

GCSE (9–1)

Combined Science A (Gateway Science)

J250/04: Paper 4 (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for November 2020

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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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Annotations

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

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

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.

For answers to section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

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

Question			Answer	Marks	AO element	Guidance
11	(a)		$78+21+0.04+0.06 = 99.1$ $100-99.1$ $= 0.9(\%) \checkmark$	1	2.2	
	(b)	(i)	water vapour $\checkmark$	1	1.1	
		(ii)	carbon dioxide $\checkmark$	1	1.1	
		(iii)	ammonia $\checkmark$	1	1.1	

Question			Answer	Marks	AO element	Guidance
12	(a)			3	3 x 1.1	All 4 correct scores 3 marks 2/3 correct scores 2 marks 1 correct scores 1 mark
	(b)	(i)	fluorine. ✓ electrons ✓	1 1	1.1 2.1	
		(ii)	same number of outer electrons/7 electrons in outer shell ✓	1	1.1	ALLOW react by gaining 1 electron/form 1- ions
	(c)		neon is unreactive / not reactive ✓ it has full <u>outer</u> (electron) shell ✓ idea that it doesn't need to gain/lose/share electrons ✓	1 1 1	1.1 2.1 2.1	ALLOW does not react/ does not bond with atoms of other elements IGNORE not very reactive / less reactive ALLOW (all) shells are full IGNORE reference to ionic/covalent bonds

Question			Answer	Marks	AO element	Guidance
13	(a)		carbon dioxide ✓	1	2.2	ALLOW carbon monoxide ALLOW carbon oxide ALLOW use of correct formulae
	(b)		copper (ions) loses (lose) oxygen/carbon removes the oxygen/carbon takes the oxygen ✓	1	1.1	ALLOW copper ions gain electrons/ $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu} / \text{Cu}^+ \rightarrow \text{Cu}^{2+} + \text{e}^-$ ALLOW loses oxygen IGNORE carbon gains oxygen unqualified
	(c)	(i)	idea that the mass of copper made in experiment 3 is <u>much</u> lower than in the other three experiments ✓ reaction not heated for long enough/incorrect mass of copper oxide used ✓	1 1	3.1a 2.2	ORA based on mass of experiments 1,2 and 4 (or mean mass) being <u>much</u> higher than experiment 3 / not close to 1.6 and 1.7 / it is an anomaly ALLOW sensible answers that result in the mass being much lower IGNORE not weighed correctly
		(ii)	FIRST CHECK ANSWER ON ANSWER LINE If answer = 1.7 (g) award 3 marks (1.7 + 1.7 + 1.6)/3 ✓ = 1.7/1.67/1.66....7 etc (g) ✓ = 1.7 (g) (2 significant figures) ✓	 1 1 1	 2.2 2.2 1.2	 . ALLOW (1.7 + 1.7 + 0.8 + 1.6)/4 = 1.5 for 1 mark only if no other answer credited
	(d)		magnesium is more reactive than carbon ✓	1	1.1	ORA

Question			Answer	Marks	AO element	Guidance
14	(a)		potable ✓	1	1.1	
	(b)		step 1 – <u>large</u> solids settle to the bottom of the beaker ✓	1	2.2	ALLOW idea <u>some</u> solids/mud settle to the bottom of the beaker
			step 2 – <u>small/fine</u> solids removed by the filter paper ✓	1	2.2	ALLOW removes all mud
				1	2.2	If M1 and M2 are not awarded ALLOW 1 mark for removes solids/mud
			step 3 – idea leaves behind any dissolved substances ✓			ALLOW water evaporates (and condenses)
	(c)	(i)	energy to heat is very expensive ✓	1	3.3b	ALLOW it uses (more) energy/heat
		(ii)	salt builds up and need to find a use for it / piping salt water to plants to treat it / transporting water to where it is needed ✓	1	3.3b	ALLOW salt builds up / salt is waste / disposing of the salt

