GCSE

CHEMISTRY

Higher Tier Paper 1

Mark scheme Practice Paper Series – Set 2 SGC/S2/SC/1H

Version 1.1 - reviewed 26 October 2026

This mark scheme is an original resource written for sciencegcse.co.uk to accompany the Set 2 practice paper SGC/S2/SC/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 Chemistry (8462) specification, sections 4.1–4.5. 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
When a fixed number of responses is requested but extra responses are given, consider the whole list. Each incorrect response or contradiction cancels one otherwise available correct response, up to the mark limit; the score cannot fall below zero. Neutral material identified by **ignore** does not cancel a correct response. Do not apply this rule as a penalty for extra relevant detail in an extended answer.

3.2 Marking procedure for calculations
A correct final answer can receive the marks indicated in the question-specific scheme without every intermediate step being written. Do not award full marks if the working shown contradicts that answer. Where the question specifically requires a method, demonstration or working, apply that requirement. Credit correct stages when the final answer is wrong, including consequential steps where permitted. A printed unit may only be replaced by another unit when the numerical value is converted consistently.

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
Use an earlier incorrect value in a later part where ECF is allowed by the question-specific scheme. Within a calculation, credit later correct stages that use an earlier incorrect value consistently, subject to any stated limits. Do not repeatedly penalise the same error.

3.5 Phonetic spelling
Accept a misspelling when the intended scientific term is clear, including when a term is being recalled. Do not accept wording that could instead name a different scientific term.

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 (questions 07.3 and 09.5 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	two or more cells connected together (in series)		1	AO1 4.5.2.1
01.2	any **two** from: • the type of metals used for the electrodes / the difference in their reactivity • the type of electrolyte • the concentration of the electrolyte	ignore temperature	2	AO1 4.5.2.1
01.3	an external electrical current is supplied (by a charger)		1	AO1 4.5.2.1
	this **reverses** the chemical reactions, so the reactants are made again		1	AO1 4.5.2.1
01.4	one of the reactants is used up		1	AO1 4.5.2.1
	so the chemical reaction that produces the electricity stops	ignore the energy is used up	1	AO1 4.5.2.1
01.5	any **one** from: • it has a lower voltage (1.2 V compared with 1.5 V) • it costs more to buy (£3.60 compared with 90p)	ignore needs a charger (not in the table)	1	AO3 4.5.2.1
		Total	**8**	
02.1	2,8,4		1	AO1 4.1.1.7
02.2	atoms of the same element with the same number of protons	allow same atomic number	1	AO1 4.1.1.6
	but different numbers of neutrons	allow different mass numbers do not accept different numbers of electrons	1	AO1 4.1.1.6
02.3	16	30 − 14	1	AO1 4.1.1.5
02.4	covalent		1	AO1 4.2.1.4
02.5	carbon dioxide is made of small molecules		1	AO1 4.2.2.4
	with weak intermolecular forces (between molecules), which need little energy to overcome	do not accept weak covalent bonds	1	AO1 4.2.2.4
	silicon dioxide has a giant (covalent) structure	allow lattice / macromolecule	1	AO2 4.2.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	many strong covalent bonds must be broken, which needs a lot of energy		1	AO2 4.2.2.6
		Total	**9**	
03.1	hydrogen peroxide is the only product / all the atoms in the reactants end up in the useful product		1	AO1 4.3.3.2
03.2	34 ÷ (169 + 98) × 100	an answer of 12.7 (%) scores **2** marks	1	AO2 4.3.3.2 MS 1c
	= **12.7** (%)	allow 12.73 / 13 (%)	1	AO2 4.3.3.2 MS 1c
03.3	544 ÷ 680 × 100	an answer of 80 (%) scores **2** marks	1	AO2 4.3.3.1 MS 1c
	= **80** (%)		1	AO2 4.3.3.1 MS 1c
03.4	moles of H_2O_2 = 680 000 ÷ 34 = 20 000 (= moles of BaO_2)	an answer of 3380 (kg) scores **2** marks allow the mass-ratio method: 680 × 169 ÷ 34	1	AO2 4.3.2.2 (HT) MS 1a, 1c
	mass of BaO_2 = 20 000 × 169 = 3 380 000 g = **3380** (kg)	allow 3.38×10^3 kg	1	AO2 4.3.2.2 (HT) MS 1a, 1c
03.5	any **two** from: • the percentage yield • the rate of reaction • the position of equilibrium • the usefulness / value of the by-products • the cost or availability of the reactants • energy costs • safety, e.g. mixtures of hydrogen and oxygen can explode	ignore atom economy	2	AO3 4.3.3.2 WS 1.4
03.6	they form ions with different charges (Mn^{2+} and Mn^{4+})		1	AO1 4.1.3.2
	they (or their compounds) are useful as catalysts	allow speed up a reaction without being used up	1	AO1 4.1.3.2
		Total	**11**	
04.1	so that the ions can move	allow in the solid the ions are fixed in place do not accept electrons move	1	AO1 4.4.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	positive electrode: chlorine		1	AO1 4.4.3.2
	negative electrode: zinc		1	AO1 4.4.3.2
04.3	$2Cl^- \rightarrow Cl_2$		1	AO2 4.4.3.5 (HT)
	+ $2e^-$ on the right	allow $2Cl^- - 2e^- \rightarrow Cl_2$	1	AO2 4.4.3.5 (HT)
04.4	chlorine (is produced, which) is toxic	allow poisonous	1	AO2 4.4.3.2
04.5	any **one** from: • graphite conducts electricity • graphite is inert / does not react with the products • graphite has a high melting point		1	AO1 4.2.3.2
		Total	**7**	
05.1	when it is heated, sodium hydrogencarbonate produces carbon dioxide (gas)		1	AO2 4.3.1.3
	the bubbles of gas expand / are trapped in the mixture, so it rises		1	AO2 4.3.1.3
05.2	more energy is needed to break the bonds in the reactants		1	AO1 4.5.1.3 (HT)
	than is released when the bonds in the products are made		1	AO1 4.5.1.3 (HT)
05.3	moles of $NaHCO_3$ = 4.20 ÷ 84 = 0.0500	an answer of 2.65 (g) scores **4** marks	1	AO2 4.3.2.2 (HT) MS 1a, 1c
	moles of Na_2CO_3 = 0.0500 ÷ 2 = 0.0250		1	AO2 4.3.2.2 (HT) MS 1a, 1c
	mass = 0.0250 × 106	allow the mass-ratio method: 168 g gives 106 g, so 4.20 × 106 ÷ 168	1	AO2 4.3.2.2 (HT) MS 1a, 1c
	= **2.65** (g)	allow 2.7 (g)	1	AO2 4.3.2.2 (HT) MS 1a, 1c
05.4	moles of CO_2 = 0.0250	an answer of 0.600 (dm^3) scores **2** marks allow ECF from 05.3	1	AO2 4.3.5 (HT) MS 1a, 1c
	0.0250 × 24 = **0.600** (dm^3)	allow 600 cm^3 only if the printed unit is changed to cm^3 allow 1 mark for 1.2 (dm^3)	1	AO2 4.3.5 (HT) MS 1a, 1c

