GCSE

COMBINED SCIENCE: TRILOGY

Foundation Tier Chemistry Paper 2

Mark scheme Practice Paper Series – Set 2 SGC/S2/C/2F

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This mark scheme is an original resource written for sciencegcse.co.uk to accompany the Set 2 practice paper SGC/S2/C/2F. 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 5.6–5.10. 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 (question 08.1 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	The remains of ancient plankton buried in mud	if more than one box is ticked, no mark	1	AO1 5.7.1.1
01.2	C_4H_{10}	allow C4H10 (numbers not written as subscripts) do not accept C_4H_8	1	AO2 5.7.1.1
01.3	Butane	if more than one box is ticked, no mark	1	AO2 5.7.1.1
01.4	$C_{12}H_{26}$	allow C12H26	1	AO2 5.7.1.1
01.5	fuel oil is very viscous (relative viscosity 400), so it does not flow easily (unless it is heated)	allow fuel oil is very thick allow heating makes it less viscous / makes it flow more easily ignore references to boiling point	1	AO3 5.7.1.3
01.6	lubricating oil		1	AO3 5.7.1.3
	its relative viscosity is 100, which is between 50 and 200	the reason mark depends on lubricating oil being chosen the reason must refer to the value 100 or to the range 50–200 allow the other fractions are too runny (viscosity 4 or less) or too thick (viscosity 400)	1	AO3 5.7.1.3
01.7	any **one** from: • polymers / plastics • solvents • detergents	allow a named polymer, e.g. poly(ethene) allow medicines / dyes / paints ignore fuels or lubricants (given in the question) do not accept a fraction, e.g. petrol	1	AO1 5.7.1.2
		Total	**8**	
02.1	Carbon dioxide → Turns limewater milky	if more than one line is drawn from a gas, no mark for that gas	1	AO1 5.8.2.2–5.8.2.4
	Chlorine → Bleaches damp litmus paper		1	AO1 5.8.2.2–5.8.2.4
	Oxygen → Relights a glowing splint		1	AO1 5.8.2.2–5.8.2.4
02.2	any **one** from: • use a fume cupboard • work in a well-ventilated room • use only a small volume of the gas	ignore wear eye protection / gloves / a lab coat ignore be careful	1	AO2 5.8.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	the results only show that the gas is not oxygen and not chlorine	allow the gas could be another gas, e.g. carbon dioxide or nitrogen	1	AO3 5.8.2.1 WS 3.5
	put a lighted / burning splint into the gas: hydrogen burns with a (squeaky) pop	the test and its result are both needed for this mark do not accept a glowing splint	1	AO1 5.8.2.1
		Total	**6**	
03.1	Large objects such as plastic and rags	if more than one box is ticked, no mark	1	AO1 5.10.1.3
03.2	sedimentation	allow settling ignore filtration	1	AO1 5.10.1.3
03.3	the air provides oxygen for (aerobic) bacteria / microorganisms	do not accept the oxygen kills the bacteria	1	AO1 5.10.1.3
	which break down / digest the organic matter (in the effluent)	allow aerobic bacteria break down the organic matter for **2** marks allow waste for organic matter	1	AO1 5.10.1.3
03.4	without oxygen	allow without air / in the absence of oxygen	1	AO1 5.10.1.3
03.5	as a fuel	allow to generate electricity / to heat the buildings / to power the treatment works	1	AO2 5.10.1.3
03.6	any **one** from: • sewage contains much more organic matter / harmful microorganisms • sewage can contain harmful chemicals	allow ground water only needs filtering and sterilising ignore sewage is dirty ignore sewage needs more stages of treatment (repeats the question)	1	AO2 5.10.1.3
03.7	any **two** from: • clear water can still contain dissolved substances / harmful chemicals • clear water can still contain (harmful) microorganisms / bacteria • the water must be sterilised (with chlorine, ozone or ultraviolet light) before it is safe to drink • the water should be tested / analysed before it is used for drinking		2	AO3 5.10.1.2, 5.10.1.3
		Total	**9**	
04.1	incomplete	answers must be in the correct order	1	AO1 5.9.3.1
	carbon monoxide		1	AO1 5.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	nitrogen and oxygen from the air react	allow nitrogen from the air is oxidised do not accept nitrogen from the fuel	1	AO1 5.9.3.1
	because of the high temperature in the engine		1	AO1 5.9.3.1
04.3	any **one** from: • global dimming • health problems for humans, e.g. damage to the lungs	allow less sunlight reaches the Earth's surface allow breathing problems / asthma ignore acid rain / global warming	1	AO1 5.9.3.2
04.4	(40 − 2) ÷ 40 × 100	an answer of 95 (%) scores **2** marks allow 1 mark for 38 ÷ 40 or 0.95	1	AO2 5.9.3.2 MS 1c
	= **95** (%)		1	AO2 5.9.3.2 MS 1c
