



GCSE

Additional Science (Route 2)

AS2FP

Mark scheme

4409

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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 / ; 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 11(c) 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	Answers	Extra information	Mark	AO / Spec ref
1(a)	genes passed on	allow DNA / chromosomes ignore characteristics	1	AO1 B2.7.3 a
	from parent(s)	allow through generations or to children / offspring	1	
1(b)	Damaged cell membranes		1	AO1 B2.7.3 b/c
1(c)(i)	Cystic fibrosis is caused by a recessive allele.		1	AO1 / AO2
	Each parent had one cystic fibrosis allele.		1	B2.7.2 c/d/e
1(c)(ii)	Embryo screening		1	AO1 B2.7.3d
1(c)(iii)	any one from: <ul style="list-style-type: none"> unethical / immoral (may lead to) killing / harming embryo (may lead to possibility of) abortion 	allow reference to against religious / cultural beliefs allow right to life argument ignore cost	1	AO3 B2.7.3d
Total			7	

Question	Answers	Extra information	Mark	AO / Spec ref
2(a)(i)	The dinosaur walked in mud and the mud turned into rock.		1	AO2 B2.8.1 a/b
2(a)(ii)	any one from: <ul style="list-style-type: none"> • many / most destroyed / damaged • few were formed 	allow they are hard to find or they are covered by sediments / rock	1	AO1 B2.8.1 c
2(b)	any two from: <ul style="list-style-type: none"> • changes to the environment (over geological time) • (new) predators • (new) diseases • (new / more successful) competitors • catastrophic event • cyclical nature of speciation 	allow example, eg global warming / ice age allow changes to the habitat allow lack of food / prey allow example eg asteroid impact / volcanic eruptions	2	AO1 B2.8.1 e
2(c)(i)	5		1	AO2 B2.8.1 e
2(c)(ii)	in 50 million years' time	do not accept if impression of being in the past	1	AO3 B2.8.1 d
2(c)(iii)	pattern not regular or idea that figure is only an average	allow cannot predict the future (accurately) allow one gap was 50 (million years) and one was 150 (million years)	1	AO3 B2.8.1 d
Total			7	

Question	Answers	Extra information	Mark	AO / Spec ref
3(a)(i)	All of the time		1	AO1 B2.6.1 c
3(a)(ii)	All of the time		1	AO1 B2.6.1c
3(b)	mitochondria		1	AO1 B2.6.1 d
3(c)(i)	6 minutes		1	AO2 B2.6.1 g
3(c)(ii)	increase in rate or faster deeper / bigger (breaths)	allow shorter (breaths) allow heavier (breaths) if no other marks awarded allow 1 mark for idea of more or harder (breathing) or increased (breathing)	1 1	AO1 B2.6.1 g
3(c)(iii)	anaerobic	do not allow aerobic	1	AO1 B2.6.2 a
Total			7	

Question	Answers	Extra information	Mark	AO / Spec ref
4(a)	electrolysis		1	AO1 C2.7.1
4(b)(i)	OH ⁻		1	AO1 C2.6.2d
4(b)(ii)	13		1	AO1 C2.6.2d
Total			3	

Question	Answers	Extra information	Mark	AO / Spec ref
5(a)(i)	(hydrogen peroxide →) water + oxygen	in either order allow H ₂ O for water allow O ₂ for oxygen	1	AO2 C2.4.1g
5(a)(ii)	To increase the rate of reaction		1	AO1 C2.4.1g
5(b)(i)	oxygen	allow O ₂ for oxygen	1	AO2 C2.4.1g
5(b)(ii)	(temperature would) increase		1	AO1 C2.5.1a/b
5(c)	any two from: <ul style="list-style-type: none"> more measurements made can measure volume of (named) gas no / less (named) gas escapes 	ignore references to accuracy allow did only one measurement in method A allow cannot measure volume of gas in A allow (more) gas can escape in A	2	AO3 C2.4.1a/g
5(d)(i)		The catalyst is used up The rate of reaction is decreasing The rate of reaction is fastest The reaction has finished	extra lines from X, Y or Z negates mark 1 1 1	AO3 C2.4.1a/g
5(d)(ii)	100(cm ³)		1	AO3 C2.4.1a/g
Total			10	

Question	Answers	Extra information	Mark	AO / Spec ref
6(a)	lowers the temperature needed (to melt the mixture or for the process)		1	AO1, AO3 C2.7.1a/h
	(which) saves energy	allow (so) uses less electricity allow (so) process is cheaper	1	
6(b)	to melt the mixture	allow as 'heat' or thermal energy allow for heating (the mixture)	1	AO1, AO2 C2.7.1b/h
	to provide an electric current	allow as electrical energy allow to provide electricity (for electrolysis)	1	
6(c)(i)	Al ³⁺ / aluminium ions are positive	ignore aluminium is positive	1	AO1, AO2 C2.7.1b/c
	(so) attracted to negative electrode	allow as opposite(s) (charges) attract	1	
6(c)(ii)	electrode is carbon		1	AO1 C2.7.1e/h
	(and so electrode / carbon) reacts with oxygen		1	
Total			8	

Question	Answers	Extra information	Mark	AO / Spec ref
7(a)(i) View with Figure 10	A - Electron B - Neutron		1 1	AO1 P2.5.1 a, c
7(a)(ii)	neutrons		1	AO1 P2.5.1 e
7(b)	proton		1	AO1 P2.5.1 b
Total			4	