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>05.5</td><td>to make sure that all of the sodium hydrogencarbonate had decomposed</td><td>allow so that the reaction was complete</td><td>1</td><td>AO3
4.3.1.3
WS 2.2</td></tr>
<tr><td>05.6</td><td>carbon dioxide and water vapour (gases) are produced and escape from the tube</td><td>allow a gas is given off</td><td>1</td><td>AO2
4.3.1.3</td></tr>
<tr><td colspan="3">Total</td><td>12</td><td></td></tr>
<tr><td>06.1</td><td>X, Y, Z (most reactive first)</td><td></td><td>1</td><td>AO3
4.4.1.2
WS 3.5</td></tr>
<tr><td></td><td>X displaces both Y and Z / Y displaces Z only / Z does not displace either metal</td><td>a reason is needed for this mark</td><td>1</td><td>AO3
4.4.1.2
WS 3.5</td></tr>
<tr><td>06.2</td><td>2 and 2 for X and X^{3+}</td><td></td><td>1</td><td>AO2
4.4.1.4 (HT)</td></tr>
<tr><td></td><td>3 and 3 for Y^{2+} and Y</td><td>allow multiples</td><td>1</td><td>AO2
4.4.1.4 (HT)</td></tr>
<tr><td>06.3</td><td>X (atoms) are oxidised</td><td></td><td>1</td><td>AO1
4.4.1.4 (HT)</td></tr>
<tr><td></td><td>because they lose electrons</td><td>allow $X \rightarrow X^{3+} + 3e^-$</td><td>1</td><td>AO1
4.4.1.4 (HT)</td></tr>
<tr><td>06.4</td><td>6</td><td>allow ECF from 06.2</td><td>1</td><td>AO2
4.4.1.4 (HT)</td></tr>
<tr><td>06.5</td><td>$3e^-$ on the left</td><td></td><td>1</td><td>AO2
4.4.3.5 (HT)</td></tr>
<tr><td></td><td>X on the right</td><td>$X^{3+} + 3e^- \rightarrow X$ scores 2 marks</td><td>1</td><td>AO2
4.4.3.5 (HT)</td></tr>
<tr><td colspan="3">Total</td><td>9</td><td></td></tr>
<tr><td>07.1</td><td>water + carbon dioxide</td><td>both needed, in either order</td><td>1</td><td>AO1
4.4.2.2</td></tr>
<tr><td>07.2</td><td>no more fizzing / bubbles or some magnesium carbonate is left (does not dissolve)</td><td></td><td>1</td><td>AO1
4.4.2.3
RP</td></tr>
<tr><td>07.3</td><td colspan="2"><table>
<tr><td>Level 3
(5–6 marks)</td><td>A clear, logical and detailed method that would produce pure, dry crystals: excess magnesium carbonate is added to the acid, the excess is removed by filtering, and the filtrate is evaporated, crystallised and dried.</td></tr>
<tr><td>Level 2
(3–4 marks)</td><td>A method with most of the main steps, for example adding magnesium carbonate to the acid, filtering and heating the solution, but with some detail missing or steps out of order.</td></tr>
<tr><td>Level 1
(1–2 marks)</td><td>Simple statements about relevant steps, for example mix the chemicals and filter.</td></tr>
<tr><td>0 marks</td><td>No relevant content.</td></tr>
</table></td><td>6</td><td>AO1 (4)
AO2 (2)
4.4.2.3
RP</td></tr>
</table>

