
GCSE

Additional Science (Route 2)

AS2FP

Mark scheme

4409

June 2016

Version/Stage: 1.1 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 / ; 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 **10(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 1

Question	Answers	Extra information	Mark	AO / Spec. ref.
1(a)	decayed		1	AO1 B2.8.1a/b/ c
1(b)	any two from: <ul style="list-style-type: none"> • changes to the environment • (new) predators • (new) diseases • (new) competitors volcanic eruption • asteroid collision • cyclical nature of speciation 	eg lack of food or climate / temperature change } if neither given, allow catastrophic event	2	AO1 B2.8.1e
1(c)(i)	snails		1	AO3 B2.8.1d
1(c)(ii)	has coils / shell	accept alternatives if consistent with figure 1 / 2 and consistent with (c)(i)	1	AO3 B2.8.1d
1(d)	species		1	AO1 B2.8.1f
Total			6	

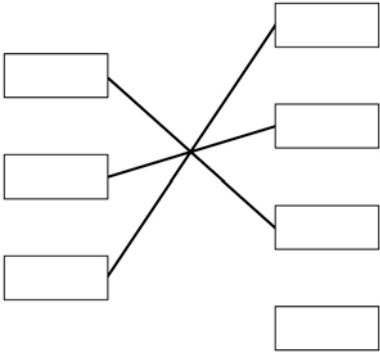
Question 2

Question	Answers	Extra information	Mark	AO / Spec. ref.
2(a)	(energy) yes yes	award 1 mark for each correct row if no correct rows award 1 mark for a correct column	1	AO1
	(lactic acid) no yes		1	B2.6.1b/e B2.6.2a/b
2(b)(i)	1000 (metres)	allow any value in the range 950–1050	1	AO2 B2.6.1
2(b)(ii)	any three from: <ul style="list-style-type: none"> • (more) light • idea of (more) food available • warm(er) • less / low pressure • more / most oxygen 	for 1 further mark allow to see food / prey / predators allow a lot of oxygen allow (more oxygen linked to) for aerobic respiration or to reduce anaerobic respiration allow (more respiration / oxygen linked to) so more energy released allow (more energy linked to) more / faster movement ignore make / produce more energy	3	AO2 AO3 B2.6.1b/e/f /h
2(b)(iii)	A		1	AO3 B2.6.1f
Total			7	

Question 3

Question	Answers	Extra information	Mark	AO / Spec. ref.
3(a)(i)		1 mark for each correct line if more than one line drawn from any statement do not award the mark for that statement	2	AO2 B2.7.2b
3(a)(ii)	23 (single chromosomes)	allow one of each (pair)	1	AO2 B2.7.1e/f
3(b)(i)	dominant (all) first generation are brown		1 1	AO3 B2.7.2c/d/ e
3(b)(ii)	3 brown : 1 white		1	AO2 B2.7.2a
3(b)(iii)	5 will inherit Y (chromosome)	allow half (of them)	1 1	AO1 AO2 B2.7.1g/i B2.7.2b
Total			8	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. ref.
4(a)(i)	hydroxide	ignore chloride / Cl ⁻ accept OH ⁻	1	AO2 C2.7.1a/c
4(a)(ii)	have opposite charge or are attracted (by the positive electrode)	allow chloride ions have a negative charge	1	AO1 C2.7.1a/c
4(a)(iii)	to allow ions to pass through		1	AO3 C2.7.1a/c
4(b)	hydrogen is less reactive than sodium		1	AO1 C2.7.1f/i
4(c)(i)	13	allow any value above 7, up to 14	1	AO2 C2.6.2d
4(c)(ii)	water	allow H ₂ O	1	AO2 C2.6.2e
4(c)(iii)	H ⁺		1	AO1 C2.6.2d
4(d)		award 1 mark for each correct line if more than 1 line from a process do not award a mark for that process	3	AO1 AO2 C2.6.1b/c
Total			10	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. ref.
5(a)	(anhydrous copper sulfate) 1.6 (g)		1	AO2 C2.5.1d
	(water) 0.9 (g)		1	
5(b)	CuSO ₄		1	AO2 C2.5.1d
5(c)(i)	\rightleftharpoons	allow \rightleftharpoons	1	AO1 C2.5.1d
5(c)(ii)	blue		1	AO1 C2.5.1d
5(c)(iii)	exothermic		1	AO1 C2.5.1b
Total			6	

Question 6

Question	Answers	Extra information	Mark	AO / Spec. ref.
6(a)(i)	precipitation		1	AO1 C2.6.1d
6(a)(ii)	filtration	accept decant or centrifuge	1	AO3 C2.6.1d
6(b)(i)	sodium nitrate		1	AO2 C2.6.1d
6(b)(ii)	(aq) aqueous (s) solid	allow dissolved in water	1 1	AO1 C2.6.1a
Total			5	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. ref.
7(a)	brown		1	AO1 P2.4.1f
7(b)(i)	805 (W)	allow 1 mark for correct substitution ie $P = 3.5 \times 230$ provided no subsequent step	2	AO2 P2.4.2c
7(b)(ii)	5 A		1	AO2 P2.4.2c
7(c)	as the current increases, the time decreases	allow the converse	1	AO3 P2.4.1
Total			5	

