GCSE
COMBINED SCIENCE: TRILOGY
8464/C/1H

Chemistry Paper 1H

Mark scheme

June 2020

Version: 1.0 Final Mark Scheme

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.

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, level of demand 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	13 14	this order only	1 1	AO2 5.1.1.4 5.1.1.5
01.2	loss of oxygen	allow (Al^{3+}) gain of electrons allow aluminium oxide loses oxygen	1	AO1 5.4.1.1 5.4.1.3
01.3	 (at high temperature) oxygen reacts with carbon / electrode (so the positive) electrode burns / wears away to produce carbon dioxide	allow anode for (positive) electrode $C + O_2 \rightarrow CO_2$ scores MP1 and MP3	 1 1 1	 AO1 5.4.3.1 5.4.3.2 5.4.3.3
01.4	(delocalised) electron(s) ion(s) (delocalised) electron(s)		1 1 1	AO1 AO2 AO1 5.2.2.3 5.2.2.8 5.2.3.2
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	any **one** from: • not to scale • not 3 dimensional / D • incorrect arrangement in space • electrons / shells not shown	allow size of atoms incorrect allow atoms are separated ignore properties of water	1	AO2 5.2.1.4
02.2	weak	allow weaker	1	AO1 5.2.2.4
02.3	CH_4O	allow CH_3OH	1	AO2 5.2.1.4
02.4	4		1	AO1 5.2.3.1
02.5	any **two** from: • (very) hard • (very) high melting point • does not conduct electricity	allow strong allow high thermal conductivity ignore shiny	2	AO1 5.2.3.1

02.6	graphite silicon dioxide	allow graphene allow silica allow silicon allow polymer(s) **or** allow (named) polymer(s) allow fullerene **or** allow carbon nanotubes ignore buckminsterfullerene	1 1	AO1 5.2.2.6

Total			**8**

Question	Answers	Mark	AO/ Spec. Ref
03	**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	5.3.1.3 5.4.2.2
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content: • weigh test tube • add metal carbonate • weigh test tube and metal carbonate • heat • allow to cool • weigh test tube and metal oxide • repeat (heat, cool and weigh) until no change in mass • determine mass of metal carbonate used • determine mass of carbon dioxide produced • repeat with different metal carbonate(s) an alternative method can be based on any mass of metal carbonates and at end divide by this mass to find mass carbon dioxide per gram metal carbonate level 3 change in mass is determined for at least one other carbonate		

Total			6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	ZnO (**s**) + HCl (**aq**) → $ZnCl_2$ (**aq**) + H_2O (**l**)	allow **1** mark for 2/3 correct state symbols	2	AO2 5.2.2.2 5.4.2.3 RPA8
04.2	any **one** from: • warm / heat the mixture • increase the concentration of the (hydrochloric) acid	ignore add a catalyst ignore stir ignore powder ignore add more zinc oxide do **not** accept volume / amount of (hydrochloric) acid do **not** accept increase the surface area	1	AO1 5.4.2.2 5.4.2.3 RPA8
04.3	zinc oxide remains **or** solid remains	ignore colour allow zinc oxide is added until in excess	1	AO1 5.3.2.4 5.4.2.2 5.4.2.3 RPA8
04.4	filtration / filter		1	AO1 5.4.2.2 5.4.2.3 RPA8
04.5	heat leave to crystallise / cool	do **not** accept heat to dryness allow leave to evaporate some water	1 1	AO1 5.4.2.2 5.4.2.3 RPA8