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
	Indicative content • measure a volume of dilute sulfuric acid (with a measuring cylinder) into a beaker • warm the acid gently • add magnesium carbonate a spatula at a time, stirring • until no more fizzing / until some solid is left (excess) • so that all of the acid has reacted • filter to remove the excess magnesium carbonate • pour the filtrate (magnesium sulfate solution) into an evaporating basin • heat to evaporate some of the water / until crystals start to form • leave the solution to cool so that crystals form • pour off the remaining solution / filter off the crystals • dry the crystals between filter paper / in a warm oven To reach Level 3 the answer must include using excess magnesium carbonate, filtering and crystallising.			
		Total	**8**	
08.1	phenolphthalein **or** methyl orange	do not accept universal indicator	1	AO1 4.4.2.5 RP
	phenolphthalein: colourless to pink **or** methyl orange: red to yellow	allow methyl orange: red to orange the colour change must match the indicator	1	AO1 4.4.2.5 RP
08.2	it measures the total volume (250 cm^3) accurately	allow a beaker is not accurate enough	1	AO1 4.4.2.5 WS 2.3
08.3	so that the colour change (at the end point) can be seen clearly		1	AO1 4.4.2.5 RP
08.4	24.65 (cm^3)		1	AO2 4.4.2.5 RP
08.5	titre 3 = 24.65 − 1.15 = 23.50 and the concordant titres are 23.40 and 23.50	allow ECF from 08.4	1	AO2 4.4.2.5 MS 2b
	(23.40 + 23.50) ÷ 2 = **23.45** (cm^3)	an answer of 23.45 (cm^3) scores **2** marks	1	AO2 4.4.2.5 MS 2b
08.6	moles of NaOH = 0.100 × 23.45 ÷ 1000 = 2.345×10^{-3}	an answer of 1.17 (mol/dm^3) scores **4** marks allow ECF from 08.5	1	AO2 4.3.4 (HT) MS 1a, 1c, 2a
	moles of H_2SO_4 = $2.345 \times 10^{-3} \div 2 = 1.1725 \times 10^{-3}$		1	AO2 4.3.4 (HT) MS 1a, 1c, 2a

