

GCSE **SCIENCE A**

SCA1HP
Mark scheme

4406
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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 ref area
1(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	
1(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
2 E	original use: as a sleeping pill		1	A01 B1.3.1d
	more recent uses: to treat leprosy	accept to treat cancers / leukaemia / skin disorders / inflammatory diseases / arthritis	1	
	also used: to treat morning sickness (in pregnant women)		1	
	reason for ban: caused arm / leg / limb abnormalities (in some babies)	allow toes / fingers / thumbs / hands / feet / body / body parts / bones	1	
Total			4	

question	answers	extra information	mark	AOs/Spec ref area
3 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 3 continues on the next page

Question 3 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
4(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	
4(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
4(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
5(a) E	rare or very small amount in Earth's crust	ignore figures without qualification	1	A03 C1.3.1c
5(b)(i) G	electrolysis		1	A01 C1.3.1d,e
5(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	A02 C1.3.1d,e
5(c) E	$2\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow 4\text{Fe} + 3\text{CO}_2$	correct formulae for 1 mark correct balancing of correct formulae for 1 mark allow multiples accept for 2 marks: $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$	2	A02 C1.3.1d
Total			5	

question	answers	extra information	mark	AOs/Spec ref area
6(a) E	contains only one sort of <u>atom</u>		1	A01 C1.1.1a
6(b) E	<p>platinum is not a compound / mixture / alloy</p> <p>or</p> <p>platinum is an element so should have own (unique) symbol</p> <p>or</p> <p>symbol shown represents 2 different sorts of atom</p>	allow platinum is (an element so) not made of gold and silver	1	A03 C1.1.1a,b
6(c) E	it contains <u>two</u> silver ions and <u>one</u> oxide ion	<p>maximum of 1 mark if mention of being mixed together / covalently bonded</p> <p>allow silver atoms for silver ions</p> <p>allow oxygen atom / ion for oxide ion</p> <p>allow for 1 mark:</p> <p>it is silver oxide</p> <p>or</p> <p>it is made of silver and oxygen</p> <p>or</p> <p>it is a compound</p> <p>or</p> <p>correct ratio of 2:1 atoms / ions for incorrect element(s)</p>	2	A01/A02 C1.1.1b C1.1.3a
Total			4	

question	answers	extra information	mark	AOs/Spec ref area
7(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
7(b)(i) G	reflector		1	A01 P1.1.1e
7(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	

question	Answers	extra information	mark	AOs/Spec ref area
8(a) A	A greater proportion of the energy is wasted		1	A01 P1.2.1b
8(b) E	any three from: <ul style="list-style-type: none"> metal is a good conductor mesh has a big surface area black surfaces are good emitters / radiators (of infrared radiation / energy) black surfaces are good absorbers of infrared radiation / energy from the laptop computer fans increase convection 	allow 'heat' for energy allow mesh / holes allows airflow allow fans replace hot air with cooler air allow fans maintain / increases temperature difference / gradient (between laptop and surroundings)	3	A02 P1.1.1c
8(c) E	arrow 4 squares wide labelled 'wasted (energy)' and arrow 6 squares wide labelled 'useful (energy)' i.e. <div style="text-align: center;"> </div>	allow for 1 mark: correct width arrows with no labels or correct width arrows with numerical labels only or arrows plotted correctly but wasted energy arrow in incorrect position or a correctly labelled diagram showing useful energy is greater than wasted energy	2	A02 P1.2.1a
Total			6	

question	answers	extra information	mark	AOs/Spec ref area
9(a) E	auxin	accept IAA / indoleacetic acid / gibberellins allow phonetic spellings	1	A01 B1.2.3b
9(b)(i) View with 9(a) E	any one from: <ul style="list-style-type: none"> the tip is needed for growth auxin / hormone is produced at the tip (of the shoot) auxin / hormone still active if tip removed and replaced 	allow ecf from (a)	1	A03 B1.2.3b
9(b)(ii) E	as a control or to see if jelly on its own affected growth	ignore references to hormones	1	A03 B1.2.3b
9(b)(iii) View with 9(a) E	auxin / hormone stimulates / is needed for growth / cell elongation (of shoots)	allow ecf from (a)	1	A03 B1.2.3b
9(b)(iv) E	no light (to affect growth) or even distribution of auxin / hormone	allow no stimulus (to affect growth)	1	A02 B1.2.3a,c
Total			5	

