AQA

GCSE
Combined Science: Synergy

8465/4F – Paper 4 – Physical Sciences – Foundation Tier

Mark scheme

8465

June 2018

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
- 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 and underlining

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 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	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

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

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 ecf 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 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore 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.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	hydrogen carbon	in either order ignore H ignore C	1 1	AO1 4.8.1.2
01.2	plankton		1	AO1 4.8.1.2
01.3	fractional distillation		1	AO1 4.8.1.3
01.4	to vaporise the hydrocarbons / (crude) oil	allow to evaporate the hydrocarbons / (crude) oil ignore to boil the hydrocarbons / (crude) oil	1	AO1 4.8.1.3
01.5	fuel oil		1	AO2 4.8.1.3
01.6	lowest boiling point bar correctly plotted (260 °C) highest boiling point bar correctly plotted (340 °C) correct label added to axis: diesel (oil)	allow ± ½ a square	1 1 1	AO2 4.8.1.3
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	alkali metals		1	AO1 4.5.1.4
02.2	any **one** from: • small piece of metal • large volume of water • use a (safety) screen • keep a safe distance (between teacher / students and apparatus)		1	AO3 4.5.1.4
02.3	reactivity increases down the group any **two** from: • speed increases (down the group) • sodium / potassium melts but lithium does not • flame is seen with potassium, but no flame with lithium / sodium		1 2	AO1 4.5.1.4 AO2 4.5.1.4
02.4	rubidium is too reactive	allow reaction would be violent	1	AO3 4.5.1.4
02.5	$2Na + 2H_2O \rightarrow 2NaOH + H_2$	allow correct multiples	1	AO2 4.5.2.1
02.6	sodium hydroxide		1	AO2 4.5.2.1
02.7	an answer in the range 0.373–0.495 (nanometres)		1	AO3 4.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	3.04×10^{-10} m		1	AO2 4.5.1.4
02.9	batteries increased from 10 to 28 **or** batteries increased by 18	allow batteries increased approximately ×3	1	AO2 4.5.1.4
	producing ceramics and / or glass increased from 10 to 22 **or** producing ceramics and / or glass increased by 12	allow ceramics and / or glass increased by approximately ×2	1	
	lubricants decreased from 8 to 6 **or** lubricants decreased by 2	allow lubricants decreased by a quarter	1	
		if no other marks awarded allow **1** mark for batteries and glass / ceramics increased, lubricants decreased, with no or incorrect data		
Total			**13**	

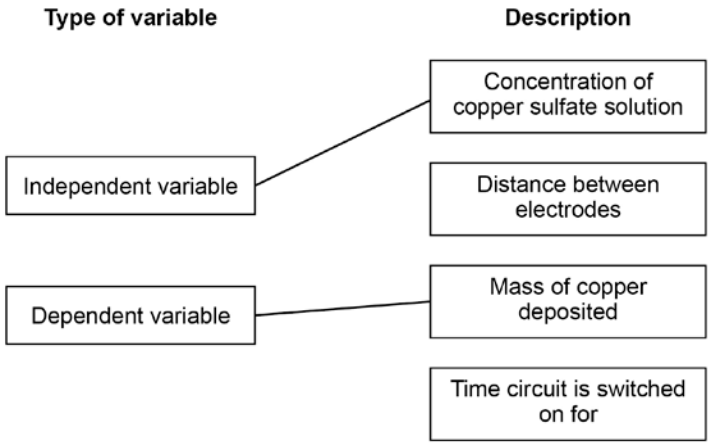
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	correct plotting of all points line of best fit	allow **1** mark for three or four correctly plotted points allow ± ½ a square	2 1	AO2 4.6.3.4
03.2	as (number of) turns increases, number of paperclips increases	allow positive correlation	1	AO2 4.6.3.4
03.3	no paperclips would be picked up (electro)magnet would not have been strong enough **or** magnetic field would not have been strong enough		1 1	AO3 4.6.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	take repeat readings		1	AO3 4.6.3.4
	to allow a mean to be calculated	allow to identify / exclude anomalies allow to reduce the effect of random errors allow to assess the repeatability of the data	1	
	or			
	extend range of data (1)			
	to see if pattern continues (1)	allow to identify / exclude anomalies		
	or			
	use smaller intervals for number of turns (1)			
	to be able to see the pattern in the data more clearly (1)	allow to identify / exclude anomalies		
	or			
	use smaller paperclips (1)			
	to be able to detect smaller changes in strength of magnetic field **or** so fewer turns required to pick up one paperclip (1)			
	or			
	increase strength of electromagnet (1)	allow increase current		
	so fewer turns required to pick up one paperclip			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	the distance from the electromagnet the size of the current through the wire		1 1	AO1 4.6.3.4
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	add thermal insulation to the roof replace the single-glazed windows with double-glazed windows		1 1	AO1 4.8.2.6
04.2	110		1	AO2 4.8.2.6
04.3	the time taken increases		1	AO3 4.8.2.6
04.4	**advantage of solar panel:** cheap(er) to run / use (as) no energy / fuel cost **or** no carbon dioxide emissions (1) (so) does not contribute to global warming **or** climate change (1) **or** renewable (1) (as) sunlight is replenished (1) **or** conserves nuclear / fossil fuels (1) (as) sunlight is renewable (1)	ignore cheap / free unqualified allow no greenhouse gases emitted allow description of effect of global warming	1 1	AO3 4.8.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4 cont.	**or** does not burn fossil fuels (1) (so) no carbon dioxide emissions (1) **disadvantage of solar panel:** unreliable (as sun)light not available **or** expensive (1) due to high cost of manufacturing / installing solar panels (1)	allow no greenhouse gases emitted allow water not always hot enough allow it may not (always) work allow not always sunny allow as it might be cloudy / dark ignore weather ignore night unqualified ignore no sun	1 1	
Total			**8**	

