

GCSE

COMBINED SCIENCE: TRILOGY

Chemistry Paper 2 Foundation Tier

Mark scheme Practice Paper Series – Set 1 SGC/S1/C/2F

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/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

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 08.2 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	nitrogen	if more than one box is ticked, no mark	1	AO1 5.9.1.1
01.2	(the early atmosphere was mostly) carbon dioxide		1	AO1 5.9.1.2
	(the gases came from) volcanoes	allow volcanic activity	1	AO1 5.9.1.2
	(the oceans formed when water vapour) condensed		1	AO1 5.9.1.2
01.3	any two from: - carbon dioxide dissolved in the oceans (carbon dioxide was used by) algae / plants for photosynthesis - carbon dioxide became locked up in sedimentary rocks / carbonate rocks (such as limestone) - carbon dioxide became locked up in fossil fuels (coal, oil, gas)	allow formed carbonates / shells of sea creatures for sedimentary rocks ignore plants absorbed / breathed in carbon dioxide unless photosynthesis is implied	2	AO1 5.9.1.4
01.4	photosynthesis		1	AO1 5.9.1.3
Total			7	
02.1	a compound of hydrogen and carbon only	if more than one box is ticked, no mark	1	AO1 5.7.1.1
02.2	C ₃ H ₈	if more than one box is ticked, no mark	1	AO2 5.7.1.1
02.3	the crude oil is heated / evaporated and the vapours rise up the column, which is cooler at the top (than at the bottom)	allow the oil is boiled / vaporised allow there is a temperature gradient in the column	1	AO1 5.7.1.2
	(the hydrocarbons) condense at different levels / temperatures, according to their boiling points	allow each fraction contains hydrocarbons with similar boiling points / numbers of carbon atoms	1	AO1 5.7.1.2
02.4	the more carbon atoms (in the molecules), the higher the boiling point	allow the converse allow larger molecules have higher boiling points	1	AO3 5.7.1.3
02.5	petrol		1	AO2 5.7.1.3
02.6	(hydrocarbon + oxygen →) carbon dioxide	allow CO ₂	1	AO1 5.7.1.3
	(+) water	allow H ₂ O allow the products in either order	1	AO1 5.7.1.3
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	the (hydrocarbon / alkane) is heated to vaporise it	allow the hydrocarbon vapour is used	1	AO1 5.7.1.4
	(the vapour is) passed over a hot catalyst or mixed with steam and heated to a very high temperature	allow either catalytic cracking or steam cracking	1	AO1 5.7.1.4
03.2	any one from: • (the smaller molecules / alkanes are) more useful as fuels / there is more demand for smaller molecules (such as petrol) than for the large molecules • produces alkenes, which are used to make polymers / plastics • alkenes are used as starting materials for other chemicals	allow makes petrol from the less useful (heavier) fractions	1	AO1 5.7.1.4
03.3	(test) add bromine water (and shake)	allow orange / yellow bromine water	1	AO1 5.7.1.4
	(result) the bromine water turns from orange to colourless	allow the bromine water is decolourised do not accept goes clear	1	AO1 5.7.1.4
03.4	(alkenes) have a double (carbon–carbon) bond or are unsaturated	allow C=C	1	AO1 5.7.1.4
Total			6	
04.1	pencil is insoluble (in the solvent) or ink would dissolve / move up the paper (and mix with the dyes)	allow the ink would separate into its own colours	1	AO1 5.8.1.3 RP 12
04.2	(otherwise) the dyes / spots would dissolve into the solvent (in the beaker) instead of moving up the paper	allow the sample would wash off the paper	1	AO1 5.8.1.3 RP 12
04.3	a mixture made in a fixed proportion for a purpose	if more than one box is ticked, no mark	1	AO1 5.8.1.2
04.4	A		1	AO3 5.8.1.3 RP 12
	C	allow the dyes in either order	1	AO3 5.8.1.3 RP 12
04.5	$(R_f =) 4.8 \div 8.0$		1	AO2 5.8.1.3 MS 1c, 3c RP 12
	= 0.6	an answer of 0.6 scores 2 marks an answer of 1.67 (inverted) scores 1 mark	1	AO2 5.8.1.3 MS 1c, 3c RP 12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	(dye D) produces only one spot	allow it does not separate (into more than one substance)	1	AO2 5.8.1.1 5.8.1.3
Total			8	
05.1	(passed through) filter beds		1	AO1 5.10.1.2
	(the water is then) sterilised		1	AO1 5.10.1.2
05.2	(potable water) contains dissolved substances / dissolved salts / ions (and low levels of microbes)	allow it is a mixture / contains other substances do not accept it contains dirt	1	AO1 5.10.1.2
05.3	weigh an (empty) evaporating basin, add the (100 cm ³ of) water and evaporate / heat until all the water has gone	allow leave the water to evaporate	1	AO1 5.10.1.2 RP 13
	weigh the basin again and subtract the mass of the empty basin	allow the increase in mass of the basin is the mass of dissolved solids	1	AO1 5.10.1.2 RP 13
05.4	(3.50 × 10 =) 35 (g)	allow 35.0	1	AO2 5.10.1.2 MS 1a RP 13
05.5	the sea water is heated / boiled so that the water evaporates (and the salts are left behind)	allow the water turns to steam / vapour	1	AO1 5.10.1.2 RP 13
	the water vapour / steam is cooled and condenses (and is collected)	allow cooled in a condenser	1	AO1 5.10.1.2 RP 13
Total			8	
06.1	(414 – 317) ÷ 317 × 100 or 97 ÷ 317 × 100		1	AO2 5.9.2.2 MS 1c
	= 30.6 (%)	allow 30.60 / 31 an answer of 30.6 scores 2 marks an answer of 23.4 (97 ÷ 414) scores 1 mark	1	AO2 5.9.2.2 MS 1c