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td></td><td>concentration of the diluted acid = 1.1725 × 10^{-3} ÷ 0.0250 = 0.0469 (mol/dm^3)</td><td></td><td>1</td><td>AO2
4.3.4 (HT)
MS 1a, 1c, 2a</td></tr>
<tr><td></td><td>original concentration = 0.0469 × 25 = 1.17 (mol/dm^3)</td><td>an answer of 0.0469 (mol/dm^3) scores 3 marks</td><td>1</td><td>AO2
4.3.4 (HT)
MS 1a, 1c, 2a</td></tr>
<tr><td>08.7</td><td>the sodium hydroxide solution is diluted, so a larger volume (titre) is needed</td><td></td><td>1</td><td>AO3
4.4.2.5
WS 3.7</td></tr>
<tr><td></td><td>so the calculated concentration of the sulfuric acid would be too high</td><td></td><td>1</td><td>AO3
4.4.2.5
WS 3.7</td></tr>
<tr><td colspan="3">Total</td><td>13</td><td></td></tr>
<tr><td>09.1</td><td>1 (nm) to 100 (nm)</td><td>both values needed</td><td>1</td><td>AO1
4.2.4.1</td></tr>
<tr><td>09.2</td><td>any one from:
• in sun creams
• in deodorants
• as catalysts
• in electronics / computers
• for delivering drugs into the body
• in cosmetics</td><td>ignore wound dressings</td><td>1</td><td>AO1
4.2.4.2</td></tr>
<tr><td>09.3</td><td>to show that it was the silver that killed the bacteria / for comparison</td><td>allow to show that the dressing material alone kills few bacteria</td><td>1</td><td>AO3
4.2.4.2
WS 2.2</td></tr>
<tr><td>09.4</td><td>the smaller the diameter of the particles, the more silver is released</td><td>allow use of data, e.g. 20 nm releases 120 µg but 2000 nm releases 25 µg</td><td>1</td><td>AO3
4.2.4.1
WS 3.5</td></tr>
<tr><td></td><td>because smaller particles have a larger surface area to volume ratio, so more silver is at the surface</td><td></td><td>1</td><td>AO1
4.2.4.1</td></tr>
<tr><td>09.5</td><td colspan="2"><table>
<tr><td>Level 3
(5–6 marks)</td><td>A detailed evaluation that compares the three dressings using several pieces of data (for example mean, range, silver released and cost), considers possible risks of nanoparticles and reaches a justified conclusion.</td></tr>
<tr><td>Level 2
(3–4 marks)</td><td>Some comparison of at least two dressings using some data from the table. A conclusion may be given but it is not fully justified.</td></tr>
<tr><td>Level 1
(1–2 marks)</td><td>Simple statements about one or more dressings, for example A kills the most bacteria.</td></tr>
<tr><td>0 marks</td><td>No relevant content.</td></tr>
</table></td><td>6</td><td>AO3
4.2.4.1, 4.2.4.2
WS 1.4</td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	Indicative content • all three silver dressings kill many more bacteria than the control (4.0%) • A kills the highest percentage of bacteria (99.2%) and has the smallest range, so its results are the most repeatable • B kills almost as many (97.0%) and the ranges of A and B overlap, so the difference may not be significant • C kills the fewest bacteria (81.5%) and has the largest range • the smaller nanoparticles (A) have a larger surface area to volume ratio, so they release the most silver (120 μg) • silver released into the wound might harm human cells; the effects of nanoparticles on the body are not fully known • A is the most expensive (£4.50) and C is the cheapest (£2.10) • conclusion, e.g. B gives almost the same effect as A for less cost and less silver released; A may be best for badly infected wounds To reach Level 3 the answer must use data from the table and give a justified conclusion. Any reasoned conclusion can be credited.			
		Total	**11**	
10.1	41		1	AO2 4.3.1.2
10.2	Al: 5.40 ÷ 27 = 0.200 (mol)	an answer of $2Al + N_2 \rightarrow 2AlN$ with correct working scores **4** marks	1	AO2 4.3.2.3 (HT) MS 1a, 1c
	N_2: 2.80 ÷ 28 = 0.100 (mol)		1	AO2 4.3.2.3 (HT) MS 1a, 1c
	AlN: 8.20 ÷ 41 = 0.200 (mol)	allow ECF from 10.1	1	AO2 4.3.2.3 (HT) MS 1a, 1c
	ratio 2 : 1 : 2 so **2**Al + N_2 → **2**AlN	allow 1 mark for a correctly balanced equation without working	1	AO2 4.3.2.3 (HT) MS 1a, 1c
10.3	atoms are not created or destroyed (in a chemical reaction), they are only rearranged	allow mass is conserved because no atoms are lost	1	AO1 4.3.1.1
10.4	the mass increase is the mass of nitrogen that reacted: moles of N = 1.26 ÷ 14 = 0.0900	an answer of 90 (%) scores **4** marks allow moles of N_2 = 1.26 ÷ 28 = 0.0450	1	AO2 4.3.2.2 (HT) MS 1a, 1c
	moles of Al = 0.0900	allow ECF from the ratio in 10.2	1	AO2 4.3.2.2 (HT) MS 1a, 1c
	mass of Al = 0.0900 × 27 = 2.43 (g)	allow the mass-ratio method: 27 g Al reacts with 14 g N, so 1.26 × 27 ÷ 14 = 2.43 (g)	1	AO2 4.3.2.2 (HT) MS 1a, 1c
	2.43 ÷ 2.70 × 100 = **90.0** (%)	allow 90 (%)	1	AO2 4.3.2.2 (HT) MS 1a, 1c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	the increase in mass would appear smaller, so the calculated mass of aluminium would be too low		1	AO3 4.3.2.2 WS 3.7
	so the calculated percentage of aluminium would be **lower** than the true value		1	AO3 4.3.2.2 WS 3.7
		Total	**12**	
		TOTAL FOR PAPER	**100**	