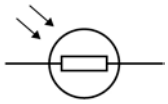
Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	switch		1	AO1 4.7.2.4
05.2	electrolysis		1	AO1 4.7.5.3
05.3	 1 mark for each correct line		2	AO1 4.7.5.3
05.4	some copper fell off the electrode		1	AO3 4.7.5.3
05.5	0.16 (g)		1	AO3 4.7.5.3
05.6	a positive charge	answer line takes precedence	1	AO1 4.7.5.3
05.7	the ions cannot move		1	AO1 4.6.2.3 4.7.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8		an answer of 180 (coulombs) scores **2** marks		AO2 4.7.2.1
	(charge flow =) 0.6 × 300		1	
	(charge flow =) 180 (coulombs)		1	
Total			**10**	

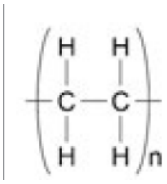
Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	20 (degrees)	allow answers in the range 19–21 (degrees)	1	AO2 4.6.1.1
06.2	vector scalar	in this order only	1 1	AO1 4.6.1.1
06.3	weight **or** (normal) contact (force)	allow gravity do **not** accept gravitational potential energy allow (normal) reaction (force) allow air resistance allow drag	1	AO2 4.6.1.1
06.4	the resultant force on the block is zero		1	AO2 4.7.1.5
06.5	any **two** from: • the (same) block • speed (at which block is pulled) • angle (of string)	do **not** accept force allow named feature of block eg mass / weight	2	AO3 4.6.1.1
06.6	$\left(\frac{5.2 + 5.6 + 5.4}{3} =\right)$ 5.4 (N)		1	AO2 4.6.1.1
06.7	glass	allow ecf from question **06.6** if glass not given	1	AO3 4.6.1.1
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1		an answer 31 320 000 (J) scores **2** marks		AO2 4.7.2.8
	870 000 × 36		1	
	31 320 000 (J) **or** 3.1×10^7 (J)	allow 31 000 000 (J) **or** 31 300 000(J)	1	
07.2	some energy was wasted / dissipated	allow efficiency is always less than100%	1	AO1 4.8.2.5
	(and) transferred to thermal energy		1	
07.3	27 (%)		1	AO2 4.5.2.1
07.4	**similarity** any **one** from: • contain same amount of aluminium • contain (very) similar amounts of silicon • oxygen makes up the highest percentage	do **not** allow 2 marks for silicon as both similarity and difference ignore same amount of silicon unless their answer to question **07.3** was 28% allow both contain aluminium, iron, oxygen and silicon	1	AO3 4.5.2.1
	difference any **one** from: • Moon rock contains more iron (than Earth rock) • Moon rock contains less oxygen (than Earth rock) • Moon rock contains less silicon (than Earth rock)	allow ecf from question **07.3**	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	scientists discover new evidence which the existing theory cannot explain		1	key ideas AO2
07.6	gravitational potential energy = mass × gravitational field strength × height	allow E_p = mgh	1	AO1 4.6.1.5
07.7		an answer 25 000 (m) scores **3** marks		AO2 4.6.1.5
	86 000 000 = 2150 × 1.6 × h		1	
	(h =) $\frac{86\ 000\ 000}{2150 \times 1.6}$		1	
	(h =) 25 000 (m)		1	
Total			**12**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1			1	AO1 4.7.2.4
08.2	in series with LDR in parallel with LDR		1	AO1 4.7.2.2 4.7.2.3
08.3	(graph shows) direct proportion (because) it is a straight line through the origin	 allow inverse proportion would show a curve with a negative gradient	1 1	AO3 4.7.2.2
08.4	straight line through the origin with a positive gradient current is always of smaller magnitude than line already plotted for a given potential difference	 this mark only scores if first mark is awarded allow for **2** marks a straight horizontal line along the *x*-axis	1 1	AO2 4.7.2.2
08.5	potential difference = current × resistance	allow $V = IR$	1	AO1 4.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6		an answer of 440 (Ω) scores **4** marks an answer of 0.44 (Ω) scores **3** marks		AO2 4.7.2.2
	12.5 mA = 0.0125 A		1	
