GCSE
COMBINED SCIENCE: TRILOGY

8464/C/2F - CHEMISTRY PAPER 2 FOUNDATION TIER

Mark scheme

8464

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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
- 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	16		1	AO2 5.1.1.5
01.2	8 e^- in 2nd shell 6 e^- in 3rd shell	allow ●, x ,e^- or any combination	1	AO2 5.1.1.7
01.3	oxygen → sulfur dioxide	allow = in place of → do **not** accept sulfur oxide ignore symbols	1	AO2 5.1.1.1 5.9.3.1
01.4	acid rain		1	AO1 5.9.3.2
01.5	yes / no any **two** from: • increases • constant • decreases correct date range for any one of the above • (increases) 1984–1987 • (constant) 1987–1990 • (decreases) 1990–2014	 allow goes up allow similar allow goes down allow levels off (at the end)	 2 1	 AO3 5.9.3.1 AO2 5.9.3.1
01.6	(69 + 6 =) 75 100 – 75 = 25(%)	an answer of 25(%) scores **2** marks allow a final percentage calculated from an incorrect value in the first step	1 1	AO2 5.9.3.1
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	red **and** blue	both needed for mark	1	AO3 5.8.1.3 5.10.2.12
	unknown		1	
02.2	red	ignore black	1	AO3 5.8.1.3 5.10.2.12
	travels least far	dependent on correct colour allow closest to the start line	1	AO2 5.8.1.3 5.10.2.12
02.3	distance moved by green colour = 12 mm	allow 10 to 14 mm	1	AO2 5.8.1.3 5.10.2.12
	distance moved by solvent = 36 mm	allow 35 to 36 mm	1	
	$\frac{12}{36}$	allow correct substitution of student's measurements	1	
	R_f value = 0.33	allow correct answer from student's measurements for **2** marks	1	
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	watch glass		1	AO1 5.10.1.2 5.10.2.13
03.2	identify 0.29 as anomaly	an answer of 0.14 (g) scores **3** marks	1	AO3 5.10.1.2 5.10.2.13
	$\frac{0.12 + 0.14 + 0.15}{3}$ **or** $\frac{0.41}{3}$	allow $\frac{0.12 + 0.29 + 0.14 + 0.15}{4}$ **or** $\frac{0.70}{4}$	1	AO2 5.10.1.2 5.10.2.13
	(=) 0.14 (g)	allow 0.18 (g) if first marking point not awarded	1	AO2 5.10.1.2 5.10.2.13
03.3	evaporating **or** vaporisation	allow from liquid to vapour / gas do **not** accept boiling	1	AO1 5.1.1.2 5.2.2.1 5.10.2.13
03.4	pure **or** no salt	allow converse answers relating to seawater allow not a mixture allow desalinated do **not** accept less salt do **not** accept filtered	1	AO1 5.1.1.2 5.10.1.2 5.10.2.13
03.5	uses (a lot of) energy	allow needs heating allow needs electricity allow needs fuel **or** any suitable fuel ignore references to equipment ignore references to time	1	AO1 5.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	filtering removes particles	allow solids **or** suitable named solids	1	AO1 5.10.1.2
	sterilising kills bacteria / microbes	allow destroys viruses allow kills viruses	1	
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	80		1	AO1 5.9.1.1
04.2	volcanoes	allow ammonia allow meteorites	1	AO1 5.9.1.2
04.3	⇌	ignore any extra words	1	AO1 5.6.2.1
04.4	rate	allow speed allow pace do **not** accept time do **not** accept amount do **not** accept level do **not** accept point	1	AO1 5.6.2.3
04.5	a mixture designed as a useful product		1	AO1 5.8.1.2
04.6	bar for K to 5.8%	allow ± ½ a small square	1	AO2 5.8.1.2
04.7	$\frac{0.225 \times 100}{3.0}$		1	AO2 5.8.1.2
04.8	use has increased (increase is) less in country B **or** (increase is) less in country D example of data	 allow (increase is) more in country A **or** (increase is) more in country C 	1 1 1	AO2 5.8.1.2 AO3 5.8.1.2 AO3 5.8.1.2
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	lines from: • independent to size of marble chips • control to volume of acid	ignore arrowheads do **not** accept if more than one line from one box	 1 1	AO2 AO3 5.6.1.2
05.2	calcium chloride carbon dioxide water	all three needed for **2** marks allow **1** mark if two correct do **not** accept carbon oxide do **not** accept hydrogen oxide	2	AO2 5.1.1.1 5.3.1.3
05.3	stops loss of acid	allow stops loss of water / liquid allow to ensure that only the gas escapes do **not** accept stops acid evaporating do **not** accept stops gas / CO_2 / water vapour escaping	1	AO3 5.5.6.1
05.4	0.053	allow 0.05 allow 0.053333… do **not** accept 0.052 ignore units	1	AO2 5.6.1.1
05.5	g/s		1	AO1 5.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	all points correctly plotted	allow **1** mark for 5 points correctly plotted allow ± ½ a small square	2	AO2 5.6.1.1
	line of best fit	should be a curve nearer to (10,0.8) than the anomaly (20, 0.6) and through all other points if plotting incorrect allow **1** mark for appropriate line of best fit through student's points	1	AO3 5.6.1.1
05.7	the eight small marble chips have a larger surface area, so more frequent collisions		1	AO3 5.6.1.2 5.6.1.3
Total			**11**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	condenses		1	AO1 5.7.1.2
06.2	the fractions have different boiling points		1	AO1 5.7.1.2 5.7.1.3
06.3	propane	do **not** accept propene	1	AO2 5.7.1.1
06.4	C_nH_{2n+2}		1	AO1 5.7.1.1
06.5	$CH_4 + \mathbf{2}\ O_2 \rightarrow CO_2 + \mathbf{2}\ H_2O$	allow multiples	1	AO2 5.1.1.1 5.7.1.3
06.6	bromine water		1	AO1 5.7.1.4
06.7	to assess the environmental impact (of the stages in the life of a product)	allow to see the effect / harm / damage on the Earth / environment / planet ignore references to energy, pollution, carbon footprint, carbon dioxide, sustainability	1	AO1 5.10.2.1