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	any two from: • burning fossil fuels / coal / oil / (natural) gas / petrol (e.g. in power stations, vehicles) • deforestation / cutting down (and burning) trees • (increased) farming / agriculture • (increased) industry / manufacturing (e.g. making cement)	allow specific examples, e.g. driving cars, flying ignore 'pollution' unqualified ignore breathing	2	AO1 5.9.2.2
06.3	methane	if more than one box is ticked, no mark	1	AO1 5.9.2.1
06.4	any two from: • sea levels rise (as ice caps / glaciers melt), causing flooding / coastal erosion • more extreme weather (e.g. storms, droughts, heat waves) • changes in rainfall patterns, affecting food production / crop yields • changes to the distribution of species / loss of habitats / migration of species	allow more frequent flooding / famine ignore the Earth gets hotter (given)	2	AO1 5.9.2.3
06.5	(gas) sulfur dioxide	allow SO ₂ do not accept sulfur trioxide	1	AO1 5.9.3.1
	(problem) acid rain or respiratory / breathing problems (in humans)	allow damage to buildings / plants / aquatic life if linked to acid rain	1	AO1 5.9.3.2
Total			9	
07.1	(test) hold a burning / lit splint at the (open end of the) tube of gas	do not accept glowing splint	1	AO1 5.8.2.1
	(result) the gas burns with a (squeaky) pop	allow a squeaky pop is heard	1	AO1 5.8.2.1
07.2	all seven points plotted correctly (to within $\pm$ half a small square)	allow 1 mark for five or six points plotted correctly points: (0, 0), (20, 24), (40, 40), (60, 50), (80, 56), (100, 60), (120, 60)	2	AO2 5.6.1.1 MS 4c RP 11
07.3	a smooth curve of best fit through the points, levelling off / horizontal from 100 s	allow a curve through the plotted points even if some are incorrectly plotted do not accept a ruled straight line or a line that joins the points dot-to-dot	1	AO2 5.6.1.1 MS 4c RP 11
07.4	(rate =) $24 \div 20$		1	AO2 5.6.1.1 MS 1a, 3c