Question			Answer	Marks	AO element	Guidance
15	(a)		FIRST CHECK ANSWER IN TABLE If answer = 3.16 or 3.2×10^3 (kJ) award 3 marks			ALLOW $3.16 \times 10^1/3.16$ or 3.16×10^6 for 2 marks IGNORE rounding unless incorrect
			convert J to kJ = $31600/1000 = 31.6$ kJ ✓	1	2. 2	Mark is for $\div 1000$
			convert 1 bag into 100 bags = $31.6 \times 100 = 3160$ kJ ✓	1	2. 2	Mark is for $\times 100$
			standard form = 3.16×10^3 (kJ) ✓	1	1.2	ecf
	(b)			1	3.1b	DO NOT ALLOW unless answers are taken from the information in the table.
				1	3.1b	IGNORE comparisons to bag C / both bags IGNORE waste IGNORE energy
			Plastic bag A - weighs less/uses less energy ✓			
			Plastic bag B - larger volume/produces less waste ✓			

Question	Answer	Marks	AO element	Guidance
16*	<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Describes a detailed method of comparing the reactivity of the four metals. AND Describes in detail how the results of their method are used to place the four metals in an order of reactivity.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) Describes a suitable method of comparing the reactivity of the four metals. AND Gives an outline of how the results of their method are used to place the four metals in an order of reactivity.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Describes a basic method of comparing the reactivity of the four metals. OR Attempts to describe how the results of their method are used to place the four metals in an order of reactivity.</p> <p><i>There is an attempt at a logical structure with a line of</i></p>	6	3 x 1.2 3 x 2.2	<p>AO1.2 Demonstrates knowledge and understanding of scientific techniques and procedures Describes a suitable method of comparing the reactivity of the four metals e.g.</p> <ul style="list-style-type: none"> • score the amount of fizzing • measure the rise in temperature • time how long it takes for the metal to disappear • time how long it takes to capture a certain volume of the gas • Describes the variables that need to be controlled e.g. <ul style="list-style-type: none"> ○ same amount of metal ○ same volume of acid ○ same concentration of acid ○ same temperature of acid <p>AO2.2 Application of knowledge and understanding of scientific enquiry, techniques and procedures Describes how the results of their method are used to place the four metals in an order of reactivity e.g.</p> <ul style="list-style-type: none"> • the more fizzing the more reactive the metal • the greater the temperature rise the more reactive the metal • the quicker the metal disappears the more reactive the metal • the less time to collect the volume of gas the more reactive the metal

Question			Answer	Marks	AO element	Guidance
			<i>reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>			

Question			Answer	Marks	AO element	Guidance
17	(a)		cracking ✓	1	1.2	IGNORE answers based upon turning large molecules into small molecules or producing more useful molecules etc. ALLOW thermal decomposition IGNORE references to catalytic/steam
	(b)		demand for petrol exceeds supply (and supply for fuel oil exceed demand) ORA ✓ <u>fuel oil</u> is turned into <u>petrol</u> ✓	1 1	3.2.b 3.2b	ALLOW demand for petrol is larger than demand for fuel oil IGNORE answers based upon turning large molecules into small molecules or producing more useful molecules etc.
	(c)	(i)	any answer in the range -60 to -30 °C ✓	1	3.2b	Correct value = -42 °C
		(ii)	C ₇ H ₁₆ ✓	1	2.2	ALLOW H ₁₆ C ₇ DO NOT ALLOW incorrect placements of subscripts e.g. C7H16 etc.

Question			Answer	Marks	AO element	Guidance
18	(a)		S(s) ✓	1	3.2a	
	(b)		FIRST CHECK ANSWER ON ANSWER LINE If answer = 0.07 (/ s) award 3 marks time (at 0.25 mol/dm ³) = 14 (seconds) ✓ rate of reaction = 1/14 = 0.1/0.07/0.071/0.0714 etc ✓ = 0.07 (/ s) (2 decimal places) ✓	1 1 1	3.1a 2.2 1.2	ECF from incorrect time read of graph used correctly in the calculation
	(c)	(i)	As concentration (of thiosulfate) increases the reaction time decreases ORA ✓	1	3.1a	ALLOW as concentration increase reaction rate increases
		(ii)	As concentration (of thiosulfate) increases the rate of reaction increases ORA ✓	1	2.1	
	(d)		0.240 (/ s)	1	2.2	ALLOW 0.24

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