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AQA · GCSE COMBINED SCIENCE: TRILOGY 8464

Chemistry — Foundation Tier, Paper 2

June 2024 exam series

MARK SCHEME

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GCSE
COMBINED SCIENCE: TRILOGY
8464/C/2F

Chemistry Paper 2F

Mark scheme

June 2024

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 Examiner.

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.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

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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 their 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 (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification).

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**.
Alternative words in the mark scheme are shown by a solidus eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

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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** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, 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. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks should be awarded for a correct numerical answer, without any working shown.
Full marks are **not** awarded for a correct final answer from incorrect working.

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

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **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.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

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, if necessary, 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. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

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.

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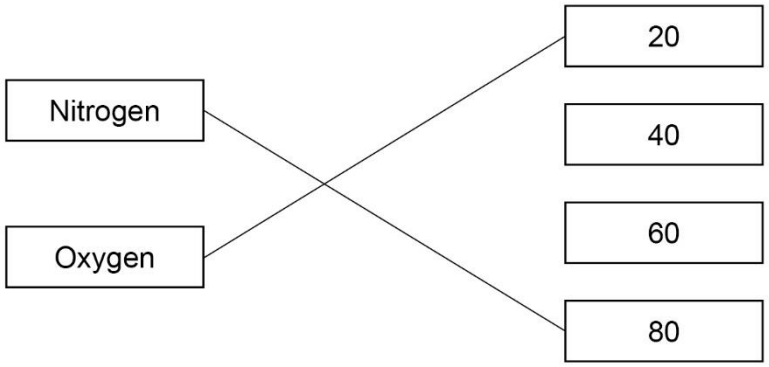
Question 1

Question	Answers	Mark	AO / Spec. Ref.
01.1	**Gas** **Percentage (%) of gas**  do **not** accept more than one line from a box on the left	1 1	AO1 5.9.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	dissolving in oceans photosynthesis		1 1	AO1 5.9.1.2 5.9.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	(from 1800 carbon dioxide percentage is) constant until 1850 (then) increases (to 2020)	 allow a value in the range 1850 to 1865	1 1 1	AO2 5.9.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	methane		1	AO1 5.9.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	climate change		1	AO1 5.9.2.2 5.9.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	(M_r =) 12 + (2 × 16) = 44		 1 1	AO2 5.3.1.2 5.9.2.2

Total Question 1	**11**

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Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(substance) **B** (**B**) has a specific melting point	allow 61 (°C) allow all the other substances melted over a range of temperatures MP2 is dependent on MP1 being awarded	1 1	AO3 5.8.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(from) white (to) blue	 allow **1** mark from blue to white	1 1	AO1 5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(the symbol / sign) ⇌	allow the symbol with arrows both ways	1	AO2 5.6.2.1 5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	6		1	AO2 5.1.1.1 5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(test) damp (blue / red) litmus paper (result) (litmus paper) is bleached **or** (litmus paper) turns white	 ignore paper turns red	1 1	AO1 5.8.2.4

Total Question 2	**8**

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	formulation		1	AO1 5.8.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	pencil (reason) (so) the start line does not dissolve in the solvent		1 1	AO3 5.8.1.3 RPA12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	(distance moved by red colour) 3.2 (cm) **or** 32 (mm) (distance moved by solvent) 8.0 (cm) **or** 80 (mm) (R_f =) $\frac{3.2}{8.0}$ **or** $\frac{32}{80}$ = 0.4	allow a value in the range 3.1 to 3.3 (cm) allow a value in the range 31 to 33 (mm) allow correct use of incorrectly determined distance(s)	1 1 1 1	AO2 5.8.1.3 RPA12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	prussian (prussian) has the closest R_f value (to the colour in the printer ink)	allow 0.88	1 1	AO3 5.8.1.3 RPA12

Total Question 3	**9**

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	potable water		1	AO1 5.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	ozone ultraviolet light		1 1	AO1 5.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	measuring cylinder		1	AO3 5.10.1.2 RPA13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	3.5 (g)		1	AO2 5.10.1.2 RPA13

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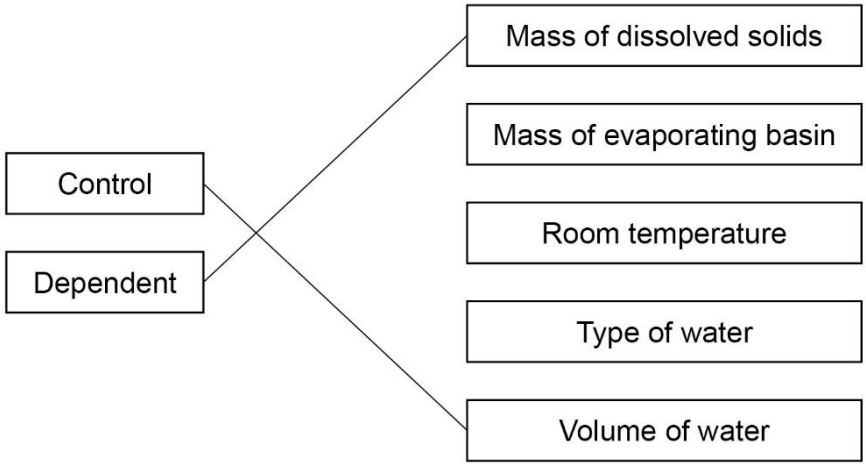
Question	Answers	Mark	AO / Spec. Ref.
04.5	**Variable** / **Example of variable**  do **not** accept more than one line from a box on the left	1 1	AO1 5.10.1.2 RPA13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	complete the scale on the *y*-axis at 2.0, 2.5, 3.0 plotting and labelling magnesium ion plotting and labelling sulfate ion	ignore intermediate values allow **1** mark if magnesium ion and sulfate ion plotted correctly but not labelled allow a tolerance of ± ½ a small square throughout	1 1 1	AO2 5.10.1.2 RPA13