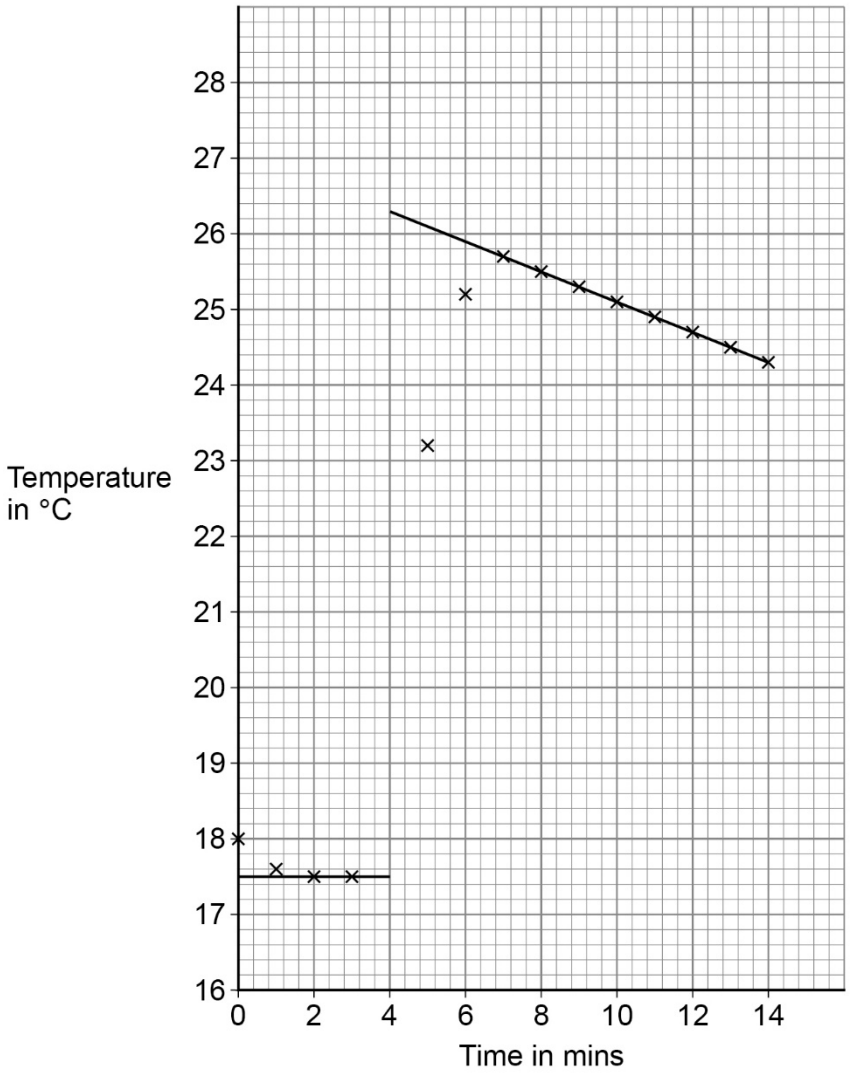
04.6	(at start) value in range 12–14 (at end) value in range 0–3	must be in this order	1 1	AO1 AO2.2 5.4.2.2 5.4.2.4

04.7	2 NaOH + H_2SO_4 → Na_2SO_4 + 2 H_2O	allow 1 mark for Na_2SO_4 **and** H_2O	2	AO2 5.1.1.1 5.4.2.2

04.8	0.10 mol/dm^3		1	AO3 5.4.2.2 5.4.2.4

Total			**12**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	temperature (change)		1	AO2 5.4.1.2 5.5.1.1 RPA 10
05.2	to reach a constant temperature	allow to reach room temperature	1	AO3 5.4.1.2 5.5.1.1 RPA 10

05.3	line of best fit after 7 minutes extends line back to 4 minutes	 ignore extension of line beyond 4 minutes	1 1	AO2 5.4.1.2 5.5.1.1 RPA 10
	the diagram below scores **2** marks  			

05.4	(maximum **and** minimum values at 4 minutes) 26.3 (°C) **and** 17.5 (°C) (temperature change at 4 minutes) = 8.8 (°C)	allow ecf from **05.3**	1 1	AO3 5.4.1.2 5.5.1.1 RPA 10

05.5	the reaction finished / stopped (so) energy is lost to surroundings / atmosphere **or** (so the) solution cools (back to room temperature)	allow maximum temperature has been reached allow heat for energy	1 1	AO3 5.4.1.2 5.5.1.1 RPA 10