Question	Answers	Extra information	Mark	AO / Spec ref
8(a)(i)	More than one million years		1	AO1 P2.6.2 f
8(a)(ii)	P – red giant Q – white dwarf		1 1	AO1 P2.6.2 e
8(b)	(Earth was formed) from a supernova		1	AO3 P2.6.2 f
8(c)	any two from: <ul style="list-style-type: none"> • fusion releases large amounts of energy • renewable resource • products (of fusion) are non-polluting • help develop future technologies 	allow water will never run out or large amounts available allow reduces the use of polluting energy resources allow to develop / increase scientific understanding / knowledge ignore references to cost	2	AO3 P2.6
Total			6	

Question	Answers	Extra information	Mark	AO / Spec ref
9(a)	(as the paper thickness increases, the amount of beta radiation detected) decreases	allow converse relationship	1	AO2 P2.5
9(b)(i)	constant between 0 – 20 seconds or constant between 20 – 40 seconds or constant between 40 – 60 seconds	allow constant for 20 seconds	1	AO2 P2.5
	increases from 2000 – 2200 or increases at 20 seconds	allow increases by 200	1	
	decreases from 2200 – 2000 or decreases at 40 seconds	allow decreases by 200 allow it is highest between 20 – 40 seconds for 1 mark	1	
9(b)(ii)	The thickness of the paper stayed the same.		1	AO3 P2.5.2eg
9(c)	So that the mean count from the source is constant		1	AO2 P2.5
9(d)	increased exposure (near it) or increased risk		1	AO1/ AO2 P2.5 2.5.2g
	(as) radiation causes cancer	allow radiation poisoning allow damage to cells / DNA allow mutation(s)	1	
9(e)	cosmic rays		1	AO1 P2.5.2 b
	rocks		1	
Total			10	

Question	Answers	Extra information	Mark	AO / Spec ref
10(a)	amino acid(s)		1	AO2 B2.5.2 e
10(b)(i)	so they reach same temperature / 15°C	allow so they do not react at the wrong temperature or so they react at the right temperature	1	AO3 B2.5.2
10(b)(ii)	3		1	AO3 B2.5.2
10(c)(i)	it doubles for each 10 °C rise	allow exponential increase allow (volume of egg white digested) increases for 1 mark	2	AO2 B2.5.2
10(c)(ii)	do / repeat at other temperature(s) (in the range 10 – 50 °C) between 30 and 40 (°C) or between 40 and 50 (°C) or between 30 and 50 (°C) or around 40 (°C)	ignore repeat without qualification allow eg ref to 37 (°C) ignore ref to 'body temperature'	1 1	AO2 B2.5.2
10(c)(iii)	protease / enzyme is not killed or protease / enzyme is not living reference to protease / enzyme being denatured / destroyed	mark together allow description of denaturation, eg active site / shape changed	1 1	AO1 / AO2 B2.5.2 a/j
Total			9	

Question	Answers	Extra information	Mark	AO / Spec ref
11(a)	base.		1	AO1 C2.6.2a
11(b)	(s) (aq) (l)	in this order only award 2 marks for all three correct award 1 mark if one or two are correct	2	AO1 C2.6.1a

QWC Mark Scheme

Question	Answers	Extra information	Mark	AO / Spec ref
11(c)			6	AO1, AO2 C2.6.1b/c
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 comment.	A simple statement is made about the reaction or separation or crystallisation	Statements are made in a sensible sequence about the reaction and separation or the reaction and crystallisation or separation and crystallisation but some steps may be missing.	Statements are made in a sensible sequence about the reaction, separation and crystallisation in an organised method.	
examples of points made in the response		extra information		
Reaction <ul style="list-style-type: none"> place sulfuric acid in beaker gently warm sulfuric acid add magnesium oxide (using a spatula) stir mixture of magnesium oxide and sulfuric acid add magnesium oxide until no more will react Separation <ul style="list-style-type: none"> filter mixture (to remove excess solid/magnesium oxide) Crystallisation <ul style="list-style-type: none"> heat filtrate in evaporating dish until half volume remains pour into a crystallising dish leave to crystallise 		ignore references to colours of reactants and products allow diagrams showing correct use of equipment		
Total			9	

Question	Answers	Extra information	Mark	AO / Spec ref
12(a)(i)	live (wire)		1	AO1 P2.4.1 f
12(a)(ii)	double insulated or wood is an (electrical) insulator	allow it is not made of metal allow wood is not an (electrical) conductor it is wooden is insufficient ignore it has only two wires in cable	1	AO2 P2.4.1 f / j
12(a)(iii)	because plastic is an (electrical) insulator	allow does not conduct (electricity) ignore other features of plastic	1	AO1 P2.4.1 f
12(a)(iv)	if the current (in the fuse) exceeds 3 A the fuse will melt	allow the fuse will blow / break	1 1	AO1 P2.4.1 h
12(b)	it has a frequency of 50 Hz / hertz the supply is alternating current	allow the current changes direction 50 times per second for 2 marks	1 1	AO1 P2.4.1 b,c
12(c)	29.9 or 30	allow 1 mark for 230×0.13 provided no subsequent step	2	AO2 P2.4.2 c
12(d)	A most efficient	no mark for selection allow less energy used / input for the same output allow lowest power input for the same output allow cheapest to run for the same output ignore cheapest	1	AO3 P2.4
Total			10	