question	answers	extra information	mark	AOs/Spec ref area
10(a) E	(bacteria and viruses produce) toxins	allow poisons allow damage body cells	1	A01 B1.1.2b
10(b) E	(temperature at which) <u>enzymes</u> work best		1	A01 B1.2.2a
10(c)(i) E	body mass	allow weight allow ethnicity ignore height / size	1	A03 B1.3.1b
10(c)(ii) E	placebo / fake drug	allow sugar pill allow no treatment	1	A01 B1.3.1b
10(c)(iii) E	any one from: <ul style="list-style-type: none"> • as a control group • for comparison • to see if the drugs worked • to take account of psychological effect 	accept placebo effect allow to avoid bias	1	A03 B1.1.2g B1.3.1b
10(d)(i) G	1.2 (°C)		1	A02 B1.1.2g
10(d)(ii) G	3 (hours)		1	A02 B1.1.2g

Question 10 continues on the next page

Question 10 cont'd

question	answers	extra information	mark	AOs/Spec ref area
10(e)(i) E	(Paracetamol) any two from: <ul style="list-style-type: none"> • ibuprofen reduces body temperature faster • ibuprofen reduces temperature more • ibuprofen doesn't need to be taken as often • ibuprofen keeps body temperature lower / normal / 37 °C for longer 	allow works faster	2	A02/A03 B1.1.2g
10(e)(ii) E	(Paracetamol + ibuprofen) any two from: <ul style="list-style-type: none"> • body temperature decreases at a similar rate • ibuprofen maintained body temperature close to normal / 37 °C • (better to) take fewer drugs • easier to administer 	allow ibuprofen works (almost) as fast allow ibuprofen maintained normal body temperature almost as long allow doesn't make temperature drop below normal as long allow less chance of overdose / giving too much allow (better to) take drugs less frequently allow less chance of missing doses / taking at the wrong time	2	A02 B1.1.2g
Total			11	

question	answers	extra information	mark	AOs/Spec ref area									
11(a) E	(black) copper oxide formed loss in mass is due to carbon dioxide / gas production limewater cloudy shows carbon dioxide produced	explanation must be linked to correct observation	1 1 1	A01/A03 C1.2.1c,e									
11(b)(i) E	any one from: • (bunsen burner flame) not hot enough (to decompose potassium carbonate) • not all Group 1 carbonates decompose	ignore references to reactivity accept temperature not high enough (to decompose potassium carbonate) allow potassium is in Group 1	1	A01 C1.2.1c									
11(b)(ii) E View with table	potassium carbonate: (mass) 13.8 g (limewater) colourless zinc carbonate: (limewater turns) cloudy	accept no change for colourless ignore clear	1 1 1	A02 C1.2.1c,e									
		<table border="1"> <thead> <tr> <th>Metal carbonate</th> <th>Mass after heating in g</th> <th>Limewater</th> </tr> </thead> <tbody> <tr> <td>Potassium carbonate</td> <td>13.8</td> <td>colourless</td> </tr> <tr> <td>Zinc carbonate</td> <td></td> <td>cloudy</td> </tr> </tbody> </table>	Metal carbonate	Mass after heating in g	Limewater	Potassium carbonate	13.8	colourless	Zinc carbonate		cloudy		
Metal carbonate	Mass after heating in g	Limewater											
Potassium carbonate	13.8	colourless											
Zinc carbonate		cloudy											
Total			7										

