

GCSE ADDITIONAL SCIENCE COMBINED (ROUTE 2)

AS2FP Paper 6 Foundation Tier
Mark scheme

4409
June 2014

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 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 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 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)

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	Pluto, Mars, Moon	1
2	Pluto, 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 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 14(d) 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 1

question	answers	extra information	mark	spec ref	ID
1(a)(i)	remains / imprint / trace of an animal / plant / organism	accept equivalent ideas	1	B2.8.1b	E
	any one from: <ul style="list-style-type: none"> from many years ago in rock 	allow thousands	1		
1(a)(ii)	any one from: <ul style="list-style-type: none"> (soft tissue) does not fossilise only hard parts form fossils 	accept skin decays accept no skin left allow idea that fossils are not coloured allow nobody there or nobody has ever seen one	1	B2.8.1c	E
1(b)(i)	Tetrapods		1	B2.8.1	G
1(b)(ii)	any answer <u>between</u> 391 and 399	do not accept 390 do not accept 400 accept 'just under 400'	1	B2.8.1	G
1(b)(iii)	Elpistostege		1	B2.8.1	A
Total			6		

Question 2

question	answers	extra information	mark	spec ref	ID
2(a)(i)	(so the root can) grow	accept for growth allow to make more roots allow repair / replacement	1	B2.7.1	G
2(a)(ii)	chromosome(s)	ignore genetic material	1	B2.7.1a	G
2(a)(iii)	mitosis		1	B2.7.1a/c/d	A
2(b)(i)	<i>idea of differences (between offspring or between parents and offspring)</i>		1	B2.7.2a	E
2(b)(ii)	sexual reproduction gametes fertilisation. parent.	in this order only	1 1 1 1	B2.7.2a	G
Total			8		

Question 3

question	answers	extra information	mark	spec ref	ID
3(a)(i)	percentage / amount (of starch) decreases (in / at intestine)		1	B2.5.2d	E
3(a)(ii)	salivary glands		1	B2.5.2d	A
3(a)(iii)	sugar(s) / glucose	allow maltose	1	B2.5.2d	E
3(b)(i)	isomerase		1	B2.5.2i	A
3(b)(ii)	any three from: <ul style="list-style-type: none"> • have the same energy content (per gram) • sweeter (than glucose) • so less needed (to get same sweetness) • so less (overall) energy / less 'fattening' 	allow any correct ref to numbers or proportion that indicates this allow less calories / (kilo)joules (taken in)	3	B2.5.2i	E
Total			7		

Question 4

question	answers	extra information	mark	spec ref	ID
4(a)	nitric acid.		1	C2.6.2b/c	G
	alkaline.		1		
	fertilisers.		1		
4(b)(i)	(temperature) decreases	ignore values	1	C2.5.1a/c	E
	quickly at first or	accept (temperature decreases) at a decreasing rate	1		
	(then) stays constant	allow levels off			
4(b)(ii)	(skin feels) cold(er)	allow (feels) numb	1	C2.5.1a/c	E
	(because the reaction) takes in energy (from skin) or endothermic	allow "heat" for energy	1		
Total			7		

Question 5

question	answers	extra information	mark	spec ref	ID
5(a)	(aq)		1	C2.6.1a	A
5(b)	B		1	C2.4.1e	A
5(c)	<p>any one from:</p> <ul style="list-style-type: none"> (same) mass/ number of tablets (same) volume of acid (starting) temperature 	<p>do not allow concentration of acid</p> <p>ignore type of acid</p> <p>ignore references to time</p> <p>allow (same) size / amount of tablet / pieces</p> <p>allow (same) amount of acid</p>	1	C2.4.1a	E
5(d)	<p>be in smaller pieces.</p> <p>have a larger surface area.</p>		1 1	C2.4.1f	A
Total			5		

Question 6

question	answers	extra information	mark	spec ref	ID
6(a)	(the rate of reaction) increases	allow (rate of reaction) is faster / speeds up	1	C2.4.1d	E
6(b)	increases the rate of reaction.		1	C2.4.1g/h	A
	reduce costs.		1		
6(c)	(platinum)	answers must be comparative	1	C2.4.1g/h	E
	(advantage) faster reaction				
6(c)	(disadvantage) doesn't last as long	allow more expensive allow platinum poisoned by impurities but vanadium oxide is not	1	C2.4.1g/h	E
Total			5		