Question	Answers	Extra information	Mark	AO / Spec. Ref.								
	= 1.2 (cm ³ /s)	an answer of 1.2 scores 2 marks an answer of 0.83 (inverted) scores 1 mark	1	AO2 5.6.1.1 MS 1a, 3c								
07.5	the volume of hydrogen stays the same / stops increasing (after 100 s) or the volume at 120 s is the same as at 100 s (60 cm ³)	allow no more gas is produced	1	AO3 5.6.1.1 RP 11								
07.6	(in the 0.5 mol/dm ³ acid) there are fewer acid particles in the same volume or the acid particles are less crowded	allow the acid is less concentrated so there are fewer particles	1	AO2 5.6.1.3								
	(so) there are fewer collisions (between the acid particles and the magnesium) per second or collisions are less frequent	allow fewer successful collisions per second do not accept fewer collisions alone (the frequency of collisions must be implied)	1	AO2 5.6.1.3								
Total			10									
08.1	an assessment of the environmental impact of a product over all the stages of its life / from the raw materials to disposal	allow a description of the stages: extracting and processing raw materials, manufacturing and packaging, use, and disposal allow 'cradle to grave' ignore environmentally friendly	1	AO1 5.10.2.1								
08.2	<table><tr><td>Level 3 (5–6 marks)</td><td>A coherent evaluation that compares both types of bag using data from Table 5, covers at least three stages of the life cycle (raw materials, manufacture, use, disposal), explains the environmental consequences of the differences, and reaches a judgement that is justified by the comparison.</td></tr><tr><td>Level 2 (3–4 marks)</td><td>A comparison that uses data from Table 5 for at least two stages of the life cycle, with some explanation of the environmental consequences (for example, more energy used means more fossil fuels burned and more carbon dioxide released). A judgement may be given but it is not fully justified.</td></tr><tr><td>Level 1 (1–2 marks)</td><td>Simple, isolated comparisons, for example paper bags use more energy or plastic bags take longer to break down, with little or no explanation.</td></tr><tr><td>0 marks</td><td>No relevant content.</td></tr></table>	Level 3 (5–6 marks)	A coherent evaluation that compares both types of bag using data from Table 5, covers at least three stages of the life cycle (raw materials, manufacture, use, disposal), explains the environmental consequences of the differences, and reaches a judgement that is justified by the comparison.	Level 2 (3–4 marks)	A comparison that uses data from Table 5 for at least two stages of the life cycle, with some explanation of the environmental consequences (for example, more energy used means more fossil fuels burned and more carbon dioxide released). A judgement may be given but it is not fully justified.	Level 1 (1–2 marks)	Simple, isolated comparisons, for example paper bags use more energy or plastic bags take longer to break down, with little or no explanation.	0 marks	No relevant content.		6	AO3 5.10.2.1 5.10.2.2
Level 3 (5–6 marks)	A coherent evaluation that compares both types of bag using data from Table 5, covers at least three stages of the life cycle (raw materials, manufacture, use, disposal), explains the environmental consequences of the differences, and reaches a judgement that is justified by the comparison.											
Level 2 (3–4 marks)	A comparison that uses data from Table 5 for at least two stages of the life cycle, with some explanation of the environmental consequences (for example, more energy used means more fossil fuels burned and more carbon dioxide released). A judgement may be given but it is not fully justified.											
Level 1 (1–2 marks)	Simple, isolated comparisons, for example paper bags use more energy or plastic bags take longer to break down, with little or no explanation.											
0 marks	No relevant content.											
	Indicative content raw materials: plastic bags are made from crude oil, a finite / non-renewable resource; paper bags are made from trees, a renewable resource (if the trees are replanted), but cutting down trees can destroy habitats / reduce the carbon dioxide absorbed											

Question	Answers	Extra information	Mark	AO / Spec. Ref.
	manufacture: paper bags use much more energy (2600 MJ compared with 500 MJ, about five times as much) and much more water (1100 dm³ compared with 60 dm³); more energy means more fossil fuels burned and more carbon dioxide released - paper bags are much heavier (55 kg compared with 7 kg per 1000 bags), so more fuel is needed to transport them use: plastic bags are stronger and are reused more times (2 to 4 times compared with 1 to 2), so fewer plastic bags are needed / the impact per use is lower disposal: plastic bags are not biodegradable and take hundreds of years to break down in landfill, and they cause litter and harm to wildlife (e.g. in the sea); paper bags break down in a few months - plastic bags can be recycled, but many are not; paper bags can be recycled / composted - judgement, e.g. paper bags have the greater impact in the raw material and manufacturing stages while plastic bags have the greater impact at disposal, so neither is clearly better – reusing bags many times reduces the impact of both Credit other correct, relevant points. Credit a justified judgement either way. Data quoted from the table should be used as a comparison (e.g. more / less, or how many times), not simply copied.			
Total			7	
09.1	(a reaction in which) the products can react to form the reactants again or the reaction can go in both directions / forwards and backwards	ignore the reaction can be reversed (this repeats the question)	1	AO1 5.6.2.1
09.2	(the reverse reaction is) exothermic or energy is given out / transferred to the surroundings or the temperature rises	allow the forward reaction takes in energy but the reverse reaction gives out energy	1	AO2 5.6.2.2
	the same amount of energy is transferred (as in the forward reaction)	allow the energy given out equals the energy taken in when the crystals are heated	1	AO2 5.6.2.2
09.3	the forward and reverse reactions take place at the same rate	allow the rate of the forward reaction equals the rate of the reverse reaction do not accept the reaction has stopped	1	AO1 5.6.2.3
	(so) the amounts / concentrations of the reactants and products do not change (in the closed container)	allow the amounts of reactants and products stay constant do not accept there are equal amounts of reactants and products	1	AO1 5.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	(a catalyst) provides a different pathway for the reaction	allow provides an alternative route	1	AO1 5.6.1.4
	(which has a) lower activation energy	allow (so) more particles have enough energy to react when they collide ignore 'speeds up the reaction' (given) do not accept the catalyst gives the particles more energy	1	AO1 5.6.1.4
Total			7	
TOTAL FOR PAPER			70	