GCSE

Science A

SCA2FP

Mark scheme

4406

June 2015

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 / ; 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 <u>not</u> allow

Ignore of 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 **13(b)** 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

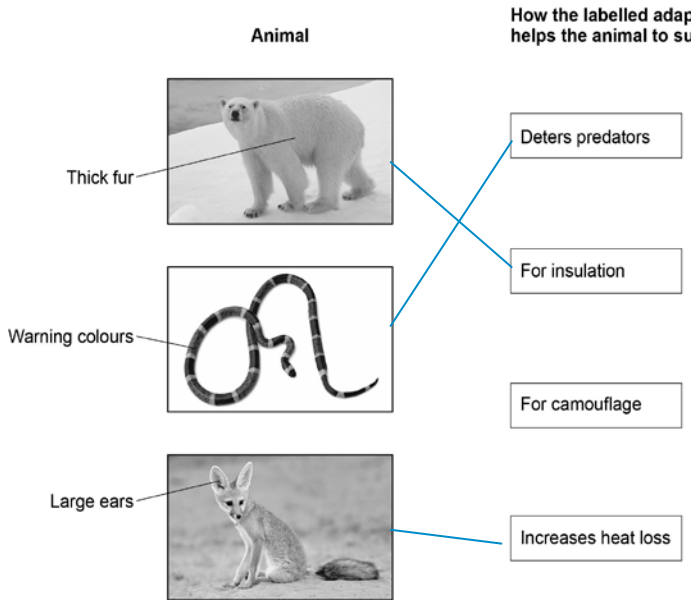
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

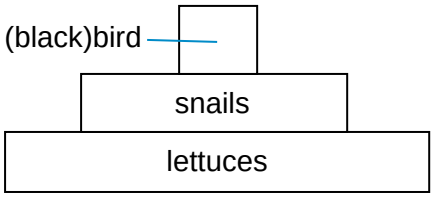
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some 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)		extra lines drawn negates the mark	3	AO1 and AO2 B1.4.1d,f,g
1(b)	any **two** from: • food / prey • mate(s) • territory	allow water allow females / males allow space / shelter	2	AO1 B1.4.1c
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	3 billion years ago		1	AO1 B1.8.1a
2(a)(ii)	any **one** from: • the theory challenged religious beliefs • there was insufficient evidence at the time • mechanism of inheritance / variation not known • people believed in different theories	allow no evidence / proof accept genes not known about	1	AO1 B1.8.1b
2(b)(i)	2 (million years ago)		1	AO2 B1.8.1d
2(b)(ii)	Snow leopard	do **not** allow leopard	1	AO2 B1.8.1d
2(c)	camouflaged	allow description of camouflage, eg blends in with background allow less likely to be seen	1	AO3 B1.4.1d,f
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	correctly labelled pyramid  	allow **1** mark for one bar **or** two bars correctly labelled	2	AO2 B1.5.1b
3(b)(i)	microorganisms / fungi / bacteria	allow decomposers allow yeast ignore mould ignore detritivores / earthworms	1	AO1 B1.6.1b
3(b)(ii)	Aerobic Moist		1 1	AO1 B1.6.1b
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	egg (cell)	accept ovum allow ova ignore gamete	1	AO1 B1.7.1a, B1.7.2c
4(a)(ii)	gamete sexual reproduction		1 1	AO1 B1.7.1a B1.7.2a
4(b)(i)	*Labrador father* any **one** from: • (fur) colour • (shape of) nose / face / head	 allow (shape of) eyes do **not** allow references to ears / tail	 1	AO2 B1.7.1a
4(b)(ii)	*Poodle mother* any **one** from: • curly fur • furry legs • (shape of) tail • (shape of) legs • (shape of) ears	 allow same body shape	 1	AO2 B1.7.1a
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	pressing		1	AO1 C1.6.1a
5(a)(ii)	(sunflower) oil is less dense than water (sunflower) oil does not dissolve in water	allow oil is lighter than water allow (sunflower oil) does not mix / react with water allow oil and water are immiscible allow oil is hydrophobic	1 1	AO3 C1.6.1a C1.6.2a
5(b)(i)	colourless		1	AO1 C1.6.3a C1.5.1d
5(b)(ii)	any **one** from: • volume of vegetable oil • concentration of bromine water • temperature (of oil / bromine water)	do **not** accept volume of bromine water allow amount of vegetable oil	1	AO3 C1.6.3a