Question 7

question	answers	extra information	mark	spec ref	ID
7(a)(i)	free to move.		1	C2.7.1a	A
7(a)(ii)	they are positive(ly charged)	do not accept (they are the) positive electrode accept they are oppositely charged allow they are attracted	1	C2.7.1c	E
7(a)(iii)	gain		1	C2.7.1e	A
7(b)	52		1	C2.7.1d	G
Total			4		

Question 8

question	answers	extra information	mark	spec ref	ID
8(a)(i)	proton(s) electron(s) neutron(s)	2 marks for all 3 correct 1 mark for one or two correct	2	P2.5.1a/b	G
8(a)(ii)	11 11	allow the same number as given for the number of protons	1 1	P2.5.1c/e	G
8(b)	electron(s)		1	P2.5.1d	G
Total			5		

Question 9

question	answers	extra information	mark	spec ref	ID
9(a)(i)	Radioactive decay is a random process.		1	P2.5.2a	A
9(a)(ii)	18 / eighteen		1	P2.5	G
9(b)(i)	Use tongs to pick up the source Replace the source in a lead-lined box after use		1 1	P2.5	A
9(b)(ii)	The teacher did not reset the counter to zero.		1	P2.5	A
9(b)(iii)	any number between 3(.0) and 4(.0) inclusive		1	P2.5	E
9(c)	alpha stopped by paper	accept stopped by aluminium allow only travels a few cm in air if no other mark awarded, award 1 mark for selection of gamma and penetrates both paper and aluminium	1 1	P2.5.2e	E
Total			8		

Question 10

question	answers	extra information	mark	spec ref	ID
10(a)(i)	melts	allow blows do not accept sets on fire or explodes	1	P2.4.1h	E
10(a)(ii)	(the circuit) breaks	accept no current	1	P2.4.1g	E
10(a)(iii)	any one from: <ul style="list-style-type: none"> • the circuit has been broken • (live wire has) no current • casing is no longer live 		1	P2.4.1g/h/j	E
10(b)(i)	Aluminium toaster Steel washing machine		1 1	P2.4.1j	A
10(b)(ii)	earth		1	P2.4.1j	G
10(c)	any one from: <ul style="list-style-type: none"> • (RCCB operates) faster (than a fuse) • (RCCBs) can be reset (easily) 	accept safer	1	P2.4.1i	E
Total			7		

Question 11

question	answers	extra information	mark	spec ref	ID
11(a)	carbon dioxide water	in either order allow CO ₂ / CO2 allow H ₂ O / H2O	1 1	B2.6.1e	G
11(b)(i) <i>Clip to include table</i> <i>Clip with (b)(ii)</i>	2400		1	B2.6.1g	E
11(b)(ii) <i>Clip with (b)(i)</i>	1392	accept 1400 or 1390 award 2 marks for correct answer to (answer given in bi) x 58/100 award 1 mark to 2400 x 58/100 or equivalent with no answer or incorrect answer award 1 mark to (answer to bi) x 58/100 with no answer or incorrect answer allow 1416 or 1420 for 1 mark (as ecf from misreading graph as 59)	2	B2.6.1	E

Question 11 continues on the next page

Question 11 cont'd

question	answers	extra information	mark	spec ref	ID
11(b)(iii)	<p>any four from:</p> <p><i>(ref aerobic respiration)</i></p> <ul style="list-style-type: none"> • (at first) aerobic • uses oxygen (from air in lungs) • (large lung capacity means) more oxygen available • (more oxygen available so) aerobic respiration lasts longer <p><i>(ref anaerobic respiration)</i></p> <ul style="list-style-type: none"> • later, or when all / most oxygen used, anaerobic • no oxygen needed • no carbon dioxide released • (anaerobic respiration) releases lactic acid • tolerance of (high) lactic acid no/ reduces pain / fatigue <p><i>(ref blood flow)</i></p> <ul style="list-style-type: none"> • low / less blood to kidney / liver / skin • so less / low respiration in kidney / liver / skin • high / more / most blood to muscles • so more / high respiration in muscles • reduced heart rate (reduces demand for energy by heart) 	<p>max 3 marks for reference to respiration</p> <p>max 3 marks for ref to blood flow</p> <p>accept blood diverted from kidney / liver / skin</p> <p>accept blood diverted to muscles</p> <p>allow glycogen converted to glucose</p> <p>allow (extra) blood (to muscles) transports glucose</p>	4	B2.6.1h	E
Total			9		