Question 8

Question	Answers	Extra information	Mark	AO / Spec. ref.
8(a)	fallout from nuclear weapons tests		1	AO1
	medical X-rays		1	P2.5.2b
8(b)(i)	30		1	AO2 P2.5.2h
8(b)(ii)	30	allow candidates value from 8(b)(i)	1	AO1 P2.5.2h
8(c)(i)	any one from: <ul style="list-style-type: none"> • cancer • mutation • radiation sickness 	allow named cancer allow change DNA or cell damage allow radiation poisoning allow (radiation) burns	1	AO1 P2.5.2g
8(c)(ii)	stay indoors		1	AO3 P2.5.2g
8(d)(i)	an electron from the nucleus		1	AO1 P2.5.2c
8(d)(ii)	metal drum		1	AO1, AO3
	beta cannot penetrate		1	P2.5.2e
Total			9	

Question 9

Question	Answers	Extra information	Mark	AO / Spec. ref.
9(a)	6 (V)	allow 1 mark for evidence of using 3 scale divisions or allow 1 mark for 12	2	AO2 P2.4.1b
9(b)	horizontal line (horizontal line) at 3 V	may be above or below the 0 line judged by eye if no other mark awarded allow 1 mark for an alternating signal between +3 and -3	1 1	AO2 P2.4.1a/b
9(c)(i)	some bulbs are used for longer / more (often) than others	allow cost of electricity changes	1	AO3 P2.3
9(c)(ii)	more / other bulbs need to be compared		1	AO3 P2.3
9(c)(iii)	B has a lower input power (than A) or the annual cost of B is lower (than A)	ignore it has a lower power	1	AO3 P2.3
Total			7	

Question 10

Question	Answers	Extra information	Mark	AO / Spec. ref.
10(a)	protein	allow amino acids	1	AO1 B2.5.1b
10(b)(i)	for slimming foods	allow it is sweeter allow less needs to be used (for the same sweetness)	1	AO1 B2.5.2i
10(b)(ii)	enzyme / isomerase shape changed	allow enzyme / isomerase denatured / destroyed / damaged do not allow killed	1	AO2 B2.5.2a/b

Question 10 continues on the next page

Question 10 continued

Question	Answers	Extra information	Mark	AO / Spec. ref.
10(c)			6	AO1 B2.5.2c/d/ e/f/g/h/i
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.	identifies at least one digestive enzyme or a food substance that is broken down in digestion or the product(s) of the digestion of a food substance.	identifies at least one link between a digestive enzyme and a food substance broken down by the enzyme or a digestive enzyme and a product of digestion by that enzyme or a food substance and its product of digestion.	identifies digestive enzymes and at least one food substance broken down by an enzyme and a product of digestion by that enzyme.	
examples of biology points made in the response: <ul style="list-style-type: none"> • (E) amylase • (F) starch • (P) sugar • (E) protease • (F) protein • (P) amino acids • (E) lipase • (F) fat / lipid • (P) fatty acid • (P) glycerol 		extra information <p>allow ref to carbohydrase for amylase</p> <p>allow pepsin for protease</p> <p>accept names of other digestive enzymes and their functions</p> <p>ignore ref to acid / bile</p> <p>ignore the parts of the digestive system where reactions occur</p> <p>ignore industrial uses of enzymes</p>		
Total			9	

Question 11

Question	Answers	Extra information	Mark	AO / Spec. ref.
11(a)	rate of reaction = $\frac{\text{volume of gas produced}}{\text{time}}$		1	AO1 C2.4.1a
11(b)(i)	0.28 (arbitrary units)	allow any value in the range 0.27–0.29	1	AO2 C2.4.1a
11(b)(ii)	supports (conclusion is correct) between 10 °C and 20 °C does not support temperatures above 20 °C values of rate given 10 °C apart to support either answer	allow specific values 10 °C apart above 20 °C	1	AO3 C2.4.1c
			1	
			1	
11(c)(i)	particles move faster or particles have more energy so the particles collide more often / frequently	allow for 2 marks more particles have necessary activation energy to react	1	AO1 C2.4.1b/c
			1	
11(c)(ii)	increase surface area of calcium carbonate increase concentration of hydrochloric acid	ignore references to temperature allow use smaller pieces of calcium carbonate allow use a catalyst	1	AO1 C2.4.1e/f
			1	
Total			9	

Question 12

Question	Answers	Extra information	Mark	AO / Spec. ref.
12(a)	(atomic) nuclei join	allow nuclei fuse / combine ignore nuclei meet / collide / come together	1	AO1 P2.6.2a
12(b)	it has a high mass (of hydrogen)	allow it is massive allow a lot of hydrogen ignore it is big ignore high weight	1	AO1 P2.6.2e
12(c)(i)	gas / dust pulled (together) by gravity		1 1	AO1 P2.6.2c
12(c)(ii)	main sequence (star)		1	AO1 P2.6.2e
12(d)(i)	explosion (of a (massive) star)	allow explosion of a red super giant	1	AO1 P2.6.2f
12(d)(ii)	any one from: • neutron star • black hole	do not allow neutral star do not allow black dwarf	1	AO1 P2.6.2e
12(d)(iii)	iron	allow Fe	1	AO1 P2.6.2f

Question 12 continued

Question	Answers	Extra information	Mark	AO / Spec. ref.
12(d)(iv)	its mass is too low	allow mass is lower than the Sun allow only massive stars will supernova ignore it is too small ignore weight is too low or it is not heavy enough do not allow references to temperature	1	AO2 P2.6.2e
Total			9	