5(c)(i)	20.5		1	AO3 C1.6.3a
5(c)(ii)	any **one** from: • misread the burette • did not close the tap soon enough • used more vegetable oil	 allow too many <u>drops</u> of bromine water added allow errors in using the burette eg did not fill the jet allow used incorrect volume of vegetable oil do **not** allow used less vegetable oil	1	AO3 C1.6.3a
5(c)(iii)	as the volume (of bromine water) increases the percentage (unsaturation) increases		1	AO2 C1.6.3a
5(d)	Which vegetable oil provides the most energy?		1	AO3 C1.6.1b
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	any **two** from: • high demand for petrol (compared to petrol supply) • insufficient supply of petrol • surplus kerosene • greater demand for petrol than kerosene • (hydrocarbon) molecules in kerosene are bigger (so can be cracked / made smaller)	allow less demand for kerosene (compared to supply) allow petrol is used more (than kerosene) allow for **2** marks: more demand for petrol than supply **or** kerosene more supply than demand	2	AO3 C1.5.1a
6(b)	cracking catalyst	answers must be in this order	1 1	AO1 C1.5.1a
Total			**4**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	40 (%)		1	AO2 C1.5.2b
7(b)	smart		1	AO1 C1.5.2b
7(c)(i)	C_2H_4		1	AO2 C1.5.1c
7(c)(ii)	Many ethene molecules join together. The monomer is ethene.	extra ticks negate mark	1 1	AO1 C1.5.2a
7(d)	Cornstarch is biodegradable.		1	AO1 C1.5.2c,d
7(e)(i)	ethene (+ water) → ethanol	do **not** allow ethane do **not** allow ethanal	1	AO2 C1.5.3a
7(e)(ii)	hydration		1	AO1 C1.5.3a
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8 (a) (i)	angle of reflection is equal to the angle of incidence	angle of reflection is equal to angle of incidence judged by eye. straight, continuous line judged by eye. do **not** accept a line with an arrow towards the mirror.	1	AO2 P1.5.2b
8 (a) (ii)	(angle) **B**		1	AO1 P1.5.2b
8 (b) (i)	X-rays Infrared Radio (Waves)	all 3 correct for **2** marks 1 or 2 correct for **1** mark answers must be in this order	2	AO1 P1.5.1e
8 (b) (ii)	They can travel through a vacuum. They travel at the same speed through space.		1 1	AO1 P1.5.1c,d
Total			**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9 (a)	**A**: (transmission) cable(s) / line(s) **B**: <u>step-down transformer</u>	allow power for transmission ignore wire(s) ignore overhead / electrical	1 1	AO1 P1.4.2a,c
9 (b)	increased decreased	answers must be in this order	1 1	AO1 P1.4.2b
9 (c)	gas any **one** from: • (gas power stations) can supply electricity quickly • coal and oil powered stations cannot supply electricity quickly enough	no marks if the wrong power station is selected ignore gas has a short start-up time	1 1	AO3 P1.4.1a
Total			**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10 (a)	(the) Sun	ignore solar	1	AO1 P1.4.1c
10 (b) (i)	any **one** from: • the energy is free • renewable (energy source) • can be used in remote areas • no effect on the environment	ignore cheaper allow no carbon dioxide produced allow does not contribute to global warming allow no pollution	1	AO1 P1.4.1c,e,f
10 (b) (ii)	so that the street lamp works at night	allow to store energy for use at night	1	AO3 P1.4.1c
10 (c) (i)	64 (W)		1	AO2 P1.4.1c
10 (c) (ii)	point plotted at (0.4, 64) straight line of best fit through given points	ecf from **10 (c) (i)** allow a line of best fit drawn using the points already on the figure	1 1	AO2 P1.4.1c,e
10 (c) (iii)	0.25 m^2	allow 0.24-0.26 m^2 allow answers that are consistent with the candidate's line of best fit	1	AO2 P1.4.1c,e
10 (c) (iv)	any **one** from: • waste of raw materials • supporting post would need to be stronger		1	AO3 P1.4.1c,e

