3.1e,f
3(b) E	suffer withdrawal symptoms	allow crave the drug allow become ill / sick allow depression / paranoia / anxiety / hallucinations	1	A01 B1.3.1h
Total			4	

question	answers	extra information	mark	AOs/Spec ref area
4(a) G	enzymes		1	A01 B1.2.2a
4(b)(i) E	any one from: <ul style="list-style-type: none"> • age • gender • body mass • number in group / 50 • high body temperature 	allow number of children allow starting temperature allow dose / amount of drug given	1	A02 B1.1.2g
4(b)(ii) E	any one from: <ul style="list-style-type: none"> • tablet that does not contain a drug / anything • fake drug 	allow sugar pill do not allow a different drug	1	A01 B1.3.1b
4(c)(i) G	38.2 (°C)		1	A02 B1.1.2g

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4(c)(ii) E	ibuprofen any two from: <ul style="list-style-type: none"> • reduced body temperature fast(er) • maintained temperature in normal range / around 37 °C (longer / for several hours) • paracetamol did not reduce temperature to normal / 37 °C • ibuprofen given less frequently 	no mark for drug no marks if wrong drug selected allow acts fast(er) accept ibuprofen did reduce temperature to normal / 37 °C allow less drug needed ignore cheaper unless qualified	2	A02/A03 B1.1.2g
Total			6	

question	answers	extra information	mark	AOs/Spec ref area
5(a) A	combustion		1	A01 C1.4.3b
5(b) G	<p style="text-align: center;">Substance</p> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Carbon dioxide</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Oxides of nitrogen</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Solid particles</div> </div>	<p style="text-align: center;">Environmental effect</p> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Acid rain</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Bioleaching</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Global dimming</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Global warming</div> </div> <p style="text-align: center; margin-top: 20px;">extra lines from substance negates mark</p>	<p style="text-align: center;">1</p> <p style="text-align: center;">1</p> <p style="text-align: center;">1</p>	<p style="text-align: center;">A01 C1.4.3a,c</p>
Total			4	

question	answers	extra information	mark	AOs/Spec ref area
6(a)(i) A	atom		1	A01 C1.1.1a
6(a)(ii) A	protons		1	A01 C1.1.1f
6(b) E	metals	accept metal with carbon allow iron with carbon allow metal with (an)other element(s) ignore a mixture of gold and silver	1	A01 C1.3.2c
6(c) E	any three from: <ul style="list-style-type: none"> • silver • oxygen • (silver) <u>two</u> atoms • (oxygen) <u>one</u> atom 	do not accept oxide accept <u>two</u> ions / Ag ⁺ accept <u>one</u> (oxide) ion / O ²⁻	3	A02 C1.1.1a,b
Total			6	

question	answers	extra information	mark	AOs/Spec ref area
7(a) G	acid (rain)	must be in correct order	1	A01 C1.2.1a,f C1.4.3c
	calcium	ignore CaCO ₃	1	
7(b)(i) E	(concentration of) sulfur dioxide decreases (from 1980 to 2010)	allow there is a negative correlation	1	A02 C1.4.3a
7(b)(ii) E	any two from: <ul style="list-style-type: none"> • less sulfur dioxide produced • less acid rain produced • (complies with) law • sulfur burns to form sulfur dioxide 	ignore references to cost allow reduces damage to buildings / vegetation / wildlife allow references to improved air quality or reduction in respiratory problems eg asthma	2	A03 C1.4.3a,c,d
Total			5	

question	answers	extra information	mark	AOs/Spec ref area
8(a) G	black		1	A02 C1.2.1c
8(b) G	limewater	accept calcium hydroxide (solution)	1	A01 C1.2.1e
8(ci) G	decomposition	allow thermal decomposition	1	A01 C1.2.1b,c
8(cii) E	colour (of carbonate) did not change / stayed white mass did not change / stayed at 13.8 g solution / limewater did not change (colour) / remained colourless		1 1 1	A02 C1.2.1b,c
Total			6	

question	answers	extra information	mark	AOs/Spec ref area
9(a) G	the same as		1	A01 P1.2.1a
9(b) E	36 000 (J)	<p>allow correct substitution for 1 mark: $E = 120 \times 300$ provided no subsequent step</p> <p><i>Allow 1 mark for an answer of 600 (watt-minutes) or an answer of 10 (watt-hours).</i></p> <p><i>If unit on answer line is crossed out and a correct unit is given with answer award 2 marks:</i></p> <p><i>e.g. 600 watt-minutes</i></p> <p><i>or</i></p> <p><i>10 watt-hours</i></p>	2	A02 P1.3.1c
9(c) G	kinetic light	correct order only	1 1	A01 P1.3.1a
Total			5	

question	answers	extra information	mark	AOs/Spec ref area
10(a) A	A greater proportion of the energy is wasted		1	A01 P1.2.1b
10(b) G	conductor infrared/IR area	correct order only	1 1 1	A01 P1.1.1c P1.1.3a,c
10(c)(i) G	6(J)		1	A02 P1.2.1b
10(c)(ii) E (View with ci)	60 % or 0.6	allow ecf from (c)(i) for 2 marks allow 1 mark for correct substitution, i.e. $\frac{6}{10}(\times 100)$ allow for 1 mark: $\frac{ecf(c)(i)}{10}(\times 100)$ allow for 1 mark an answer of 60 or 0.6 with unit	2	A02 P1.2.1d
10(c)(iii) E	heats them / increases the temperature		1	A01 P1.2.1c
Total			8	

