

GCSE (9–1)

Combined Science A (Chemistry) A (Gateway Science)

J250/10: Paper 10 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for Autumn 2021

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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1. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

2. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

3. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science A:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

Question			Answer	Marks	AO element	Guidance
1			C ✓	1	2.2	
2			B ✓	1	2.2	
3			B ✓	1	1.1	
4			B ✓	1	2.1	
5			D ✓	1	1.1	
6			A ✓	1	1.1	
7			A ✓	1	1.1	
8			A ✓	1	2.2	
9			C ✓	1	1.1	
10			C ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
11	(a)		FIRST CHECK ANSWER ON ANSWER LINE If answer = 16.5-16.9 award 3 marks use of correct figures from graph for calculating gradient e.g. $50 \div 3$. ✓ correct answer e.g. 16.66•/16.67 ✓ answer to 1 decimal place e.g. 16.7 ✓	3	 2 x 2.2 1 x 1.2	
	(b)		Rate decreases ✓ (as reaction progresses) There are fewer reactant (magnesium/acid) particles ✓ The <u>frequency</u> of collisions decreases ✓	3	3 x 2.1	 IGNORE less collisions
	(c)	(i)	(gradient increases) as the rate of reaction increases/faster reaction ✓	1	3.2b	IGNORE gradient increase / increase alone ALLOW answers based on ideas of increased number or increased frequency of collisions
		(ii)	40 (cm ³) ✓	1	3.2b	

Question			Answer	Marks	AO element	Guidance
12			S is the catalyst ✓ speeds up the reaction AND remains unchanged ✓ R and T are not catalysts ✓ R reacts/ T does not speed up reaction ✓	4	2.1 1.1 2.1 1.1	

Question			Answer	Marks	AO element	Guidance
13	(a)		burns with a <u>lilac</u> flame/sparks/explodes ✓	1	1.1	IGNORE fizzes
	(b)		RbOH(aq) ✓ H ₂ (g) ✓	2	2.1 1.1	Both formula and state symbols needed for the mark ALLOW RbOH <u>AND</u> H ₂ without state symbols for 1 mark only
	(c)		sodium loses an electron more easily (than lithium)/ORA ✓	1	1.1	ALLOW the electron sodium loses is further away from the nucleus (than the electron lithium loses) ORA IGNORE number of electrons
	(d)		sodium ✓ has a higher density (than potassium) ✓ OR potassium ✓ has a lower density (than sodium)	2	3.2a 3.2b 3.2a 3.2b	Explanation must match the chosen metal for the mark

Question			Answer	Marks	AO element	Guidance
14	(a)		Idea that vapours rise up the column ✓ they cool <u>and</u> condense ✓ the lower the boiling point, the higher they rise before condensing ✓ ORA	3	3 x 1.2	ALLOW idea that column is cooler nearer the top so fractions condense at different levels/temperatures for 1 mark ALLOW ideas about references about molecular size/intermolecular forces
	(b)	(i)	D ✓	1	2.2	
		(ii)	Heat Catalyst ✓	1	1.1	Both answers required for the mark
		(iii)	$C_{20}H_{42} \rightarrow C_{20}H_{40} + H_2$ ✓	1	2.2	
	(c)*		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Describes <u>and</u> explains the similarities in the boiling points of the alkanes. AND Describes <u>and</u> explains the differences in the boiling points of the alkanes. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Description of the similarities and/or the differences in the boiling points of the alkanes.	6	2.1 x 3 3.1a x 3	AO2.1 Applies knowledge and understanding of scientific ideas by explaining the boiling points of the alkanes. • the alkanes are simple molecules • they are gases at room temperature • intermolecular forces are weak • intermolecular forces require little energy to break Explains the differences in the boiling points of the alkanes: • as the boiling points increase, the intermolecular forces require more energy to break • as the molecules get larger the intermolecular forces require more energy to break • as the molecules get larger, the

		AND Explains the similarities in the boiling points of the alkanes <u>or</u> explains the differences in the boiling points of the alkanes. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Describes the similarities in the boiling points of the alkanes. AND/OR Describes the differences in the boiling points of the alkanes. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>			intermolecular forces are stronger • more heat/energy needed to break the intermolecular forces • so boiling points increase AO3.1a Analyses information and ideas to interpret and describe the boiling points of the alkanes. • describes the similarities in the boiling points of the alkanes • the alkanes have low boiling points • describes the differences in the boiling points of the alkanes • the boiling points increase as the molecules get larger • bigger difference (~70°C) between methane and ethane than the others (~40°C) ALLOW answers based on the comparison of at least two of the alkanes
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Question			Answer	Marks	AO element	Guidance
15	(a)		iron is more reactive than copper ✓ <u>displaces</u> the copper (from the copper(II) sulfate) ✓	2	2 x 1.1	ORA
	(b)		FIRST CHECK ANSWER ON ANSWER LINE If answer = 20 000 (kg) award 2 marks 1 kg (of ash contain) $2\,500 \times 10^{-6}$ (kg of copper) ✓ $50 \div 2\,500 \times 10^{-6} = 20\,000$ (kg) ✓	2	1.2 2.2	ALLOW 50kg (of ash) = 50000000 (mg) $50000000 \div 2500 = 20000$ (kg)
	(c)		Any one advantage from: idea of less pollution/damage (compared to traditional mining) ✓ idea that it is cheaper/uses less energy (than traditional mining) ✓ idea that plants are renewable/can be replanted as needed ✓ idea the iron used can be scrap iron ✓ Any one disadvantage from: idea that it only produces small amounts of copper ✓ idea that it is a slow process/that it may take several years to obtain all the copper ✓ idea sulfuric acid is corrosive/harmful to the environment ✓	2	2 x 1.1	

Question			Answer	Marks	AO element	Guidance
16	(a)		$\text{Cu}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Cu}(\text{s})$ 1 mark for correct equation ✓ 1 mark for correct state symbols ✓	2	2.2 1.2	ALLOW $\text{Cu}^{2+}(\text{aq}) \rightarrow \text{Cu}(\text{s}) - 2\text{e}^{-}$
	(b)	(i)	Any one from: Incorrect measurement of the mass of the cathode ✓ Power pack ran for too long/a different time ✓ Cathode not completely dried ✓ Incorrect calculation of the mass of the copper formed ✓	1	3.3b	
		(ii)	Yes Four of the points are close to the line of best fit ✓	1	3.1b	Both points needed for the mark ALLOW ideas that most points are close to the line of best fit/line follows the general pattern of the results
		(iii)	allows a mean/average to be calculated ✓ allows anomalous results to be identified/discarded ✓	2	2 x 3.3b	
	(c)		FIRST CHECK ANSWER ON ANSWER LINE If answer = 5 (g) award 3 marks mass of copper at 5 A = 1.6 g ✓ mass of copper at 15 A is $1.6 \times 3 = 4.8 \text{ g}$ ✓ = 5 (g) ✓	3	2.2 2.2 1.2	mark is for reading mass of graph mark is for multiplying mass from graph up to 15 A mark is for giving answer mass to 1 significant figure

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	(equilibrium is reached when) the <u>rates</u> of the forward and backward reaction are equal ✓	1	3.1a	
		(ii)	(equilibrium is reached when) the <u>concentrations</u> of NO ₂ (g) and N ₂ O ₄ (g) are constant ✓	1	3.1a	DO NOT ALLOW concentrations become equal
	(b)	(i)	B OR D ✓	1	2.1	
		(ii)	A OR C ✓	1	2.1	
		(iii)	E ✓	1	2.1	

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