05.6	aluminium / zinc / iron / beryllium metal **Q** is less reactive (than magnesium) **or** metal **Q** is lower in reactivity series	allow Al / Zn / Fe / Be do **not** accept copper, silver MP2 dependent on a correct answer to MP1 allow converse	1 1	AO3 AO2 5.4.1.2 5.5.1.1 RPA 10

05.7	(unit conversion) 30.0 cm^3 = 0.030 dm^3 **or** 0.500 dm^3 = 500 cm^3		1	AO2 5.3.2.1 5.4.1.2 5.5.1.1
	(moles = $\frac{30}{500}$ × 0.1 =) 0.006 **or** (moles = $\frac{0.030}{0.50}$ × 0.1 =) 0.006	allow correct use of incorrect / no unit conversion	1	
	mass = 0.006 × 159.5	allow correct use of incorrect value for number of moles	1	
	= 0.957 (g)	allow 0.96 (g)	1	

Total			**14**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	atoms have a positively charged nucleus. mass is concentrated in the nucleus in the centre of atoms.		1 1	AO1 5.1.1.3
06.2	$\frac{4 \times 10^{-7}}{2400}$ $= 1.66666 \times 10^{-10}$ $= 1.67 \times 10^{-10}$ (m)	 allow 0.000 000 000 167 (m) allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses the values in the question	1 1 1	AO2 5.1.1.5
06.3	(moles Au = $\frac{0.175}{197}$ =) 0.000888 (moles Cl_2 = 0.000888 × $\frac{3}{2}$ =) 0.00133 (mass Cl_2 =) 0.00133 × 71 = 0.0946 (g) = 94.6 (mg)	 allow a correct calculation using an incorrectly calculated value of moles of gold allow a correct calculation using an incorrectly calculated value of moles of chlorine allow a correct conversion using an incorrectly calculated mass of chlorine	1 1 1 1 1	AO2 5.3.1.1 5.3.2.2

	alternative approach: (from equation 2 moles of Au reacts with 3 moles of Cl_2) (so) 394 g Au reacts with 213 g Cl_2 (1) 1 g Au reacts with ($\frac{213}{394}$ =) 0.54 g Cl_2 (1) 0.175 g Au reacts with 0.54 × 0.175 g Cl_2 (1) = 0.0946 (g) (1) = 94.6 (mg) (1)	 allow a correct calculation using an incorrectly calculated value of mass of gold and / or chlorine allow a correct calculation using an incorrectly calculated value of mass of gold and / or chlorine allow a correct conversion using an incorrectly calculated mass of chlorine		

Total			**10**

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1		max **3** marks if reference to incorrect particles / bonding / structure		
	caesium atom loses one electron		1	AO1 5.1.2.5 5.2.1.2
	(and) oxygen atom gains two electrons		1	
	(so) two caesium atoms react with one oxygen atom	allow (to produce) Cs_2O	1	
	any **one** from: • (to form) Cs^+ and O^{2-} • (to form) caesium ion(s) and oxide ion(s) • (to form) ions with full outer shells / levels		1	

07.2		allow converse for sodium		
	(caesium has) more energy levels **or** (caesium has) more shells		1	AO2
	(so the) outer electron / shell is further from nucleus **or** outer electron / shell is more shielded		1	AO1
	(so) weaker attraction between nucleus and outer electron / shell		1	AO1
	(so) outer electron is more easily lost	allow (so) less energy needed to remove outer electron	1	AO1 5.1.2.3 5.1.2.5

07.3	early periodic tables were arranged with elements in order of their atomic weights	ignore atomic mass	1	AO1
	iodine has a lower atomic weight than tellurium	allow converse for tellurium	1	AO1
	(so) Mendeleev placed iodine with elements with same / similar properties **or** (so) Mendeleev placed tellurium with elements with same / similar properties	allow F / Cl / Br for elements allow O / S / Se for elements	1	AO2 5.1.2.2

Total			**11**