question	answers	extra information	mark	AOs/Spec ref area
11(a) G	temperature	correct order only	1	A01 P1.1.4d
	celsius	accept kelvin / uppercase K allow uppercase C / °C allow centigrade	1	
11(b)(i) G	(type of) metal	allow metal cylinder	1	A03 P1.1.4d
11(b)(ii) A	Copper and iron have similar specific heat capacities		1	A03 P1.1.4d
	Lead has the lowest specific heat capacity		1	
11(c) E	16 560 (J)	correct substitution = 1 mark e.g. $E = 2 \times 460 \times 18$ provided no subsequent step	2	A02 P1.1.4d
11(d) A	1°C		1	A03 P1.1.4d
Total			8	

question	answers	extra information	mark	AOs/Spec ref area
12(a) E	reduces / controls amount of light entering the eye	ignore stops light entering the eye	1	A02 B1.2.1a,d
	(so) less chance of damage	accept protects the retina allow (so) can see better (in bright light)	1	
12(b) E	any two from: A reflex action is: <ul style="list-style-type: none"> • fast(er) • automatic / not thought about • involves few(er) neurones • involves few(er) synapses • does not (always) involve the brain 	allow converse statements allow nerves do not allow reference to hormones	2	A01 B1.2.1d
Total			4	

question	answers	extra information	mark	AOs/Spec ref area
13 E			6	A01x4 A02x2 B1.1.1a,b,c,e
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	There is a brief description of either an effect of an unbalanced diet or an effect of not enough exercise on the body.	There is a description of effect(s) of an unbalanced diet and / or effect(s) of not enough exercise on the body.	There is a clear description of the effects of an unbalanced diet and of not enough exercise on the body.	
examples of the points made in the response effects of an unbalanced diet: <ul style="list-style-type: none"> • overweight or underweight • deficiency disease • (Type 2) diabetes 		extra information ignore malnourishment / no energy ignore anorexia allow named deficiency disease accept : <ul style="list-style-type: none"> • arthritis • 'weakened' immune system • periods stop in women allow: <ul style="list-style-type: none"> • affects cholesterol levels • constipation • heart disease/ heart problems • blood pressure • (bowel) cancer 		

Question 13 continues on the next page

Question 13 continued

<p>effects of not enough exercise:</p> <ul style="list-style-type: none">• less energy (transferred)• weight gain• slower metabolic rate• less muscle mass• weaker muscles• more body fat	<p>allow answers written in terms of the positive effects of exercise</p> <p>ignore no energy</p> <p>accept:</p> <ul style="list-style-type: none">• weaker bones• weaker heart• poor circulation• less flexible• effects on stress level and mood• effects on balance / coordination• longer reaction time• 'weaker' immune system <p>if no relevant content allow an answer referring to balanced diet if qualified for Level 1</p>	
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question	answers	extra information	mark	AOs/Spec ref area
14(a) E	2 neutrons		1	A01/A02 C1.1.1 c,e,g,h
	2 electrons	allow E / e / e ⁻ / a small dot for an electron	1	
	electrons on outer shell and neutrons in nucleus	do not accept the symbol for a neutron ignore number of particles	1	
14(b) E	stable arrangement of electrons	ignore references to noble gases allow have a complete / full outer shell (of electrons) allow have a complete outer energy level (of electrons)	1	A01 C1.1.2b
14(c) E	will run out (soon)	ignore references to cost allow does not remain in Earth's atmosphere only if qualified, eg can't be recovered	1	A03 C1.1.2b
	more important uses	allow is a waste (of helium) ignore people will inhale it	1	
Total			6	

question	answers	extra information	mark	AOs/Spec ref area
15(a) E	rare or very small amount in Earth's crust	ignore figures without qualification	1	A03 C1.3.1c
15(b)(i) G	electrolysis		1	A01 C1.3.1d,e
15(b)(ii) E	(electrolysis) uses more energy or there are many stages in the process	ignore references to reactivity accept uses a large amount of energy	1	A01 C1.3.1d,e
Total			3	

question	answers	extra information	mark	AOs/Spec ref area
16(a) E	any four from: <ul style="list-style-type: none"> • water particles gain (kinetic) energy • water particles spread out • (so) water becomes less dense • (so) heated water rises • (and) cooler water falls 	max 3 marks if mention of particles becoming more / less dense allow water particles move faster accept (heated) water expands do not accept (water) particles expand do not accept heat rises allow less energetic particles fall	4	A01 P1.1.3a
16(b)(i) G	reflector		1	A01 P1.1.1e
16(b)(ii) E	any four from: <ul style="list-style-type: none"> • Design A has a bigger area / is 3 m² instead of 2 m² • Design A reflects more / greater percentage of infrared radiation (in total) • Design A makes the food get hotter (quicker) • Design B always points at the Sun • Design B is (more) easily transported (because it folds) 	allow energy / 'heat' for infrared radiation allow benefit related to this point, eg labour saving allow Design B is (more) portable	4	A02/A03 P1.1.3a
Total			9	