04.5	carbon monoxide is a gas (so it passes through the filter)	allow carbon monoxide is not a solid / is not a particulate ignore the filter only traps solids, unless carbon monoxide is said to be a gas	1	AO3 5.9.3.1
		Total	**8**	
05.1	reversible		1	AO1 5.6.2.1
05.2	the top of the test tube is cooler	allow the top of the tube is not heated	1	AO2 5.6.2.1
	so ammonia and hydrogen chloride react to produce ammonium chloride (again)	allow the reverse reaction happens do not accept the ammonium chloride condenses	1	AO2 5.6.2.1
05.3	176 (kJ of energy is) given out	both parts are needed for the mark allow released / transferred to the surroundings for given out	1	AO2 5.6.2.2
05.4	the test tube is open / it is not a closed system	allow the gases can escape	1	AO2 5.6.2.3
		Total	**5**	
06.1	Development that meets the needs of people today without stopping future generations meeting their own needs	if more than one box is ticked, no mark	1	AO1 5.10.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	any **two** from: • uses less energy / less fuel • less carbon dioxide is released (from burning fuels) • conserves aluminium ore / ore is a limited resource • less mining / quarrying (less damage to the landscape or habitats) • less waste goes to landfill	ignore it is cheaper	2	AO1 5.10.2.2
06.3	1000 × 0.40 = 400 (kg)	an answer of 300 (kg) scores **2** marks	1	AO2 5.10.2.2 MS 1c
	400 × 0.75 = **300** (kg)	allow 1000 × 0.40 × 0.75 for 1 mark	1	AO2 5.10.2.2 MS 1c
06.4	20 (times)	200 ÷ 10	1	AO2 5.10.2.2 MS 1c
06.5	200 − 10 = 190 (MJ saved for each kg)	an answer of 57 000 (MJ) scores **2** marks allow ECF from 06.3	1	AO2 5.10.2.2 MS 1a
	190 × 300 = **57 000** (MJ)	allow (200 × 300) − (10 × 300) for 1 mark	1	AO2 5.10.2.2 MS 1a
06.6	any **two** from: • recycling still uses energy (10 MJ for each kg) • this energy may come from burning fossil fuels, which releases carbon dioxide / pollutants • collecting / transporting / sorting the cans uses energy / fuel	ignore cost	2	AO3 5.10.2.2
		Total	**10**	
07.1	(in chemistry) a pure substance is a single element or compound (not mixed with any other substance)	allow made of only one substance	1	AO1 5.8.1.1
	honey contains more than one substance / is a mixture	allow honey contains different sugars and water ignore honey is natural	1	AO2 5.8.1.1
07.2	B		1	AO3 5.8.1.1 WS 3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	it melts over a range of temperatures / it melts below 169 °C	the reason mark depends on **B** being chosen allow **A** melts at the same temperature as pure paracetamol	1	AO3 5.8.1.1 WS 3.5
07.3	any **one** from: • fuels • cleaning agents • paints • alloys • fertilisers • foods	allow a named example, e.g. petrol, washing-up liquid, brass, steel do not accept medicines / tablets (given in the question) do not accept a pure substance, e.g. water	1	AO1 5.8.1.2
07.4	total mass = 560 (mg)	an answer of 89.3 (%) scores **2** marks	1	AO2 5.8.1.2 MS 1c
	500 ÷ 560 × 100 = **89.3** (%)	allow 89 (%) allow ECF from an incorrect total mass	1	AO2 5.8.1.2 MS 1c
07.5	the properties of a formulation depend on the amount / proportion of each substance	allow the quantities in a formulation are carefully measured	1	AO2 5.8.1.2
	doubling the binder changes the proportions, so the tablet would have different properties, e.g. it may not break up as quickly	allow the percentage of paracetamol in the tablet would decrease allow the tablet may release the medicine more slowly	1	AO2 5.8.1.2
		Total	**9**	
08.1	**Level 3 (5–6 marks)**: A coherent method is described with relevant detail, which demonstrates a broad understanding of the techniques and procedures. The steps are in a logical order and would give valid results: the concentration is changed by mixing different volumes of the sodium thiosulfate solution with water to the same total volume, the same volume of acid is used, and the time for the cross to disappear is measured for each concentration. **Level 2 (3–4 marks)**: The bulk of a method is described with mostly relevant detail. The method may not be in a completely logical order and may be missing some detail, for example how the concentration is changed or which variables are kept the same. **Level 1 (1–2 marks)**: Simple statements are made about some of the steps, for example add acid to the sodium thiosulfate and time how long the cross takes to disappear. The response may lack a logical structure and would not give valid results. **0 marks**: No relevant content.		6	AO1 5.6.1.2 RP