10 (d)	any **one** from: • more electricity can be generated • wind turbine can generate electricity when it is dark	 accept (the manufacturer) could use a smaller solar cell allow the street light would be more reliable allow wind turbine would generate some of the electricity	1	AO3 P1.4.1b

Total			**9**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11(a)	lichens	allow phonetic spelling	1	AO1 B1.4.2c
11(b)	number of (cress) seeds that grew		1	AO2 B1.4.2b
11(c)(i)	35 (%)		1	AO2 B1.4.2b
11(c)(ii)	sulfur dioxide reduces the growth of seeds	allow SO_2 for sulfur dioxide accept sulfur dioxide reduces the germination of seeds do **not** allow sulfur dioxide prevents the growth of seeds ignore references to sodium metabisulfite (solution) or water	1	AO3 B1.4.2b
Total			**4**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
12(a)(i)	214 (billion tonnes)	allow **1** mark for reading 122 and 92 correctly allow **1** mark for the correct addition of incorrect readings	2	AO2 B1.6.2a
12(a)(ii)	18.35	allow 18.4 do **not** allow 18.3	1	AO2 B1.6.2a
12(b)(i)	(only) a small mass of carbon (dioxide) is released from burning fuels (compared to other processes)	allow the carbon (dioxide) released from other processes / respiration and decomposition is (much) greater	1	AO3 B1.6.2a
12(b)(ii)	any **two** from: • (more) plants would absorb (more) carbon (dioxide) • (due to more) photosynthesis • fewer animals would release less carbon (dioxide) • (due to less) respiration (in animals)	an idea of more is needed at least once an idea of a reduction is needed at least once ignore references to oxygen	2	AO1, AO3 B1.5.1a B1.6.2a
Total			**6**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
13(a)	crust (35)		1	AO1, AO2 C1.7.1a
	(mantle) 2865	ignore 2900	1	
	core (3500)	allow inner + outer core do **not** allow inner core do **not** allow outer core	1	

QWC Mark Scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
13(b)			6	AO1, AO2 C1.7.1a,b,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 content	At least **one** relevant statement is made about a continental change **or** a process causing the change.	Relevant statements are made about continental changes **and / or** the processes causing the changes.	Relevant statements are made about continental changes **and** the processes causing the changes. A detailed description of the processes is needed for full marks.

Examples of the points made in the response:	Extra information
continental changes	allow land masses for continents
• (250 million years ago was a) super continent	allow Pangaea allow continents were joined / very close together
• continents have separated • (and continents have) moved	allow description of named continents in new positions eg Africa and South America no longer joined together
• oceans formed between continents	allow description of position of (named) ocean
processes	
• continental drift	
• (crust and upper part of mantle) cracked into plates / large pieces	
• continents are on different plates	
• (plates) float on mantle	
• driven by heat	
• (heat released) by radioactive processes	
• (radioactive processes) in core	
• (causes) convection currents	
• (convection currents) in mantle	
• (causes) plates to move	
• (plates move) very slowly	allow (plates move) at a speed of a few centimetres a year

Total		9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
14(a)	one of the areas where particles are spread out labelled R		1	AO1 P1.5.1f
14(b)	parallel		1	AO1 P1.5.1b
14(c)	340 (m/s)	allow **1** mark for correct substitution i.e. speed = 400× 0.85 provided that no subsequent steps are shown	2	AO2 P1.5.1j
14(d)(i)	Doppler (effect)	allow phonetic spelling	1	AO1 P1.5.4a
14(d)(ii)	**two** from: • the frequency is higher (than 400 Hz) as the car moves towards the person • the frequency is lower (than 400 Hz) as the car moves away from the person • the higher the speed the car moves towards the person, the higher the frequency • the higher the speed the car moves away from the person, the lower the frequency	accept pitch for frequency ignore references to figures unless qualified accept the higher the speed the greater the change in frequency (compared to 400 Hz)	2	AO3 P1.5.4a
14(d)(iii)	3		1	AO2 P1.5.1i
14(d)(iv)	C		1	AO3 P1.5.4a
Total			**9**	