Question	Answers	Mark	AO / Spec. Ref.
06.8	**Level 2:** Scientifically relevant features are identified; the ways in which they are similar / different is made clear and the magnitude of the similarity / difference noted.	3–4	AO3
	Level 1: Relevant features are identified and differences noted.	1–2	AO2 AO3
	No relevant content	0	
	Indicative content • burning 10 000 bags produces 10 kg more of carbon dioxide than landfill • putting 10 000 bags in landfill produces 0.02 kg more of solid residue than burning. • putting 10 000 bags in landfill produces 50% more sulfur dioxide than burning • burning 10 000 bags produces 25 kg of carbon dioxide, but landfill only produces15 kg • putting 10 000 bags in landfill produces 0.07 kg of solid residue but burning only produces 0.05 kg • landfill produces less carbon dioxide than burning • landfill produces more solid residue than burning • burning produces less sulfur dioxide than landfill		5.10.2.1 5.10.2.2 5.9.2.2
Total			**11**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	methane		1	AO1 5.9.2.2
07.2	any **two** examples from: • rising sea levels • melting ice • agricultural problems • extremes of weather • loss of habitats	allow effects from the same bullet point ignore global warming ignore acid rain ignore global dimming do **not** accept reference to ozone	2	AO1 5.9.2.3
07.3	$\frac{6.0}{4.1} \times 0.0235$ = 0.0344(kg)	an answer of 0.0344(kg) scores **2** marks allow correct rounding allow calculator reading if no mark awarded: allow **1** mark for 34.4 or 0.344 allow **2** marks for 34.4 g	1 1	AO2 5.9.2.4
07.4	use less plastic **or** use recycled plastic	allow carbon capture ignore any reference to energy / fuels	1	AO1 5.9.2.4 5.10.2.2

Question	Answers	Mark	AO / Spec. Ref.
07.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to give a clear account.	5–6	AO1 5.9.1.2 5.9.1.3 5.9.1.4
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content nitrogen increased • because volcanoes produced nitrogen • because (denitrifying) bacteria produced nitrogen • because ammonia was converted to nitrogen oxygen increased • because algae and plants produced oxygen • by photosynthesis carbon dioxide decreased • because algae and plants used carbon dioxide • by photosynthesis • because oceans formed and carbon dioxide dissolved in the water • because carbon dioxide formed carbonates, which precipitate as sediments or formed sedimentary limestone rocks • because algae / plants and animals formed fossil fuels / coal / crude oil / natural gas		
Total			**12**