

GCSE (9–1)

Combined Science (Chemistry) A (Gateway Science)

J250/09: Paper 9 (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.

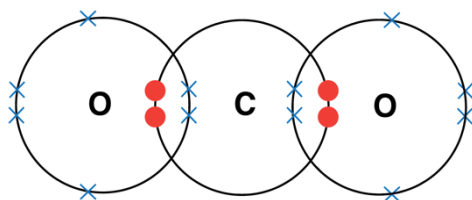
Question			Answer	Marks	AO element	Guidance
1			C ✓	1	2.1	
2			B ✓	1	1.1	
3			D ✓	1	2.1	
4			D ✓	1	1.1	
5			C ✓	1	1.2	
6			B ✓	1	2.1	
7			B ✓	1	2.2	
8			B ✓	1	2.1	
9			C ✓	1	2.1	
10			C ✓	1	1.1	

[illegible]

Question			Answer	Marks	AO element	Guidance
12			Idea that (most alpha particles passed through undeflected showing) the mass is concentrated at the centre of the atom / most of the atom is empty space ✓ (Rutherford) proposed that the atom had a positive nucleus ✓ (Nucleus is) surrounded by electrons ