

GCSE

COMBINED SCIENCE: TRILOGY

Chemistry Paper 1 Higher Tier

Mark scheme Practice Paper Series – Set 1 SGC/S1/C/1H

Version 1.1

This mark scheme is an original resource written for sciencegcse.co.uk to accompany the Set 1 practice paper SGC/S1/C/1H. It is not an AQA mark scheme and has not been produced or endorsed by AQA. It follows the structure and conventions of AQA GCSE science mark schemes so that students and teachers can mark the practice paper in the same way that a real paper is marked.

Marking should be carried out using the Information to Examiners on the following pages. The paper has not been standardised, so raw marks should not be converted into grades using any published grade boundaries.

Specification references are to the AQA GCSE Combined Science: Trilogy (8464) specification, Chemistry section 5.1–5.5. AO = assessment objective; WS = working scientifically; MS = mathematical skills; RP = required practical.

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 answer(s) expected, including alternative acceptable wording, in the **Answers** column
- guidance on which answers are and are not creditworthy in the **Extra information** column
- the assessment objective (AO) and specification reference for each marking point.

Award marks positively. Do not deduct marks for incorrect additional material unless it contradicts a correct answer (see 3.1). Marks are awarded for what the student has written, not for what they might have meant.

2. Emboldening and underlining

2.1 Where a list of acceptable answers is given and more than one mark is available, **any two from** (or similar) is used, followed by the acceptable answers.

2.2 A bold **and** indicates that both parts of the answer are needed to gain the mark.

2.3 Alternative answers acceptable for the same mark are separated by **or**. Different words that are acceptable within a marking point are separated by a forward slash (/).

2.4 Words in bold in the Answers column are the essential words that must be present, or their equivalent, for the mark to be awarded.

3. Marking points

3.1 Marking of lists

For a question asking for a fixed number of responses, consider the whole answer, including extra responses. Each incorrect or contradictory response cancels one correct response; ignore neutral additions. Numbered answer lines do not limit marking to the first responses. This rule does not apply to extended answers.

3.2 Marking procedure for calculations

Full marks can be awarded for a correct numerical answer without working, unless the question asks for working to be shown. If the answer is incorrect, marks may be awarded for the correct stages of working shown in the mark scheme. Anything shown in brackets in the Answers column (for example the unit) is not required for the mark.

3.3 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.

3.4 Errors carried forward

Any error in the answer to a structured question causes the loss of the mark(s) for that part only. Later parts should be marked on the assumption that the incorrect answer was correct, where the mark scheme indicates that error carried forward (ECF) applies.

3.5 Phonetic spelling

Accept misspelled or phonetic scientific terms when the intended answer is clear, unless the spelling could be confused with a different technical term. This also applies when the question asks for the name of a process or structure.

3.6 Brackets

Words shown in brackets in the Answers column are not required to gain the mark but help to set the context.

3.7 Allow

Answers that are acceptable but which would not normally be expected are shown as **allow**.

3.8 Ignore

Statements shown as **ignore** are neither creditworthy nor penalised. Mark the rest of the answer normally.

3.9 Do not accept

Statements shown as **do not accept** are incorrect and, where they contradict or replace the expected answer, mean the mark is not awarded.

4. Level of response marking instructions

Extended-response questions (question 09.4 in this paper) are marked using a level of response mark scheme. The scheme has three levels, each covering two marks, plus a level descriptor and indicative content.

Step 1 – Determine a level. Read the whole answer and decide which level descriptor best fits it. Use a 'best-fit' approach: an answer does not need to meet every part of a descriptor to be placed in that level, and a weak part of the answer need not prevent it from reaching the higher level if the overall quality matches the descriptor.

Step 2 – Determine a mark within the level. Award the higher mark in the level if the answer meets the descriptor fully and the points made are well linked; award the lower mark if the answer only just meets the descriptor or contains minor errors or omissions.

The indicative content is not a checklist: students need not include every point to reach the top level, and other relevant, correct points should be credited. An answer that lists points without linking them into a coherent answer should be placed in a lower level than one that develops and connects them.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	$40 + 12 + (3 \times 16)$ or $40 + 12 + 48$	an answer of 100 scores 2 marks	1	AO2 5.3.1.2 MS 1a
	$(M_r =)$ 100	an answer of 68 (only one oxygen counted) scores 1 mark	1	AO2 5.3.1.2 MS 1a
01.2	atoms are not created or destroyed or the (same) atoms are rearranged (into new substances)	allow the number of each type of atom is the same before and after the reaction	1	AO1 5.3.1.1
01.3	carbon dioxide is a gas which escapes (into the air)	allow a gas is given off / lost from the open crucible	1	AO2 5.3.1.3
01.4	$(10.0 - 5.6) \div 10.0 \times 100$ or $4.4 \div 10.0 \times 100$	an answer of 44 scores 2 marks	1	AO2 5.3.1.3 MS 1c
	(percentage decrease =) 44 (%)	an answer of 56 (percentage remaining) scores 1 mark	1	AO2 5.3.1.3 MS 1c
01.5	$40 \div 100 \times 100$	an answer of 40 scores 2 marks allow ECF from an incorrect M_r in 01.1	1	AO2 5.3.1.2 MS 1c
	(percentage of calcium =) 40 (%)		1	AO2 5.3.1.2 MS 1c
01.6	$200 \text{ cm}^3 = 0.2 \text{ dm}^3$ or $8.0 \div 0.2$	an answer of 40 scores 2 marks	1	AO2 5.3.2.5 MS 1c
	(concentration =) 40 (g/dm ³)	an answer of 0.04 (g/cm ³) scores 1 mark	1	AO2 5.3.2.5 MS 1c
Total			10	
02.1	exothermic	if more than one box is ticked, no mark	1	AO1 5.5.1.1
02.2	13 (°C)	must be written in Table 1 or clearly given as the mean for zinc	1	AO2 5.5.1.1 MS 2b
02.3	bar for zinc drawn to 13 °C	tolerance $\pm$ half a small square (± 1 °C) allow ECF from an incorrect mean in 02.2	1	AO2 5.5.1.1 MS 4c
	bar for iron drawn to 5 °C	bars must be the same width as the magnesium bar and centred on the labels; if the heights are correct but the bars touch each other, allow 1 mark in total	1	AO2 5.5.1.1 MS 4c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	magnesium	the reason mark can only be awarded if magnesium is chosen	1	AO3 5.5.1.1
	(because it gives) the largest temperature rise or releases the most energy	allow it is the most exothermic do not accept it reacts the fastest	1	AO3 5.5.1.1
02.5	copper does not react with (hydrochloric) acid or copper is less reactive than hydrogen or copper is unreactive	allow copper is below hydrogen in the reactivity series	1	AO2 5.4.2.1
02.6	$32 \div 5 = 6.4$ (times)	allow 6	1	AO2 5.5.1.1 MS 1c
02.7	A		1	AO1 5.5.1.2
Total			9	
03.1	chlorine	if more than one box is ticked, no mark	1	AO1 5.1.2.6
03.2	(going down the group) the outer shell / outer electrons are further from the nucleus or the atoms have more (electron) shells	allow the outer shell is more shielded (from the nucleus)	1	AO1 5.1.2.6
	(so) an (extra) electron is attracted less strongly (to the nucleus) and is gained less easily	allow it is harder for the atom to gain an electron do not accept the outer electron is lost more easily	1	AO1 5.1.2.6
03.3	$\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$ correct formulae for all reactants and products	allow multiples ignore state symbols	1	AO2 5.1.2.6 5.3.1.1
	correctly balanced	the balancing mark can only be awarded if all the formulae are correct	1	AO2 5.1.2.6 5.3.1.1
03.4	$\text{Cl}_2 + 2\text{Br}^- \rightarrow 2\text{Cl}^- + \text{Br}_2$ correct species, including charges, with the potassium ions omitted	allow multiples $\text{Cl}_2 + \text{Br}^- \rightarrow \text{Cl}^- + \text{Br}_2$ (unbalanced) scores 1 mark	1	AO2 5.1.2.6 5.4.1.4
	correctly balanced	do not accept an equation that includes K or K^+	1	AO2 5.1.2.6 5.4.1.4
03.5	(each) bromide ion loses an electron (to form bromine)	allow bromide ions lose electrons do not accept gains oxygen	1	AO1 5.4.1.4
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(a giant structure / regular arrangement of) positive ions	allow copper ions arranged in layers do not accept atoms / molecules	1	AO1 5.2.1.5
	(surrounded by a 'sea' of) delocalised electrons	allow free electrons allow strong (electrostatic) attraction between the positive ions and the delocalised electrons	1	AO1 5.2.1.5
04.2	the delocalised electrons are free to move (through the metal) and carry the charge / current	do not accept ions move	1	AO1 5.2.2.8
04.3	the layers (of atoms / ions) can slide over each other	allow the atoms are arranged in layers which can slide	1	AO1 5.2.2.7
04.4	(zinc) atoms are a different size (from copper atoms)	allow the atoms are different sizes	1	AO1 5.2.2.7
	(so) the layers are distorted / the regular arrangement is disrupted, so the layers cannot slide over each other (as easily)	allow the layers are harder to move	1	AO1 5.2.2.7
04.5	Brass B because it is the hardest / has the highest hardness (110) so it is scratched least easily	both the choice and a reason linked to hardness are needed for the mark ignore it contains the most zinc unless linked to hardness	1	AO3 5.2.2.7
Total			7	
05.1	$24 + (2 \times 35.5) = \mathbf{95}$	an answer of 59.5 (only one chlorine counted) scores 0 marks	1	AO2 5.3.1.2 MS 1a
05.2	$2.4 \div 24 = \mathbf{0.1}$ (mol)	allow 0.10	1	AO2 5.3.2.1 MS 1a
05.3	(moles of MgCl_2 = moles of Mg =) 0.1 (mol) or 0.1×95	an answer of 9.5 scores 2 marks allow ECF from incorrect answers to 05.1 and 05.2	1	AO2 5.3.2.2 MS 1a
	(mass =) 9.5 (g)		1	AO2 5.3.2.2 MS 1a
05.4	0.1 mol of magnesium needs $(0.1 \times 2 =) \mathbf{0.2}$ mol of hydrochloric acid or the ratio of Mg : HCl is 1 : 2	alternative approach: 0.15 mol of hydrochloric acid reacts with $(0.15 \div 2 =) 0.075$ mol of magnesium (1)	1	AO2 5.3.2.4 MS 1c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	0.15 (mol) is less than 0.2 (mol) so (all) the hydrochloric acid is used up (before the magnesium) / the magnesium is in excess	0.075 mol is less than 0.1 mol so the magnesium is in excess / not all the magnesium reacts (1)	1	AO2 5.3.2.4 MS 1c
05.5	(moles of MgCl_2 =) $0.15 \div 2 = 0.075$ (mol) or 0.075×95	an answer of 7.1 scores 2 marks an answer of 7.125 or 7.13 (not to 2 significant figures) scores 1 mark allow ECF from an incorrect M_r in 05.1	1	AO2 5.3.2.4 MS 1c MS 2a
	(mass =) $7.125 = \mathbf{7.1}$ (g)		1	AO2 5.3.2.4 MS 1c MS 2a
05.6	any one from: - some of the solution / product was lost when it was transferred or filtered - some solution was lost by spitting when it was heated (to evaporate the water) - some crystals were left in the (evaporating) basin / on the filter paper - the reaction had not finished / not all the acid had reacted	ignore human error / incorrect measurements	1	AO3 5.3.1.4 5.4.2.3
Total			9	
06.1	hydrogen	if more than one box is ticked, no mark	1	AO1 5.4.3.4
06.2	sodium is more reactive than hydrogen	allow hydrogen is less reactive than sodium or sodium is above hydrogen in the reactivity series	1	AO1 5.4.3.4
	(so) hydrogen ions (from the water) are discharged / gain electrons (in preference to sodium ions)	allow the water molecules break down to produce hydrogen ions which are discharged allow sodium ions stay in solution	1	AO1 5.4.3.4
06.3	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ correct species: Cl^- and Cl_2	allow $2\text{Cl}^- - 2\text{e}^- \rightarrow \text{Cl}_2$ $\text{Cl}^- \rightarrow \text{Cl}_2 + \text{e}^-$ (unbalanced) scores 1 mark	1	AO1 5.4.3.5
	correctly balanced, with the electrons on the right-hand side	do not accept electrons on the left-hand side	1	AO1 5.4.3.5
06.4	(negative electrode) hydrogen	do not accept sodium	1	AO2 5.4.3.4
	(positive electrode) oxygen	do not accept sulfur / sulfate	1	AO2 5.4.3.4
Total			7	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	hydrochloric acid is completely / fully ionised (in water)	allow dissociated for ionised throughout allow a strong acid is fully ionised	1	AO1 5.4.2.5
	ethanoic acid is only partially ionised (in water)	allow only some of the ethanoic acid molecules ionise	1	AO1 5.4.2.5
	(so) the hydrochloric acid has a higher concentration of hydrogen ions (H^+) so a lower pH	allow the converse for ethanoic acid do not accept answers in terms of concentrated / dilute acids	1	AO2 5.4.2.5
07.2	(pH) 2	allow 2.0	1	AO2 5.4.2.5 MS 1c
Total			4	
08.1	(energy needed to break bonds $\Rightarrow$) $(2 \times 436) + 498 = \mathbf{1370}$ (kJ/mol)	an answer of -486 scores 3 marks an answer of 486 or $+486$ (sign missing or incorrect) scores 2 marks	1	AO2 5.5.1.3 MS 1a
	(energy released when bonds form $\Rightarrow$) $4 \times 464 = \mathbf{1856}$ (kJ/mol)	allow $2 \times (2 \times 464)$	1	AO2 5.5.1.3 MS 1a
	(overall energy change $\Rightarrow$) $1370 - 1856 = \mathbf{-486}$ (kJ/mol)	allow ECF for a correct subtraction using their two values	1	AO2 5.5.1.3 MS 1a
08.2	the energy change is negative or more energy is released when the new bonds form than is taken in to break the bonds	allow the energy released forming bonds (1856) is greater than the energy needed to break bonds (1370) do not accept it gives out heat without reference to the answer to 08.1	1	AO2 5.5.1.3
08.3	(the reaction needs) activation energy or the (minimum) energy needed for the particles to react / to break the bonds (in the reactants)	allow the hydrogen and oxygen molecules do not have enough energy (to react)	1	AO1 5.5.1.2
	the spark supplies the activation energy / enough energy (to start the reaction)	allow the spark supplies enough energy to break the bonds	1	AO1 5.5.1.2
Total			6	
09.1	atoms (of the same element) with the same number of protons but different numbers of neutrons	allow atoms with the same atomic number but different mass numbers both parts are needed for the mark	1	AO1 5.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	$(20 \times 10) + (80 \times 11)$ or $200 + 880$ or $1080 (\div 100)$	an answer of 10.8 scores 2 marks allow $(0.2 \times 10) + (0.8 \times 11)$	1	AO2 5.1.1.6 MS 1a
	(relative atomic mass =) 10.8	an answer of 10.5 (a simple mean of 10 and 11) scores 0 marks	1	AO2 5.1.1.6 MS 1a
09.3	(atoms of both isotopes have) the same number of electrons or the same electronic structure (so they react in the same way)	allow the same number of outer (shell) electrons do not accept the same number of protons on its own	1	AO1 5.1.1.7

Question	Answers		Extra information	Mark	AO / Spec. Ref.
09.4	Level 3 (5–6 marks)	A clear description of the plum pudding model, a logically linked explanation of how each of the scattering results in Figure 4 led to the nuclear model, and a description of at least one later development of the model (Bohr and/or Chadwick). The points made are well organised and linked together.		6	AO1 5.1.1.3
	Level 2 (3–4 marks)	A description of the plum pudding model and of some of the scattering results, with a partial explanation of how they led to the nuclear model. Later developments may be missing or incomplete.			
	Level 1 (1–2 marks)	Simple statements about one model of the atom or about the results of the experiment, with little or no explanation of how the results changed the model.			
	0 marks	No relevant content.			
	Indicative content Plum pudding model - the atom is a ball / sphere of positive charge - with negative electrons embedded in it / spread throughout it (the mass and charge are spread evenly through the atom) Alpha scattering results and the nuclear model - most alpha particles passed straight through the foil, so most of the atom is empty space - some alpha particles were deflected, so the centre of the atom has a concentrated positive charge which repels the (positive) alpha particles - a very small number bounced back, so the mass of the atom is concentrated in a very small (dense) nucleus - the plum pudding model could not explain these results because its positive charge is spread out, so it would not deflect alpha particles strongly - this led to the nuclear model: a tiny, positively charged nucleus containing most of the mass, surrounded by electrons Later developments - Bohr adapted the nuclear model: electrons orbit the nucleus at specific distances / in energy levels (shells), which agreed with experimental observations - later experiments showed that the positive charge of the nucleus is subdivided into smaller particles, each with the same amount of positive charge (protons) - Chadwick provided evidence for the existence of neutrons in the nucleus (about 20 years after the nucleus became an accepted idea) Credit other correct, relevant points. Do not credit statements that alpha particles were attracted to the nucleus or that electrons are found in the nucleus.				
Total				10	
TOTAL FOR PAPER				70	