question	answers	extra information	mark	AOs/Spec ref area
12(a)(i) E	solid particles	accept soot / carbon / unburnt fuels	1	A01 C1.4.3a
12(a)(ii) E	global dimming	allow smog	1	A01 C1.4.3a,c
12(a)(iii) E	any two from: <ul style="list-style-type: none"> irregular pattern in the graph cannot predict future development of industry / technology cannot predict future number of cars cannot predict future efficiency / type of engines might be other sources of particulates in future change in amount of fossil fuels burnt cannot predict future volcanic eruptions 	allow change in use to other fuels / energy sources	2	A03 C1.4.3a,c
12(b)(i) E	rate of decay is lower (because) less acid rain (as) sulfur dioxide is a cause of acid rain or limestone / calcium carbonate reacts with acid (rain)	allow rate of decay is less must refer to idea of less / reduced / not as much acid rain not corrodes	1 1 1	A01/A03 C1.2.1f C1.4.3a,c
12(b)(ii) E	any one from: <ul style="list-style-type: none"> remove (sulfur dioxide) from waste gases use low sulfur fuels 	accept (sulfur dioxide) reacted with limestone / calcium carbonate / calcium hydroxide / calcium oxide accept flue gas desulfurisation	1	A01 C1.4.3d
Total			8	

question	answers	extra information	mark	AOs/Spec ref area
13(a) E	a value of 1°C or less temperatures in investigation are recorded to the nearest degree (Celsius) or differences between temperature rises for different materials is greater than 1°C	reason only scores if a correct value for the resolution is given do not allow 0 / zero	1 1	A02/A03 P1.1.4d
13(b) E	any one from: <ul style="list-style-type: none"> • room temperature / start temperature (of material) • type of insulation • thickness of insulation • time that cylinder was heated for • the power output of the immersion heater 	allow amount	1	A03 P1.1.4d
13(c) E	aluminium smallest temperature rise	reason only scores if 'aluminium' is given allow smaller temperature rise (than the other metals) accept justification by calculation	1 1	A02/A03 P1.1.4d

<p>13(d) E</p>	<p>500(J/kg °C)</p>	<p>allow temperature increase = 18 °C for 1 mark</p> <p>correct substitution 18000 = 2 x c x 18 gains 2 marks provided no subsequent step or correct substitution and rearrangement c = 18000 / (2 x 18) gains 2 marks provided no subsequent step</p> <p>allow 2 marks for 474 (J/kg °C) (a SHC calculated using a temperature of 19 °C)</p> <p>allow 1 mark for substitution 18000 = 2 x c x 19 provided no subsequent step or substitution and rearrangement c = 18000 / (2 x 19) provided no subsequent step</p> <p>allow 2 marks for a SHC calculated using a temperature increase of an incorrect metal, ie 900 (J/kg °C for aluminium) 391 (J/kg °C for copper) 450 (J/kg °C for iron) 134 (J/kg °C for lead)</p>	<p>3</p>	<p>A02 P1.1.4d</p>
<p>Total</p>			<p>8</p>	

question	answers	extra information	mark	AOs/Spec ref area
14(a) E	so it is a good insulator	ignore references to efficiency allow low (rate of) energy / 'heat' transfer do not accept prevents energy transfer	1	A01 P1.1.4a
14(b) E	<u>air</u> is a(n) (good) insulator (so) air reduces conduction trapped air / air bubbles reduce(s) / stop(s) convection	allow <u>air</u> is a poor conductor do not allow stops conduction	1 1 1	A01 P1.1.3a
14(c) E	any three from: <ul style="list-style-type: none"> ice-pack is (much) colder than the cool box contents ice-pack reduces the (overall) <u>temperature</u> of the cool box / air (in the cool box) ice pack requires a lot of energy to heat up / increase temperature / change temperature ice-pack requires heating up before the cool box contents warm up ice-pack cools the air which becomes more dense and sinks 	allow 'heat' for energy allow 'heat' for energy allow ice-pack takes a long time to heat up / increase temperature / change temperature allow ice-pack cools the air and causes (a) convection (current) accept energy / 'heat' is needed to melt the (contents of the) ice-pack	3	A01/A02 P1.1.3d P1.1.4d
Total			7	