Question 12

question	answers	extra information	mark	spec ref	ID
12(a)	carbon dioxide + water \rightleftharpoons carbonic acid	carbon dioxide + water can be in either order allow CO ₂ for carbon dioxide allow H ₂ O for water allow H ₂ CO ₃ for carbonic acid ignore state symbols	1	C2.6.2b	E
12(b)(i)	citric acid	in either order	1	C2.6.2d	E
	carbonated water	allow carbonic acid	1		
12(b)(ii)	hydrogen	accept H ⁺	1	C2.6.2d	E
Total			4		

Question 13

question	answers	extra information	mark	spec ref	ID
13(a)(i)	base.		1	C2.6.2a	A
13(a)(ii)	sulfuric (acid)	allow sulphuric (acid) allow H ₂ SO ₄	1	C2.6.2b	G
13(b)(i)	Any one from: <ul style="list-style-type: none"> black solid remains in excess all acid has reacted 	allow (the black solid) does not dissolve	1	C2.6.1b	E
13(b)(ii)	filter (then) heat (the solution) or (then) leave to crystallise	allow decant or centrifuge accept evaporate allow boil	1 1	C2.6.1b/c	E
Total			5		

Question 14

question	answers	extra information	mark	spec ref	ID
14(a)	joining of two (atomic) nuclei (to form a larger one)	accept hydrogen or helium for atomic allow fusion for joining ignore radioactive	1	P2.6.2a	E
14(b)	supernova (explosion)	allow explosion of a Red Super Giant	1	P2.6.2f	E
14(c)(i)	the greater the (relative) <u>mass</u> of the star, the shorter the life cycle or the smaller the (relative) <u>mass</u> of the star, the longer the life cycle	do not accept inversely proportional	1	P2.6.2	E
14(c)(ii)	any one from: <ul style="list-style-type: none"> • <i>idea of no</i> (actual life cycle) data to use • not enough evidence • scientists make estimates based on partial scientific information gathered 	accept too long to measure	1	SALoSE	E

question	answers	extra information	mark	spec ref	ID
14(d)	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.		6	P2.6	E

Question 14 continues on the next page

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant Information.	At least one relevant statement about the process of nuclear fission and/or at least one idea about how the energy is used.	There is a brief description of the process of nuclear fission and/or a brief description of how the energy is used.	There is a description of the process of nuclear fission and a description of how the energy is used.
<p>Examples of the points made in the response:</p> <p><i>Process of nuclear fission:</i></p> <ul style="list-style-type: none"> • (nuclear fission is the) splitting of an atomic nucleus • the U-235 nucleus • absorbs a neutron • making it unstable • (it) splits into two (different) elements / nuclei • (and 2 / 3) neutrons are released • which can go on to hit other nuclei / U-235 • (which) starts a chain reaction • splitting (of nucleus) releases energy • as kinetic energy or in the form of radiation • the remaining nuclei are stable. <p><i>How the energy is used in nuclear power stations:</i></p> <ul style="list-style-type: none"> • (following the fission reaction) the particles have kinetic energy • the energy (released in the fission process) heats water • heated water turns to steam • (the) steam drives a turbine • energy transferred to kinetic • (turbine) turns a generator • transferring kinetic to electrical energy. 			<p>Extra information</p> <p>allow particle for neutron once allow atom for nucleus once</p> <p>accept neutron fired</p> <p>accept smaller for two</p> <p>allow reference to chain reaction</p> <p>allow energy is released as "heat"</p>
Total			10