Total Question 4	10

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Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(mass of aluminium recycled =) $\frac{212 \times 68.0}{100}$		1	AO2 5.10.2.1 5.10.2.2
	= 144 (million kg)	allow 144.16 (million kg) allow for **1** mark only an answer of 144 000 000 (million kg) **or** 144 160 000 (million kg)	1	

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	(unit conversion 4 kg =) 4000 g		1	AO2 5.10.2.2
	(number of cans =) $\frac{4000}{15.8}$	allow correct use of an incorrect / no conversion	1	
	= 253.16		1	
	= 253	allow correct whole number from an incorrectly determined number of cans using the values from the question	1	
	alternative approach 1			
	(unit conversion 15.8 g =) 0.0158 kg (1)			
	(number of cans =) $\frac{4}{0.0158}$ (1)	allow correct use of an incorrect / no conversion		
	= 253.16 (1)			
	= 253 (1)	allow correct whole number from an incorrectly determined number of cans using the values from the question		
	alternative approach 2			
	(number of cans from 1000 g =) $\frac{1000}{15.8}$ (1)			
	= 63.29 (1)			
	(number of cans from 4000 g) = 63.29 × 4 (1)	allow correct use of an incorrectly determined number of cans from 1000 g		
	(= 253.16) = 253 (1)	allow correct whole number from an incorrectly determined number of cans using the values from the question		

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Question	Answers	Mark	AO / Spec. Ref.
05.3	**Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3 5.10.2.1 5.10.2.2
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content • less steel (than wood) goes to waste • (so) less space taken up in landfill • more steel (than wood) is recycled • (so) less non-renewable resources are needed • no steel is burnt • (so) no carbon dioxide produced • (so) no contribution to climate change • most wood is disposed of as waste • (so) more space taken up in landfill • least wood is disposed of by burning • (but) still produces carbon dioxide • (which) contributes to climate change • most steel is disposed of by recycling • (so) less non-renewable resources are needed • judgement		

Total Question 5	**10**

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Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(molecules) made up of carbon and hydrogen (atoms only)		1	AO1 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	$C_{10}H_{22}$		1	AO2 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	(crude oil) is heated		1	AO1 5.7.1.2
	(so some of the hydrocarbons) vaporise		1	
	the column has a temperature gradient	allow the column gets cooler going up	1	
	(so) the hydrocarbons / fractions condense at different heights / temperatures in the column **or** (and) the hydrocarbons / fractions condense at their boiling points		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	$C_{14}H_{30} \rightarrow C_8H_{18} + \mathbf{2}\,C_3H_6$		1	AO2 5.1.1.1 5.7.1.4

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	add bromine (water) (bromine water) changes (from orange) to colourless	 allow (bromine water) decolourises ignore clear MP2 is dependent on MP1 being awarded	1 1	AO1 5.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	polymer	allow plastic allow hydrocarbon	1	AO1 5.2.1.4 5.7.1.4

Total Question 6	**10**

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Question 7

Question	Answers	Mark	AO / Spec. Ref.
07.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	AO3
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	AO2
	No relevant content	0	
	Indicative content • measure volume of (hydrochloric) acid • using a measuring cylinder • measure mass of calcium carbonate • using a balance • **add (hydrochloric) acid to calcium carbonate in conical flask** • **put stopper and delivery tube into conical flask** • **start a timer** • **record volume of gas collected at set time intervals** **or** **time how long it takes for a fixed volume of gas to be collected** • **repeat using different sized pieces of calcium carbonate** • use same mass of calcium carbonate • use same volume of (hydrochloric) acid • use same concentration of (hydrochloric) acid • use same temperature of (hydrochloric) acid • repeat each experiment		5.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	(increasing the temperature) increases the rate of reaction		1	AO1 5.6.1.2 5.6.1.3
	(because) particles have more energy	allow (because) particles move faster	1	
	(so) the frequency of collisions increases	allow (so) a greater proportion of collisions have enough energy to react	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	(a substance that) increases the rate of reaction	allow (a catalyst) increases / changes the rate of reaction	1	AO1 5.6.1.4
	and is not used up during the reaction	ignore does not take part in the reaction	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	enzymes		1	AO1 5.6.1.4

Total Question 7	**12**

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