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	Indicative content • measure a volume of sodium thiosulfate solution with a measuring cylinder, e.g. 10 cm^3 • add water to make the total volume 50 cm^3 • put the mixture in the conical flask and put the flask on the cross • measure a fixed volume of hydrochloric acid with a different measuring cylinder, e.g. 10 cm^3 • add the acid to the flask, swirl, and start the stopwatch at the same time • look down through the mixture from above • stop the stopwatch when the cross can no longer be seen • repeat with different volumes of sodium thiosulfate solution, e.g. 10, 20, 30, 40 and 50 cm^3, each made up to 50 cm^3 with water • keep the volume and concentration of the acid, the total volume, the temperature and the cross the same • the same person should judge when the cross disappears • repeat each concentration and calculate a mean time • rinse the flask between experiments • work in a well-ventilated room because sulfur dioxide is produced / wear eye protection To reach Level 3 the method must change the concentration by dilution to the same total volume (or another valid way), keep the volume of acid the same and time how long the cross takes to disappear.			
08.2	(29 + 31) ÷ 2	an answer of 30 (s) scores **2** marks	1	AO2 5.6.1.2 RP MS 2b
	= **30** (s)	an answer of 32.7 (the anomalous result included) scores 1 mark	1	AO2 5.6.1.2 RP MS 2b
08.3	point plotted correctly at (20, 60)	allow ± half a small square	1	AO2 5.6.1.2 RP MS 4a, 4c
	point plotted correctly at (40, 30)	allow ECF from 08.2 allow ± half a small square	1	AO2 5.6.1.2 RP MS 4a, 4c
	a smooth curve of best fit that passes through or close to all the points	do not accept points joined dot to dot or a straight line	1	AO2 5.6.1.2 RP MS 4a, 4c
08.4	(at a higher concentration) there are more (reacting) particles in the same volume	do not accept the particles move faster	1	AO1 5.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	so the particles collide more frequently	allow more collisions per second / more successful collisions per second ignore more collisions unless linked to time	1	AO1 5.6.1.3
08.5	yes: the mean time for 50 g/dm^3 (25 s) is shorter than the mean time for 40 g/dm^3 (30 s)	allow ECF from 08.2	1	AO3 5.6.1.2 RP WS 3.5, 3.7
	the repeat results do not overlap (24–26 s and 29–31 s), supporting a difference in rate under these conditions	allow the difference between the means is bigger than the spread of the repeats ignore the anomalous result (38 s)	1	AO3 5.6.1.2 RP WS 3.5, 3.7
		Total	**15**	
		TOTAL FOR PAPER	**70**	