	5.50 = 0.0125 × R	this mark may be awarded if current is incorrectly / not converted	1	
	(R =) $\frac{5.50}{0.0125}$	this mark may be awarded if current is incorrectly / not converted	1	
	(R =) 440 (Ω)	allow an answer consistent with incorrectly / not converted current	1	
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	five single bonds inside the brackets (1 C–C bond and 4 C–H bonds) two single bonds extending from the carbons	allow **2** marks for an answer of: 	1 1	AO1 4.6.2.4
09.2	HD (poly(ethene) polymer chains) have no side chains chains are closer together in HD (poly(ethene) than LD poly(ethene))	allow LD (poly(ethene) polymer chains) have side chains ignore cross links	1 1	AO2 4.6.2.4 AO3 4.6.2.4
09.3	**Level 2:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		3-4	AO3 4.6.1.6
	Level 1: The method would not necessarily lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	
	No relevant content		0	
	Indicative content • suspend a poly(ethene) strip / bag • (use a ruler) to measure length **or** to locate starting position • add (known) mass / weight to the strip / bag **or** pull with a newtonmeter • determine extension • repeat using different forces (by adding further masses / weights **or** pulling harder) • control variables: size / thickness of strip • repeat and calculate a mean			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	any **two** from: • both have increasing extension with increasing force • both extend non-linearly • HD poly(ethene) has a smaller extension (than LD poly(ethene)) for a given force • HD poly(ethene) has a smaller maximum extension (than LD poly(ethene))	allow LD poly(ethene) stretches more for a given force allow correct readings of extension for a given force for both polymers allow HD poly(ethene) breaks at a greater (maximum) force ignore references to strong / weak	2	AO3 4.6.1.6
09.5	$\frac{85}{100}$ × 8.0 (billion) **or** 6.8 (billion) (8 billion − 6.8 billion =) 1.2 billion **or** 1200 000 000 **or** 1.2×10^9	an answer of 1.2 billion scores **2** marks an answer of 1.2 scores **1** mark allow $\frac{15}{100}$ × 8.0 (billion) allow **1** mark for an answer consistent with an incorrect conversion of billion	1 1	AO2 4.8.2.9

Question	Answers	Mark	AO / Spec. Ref.
09.6	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.4.1.4 4.8.1.2 4.8.2.8 4.8.2.9
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content **similarities** • both made from crude oil • crude oil is a finite resource • production and transport of both cause emissions of carbon dioxide • carbon dioxide contributes to global warming • both can be disposed of in the same ways **disadvantages of disposable bags** • each disposable bag generates more waste (than one bag for life) • each disposable bag generates approximately 2.5 times more waste **or** 0.25 g more waste (than one bag for life) • if 6 disposable bags used they generate approximately 15 times more waste **or** 2.35 g more waste (than one bag for life) • if 6 disposable bags used it causes more CO_2 to be emitted (than one bag for life) • if 6 disposable bags used 2.7 g more CO_2 emitted **or** approximately 1.4 times more (than one bag for life) **advantages of disposable bags** • a disposable bag causes less CO_2 to be emitted (than one bag for life) • a disposable bag emits 5.3 g less CO_2 (than one bag for life) • if disposable bags used more than once less CO_2 emitted (than one bag for life) • if bag for life is used fewer than 5 times, it results in more CO_2 being emitted (than one disposable bag) • disposable bags extend less as made from HD poly(ethene)		

Total			18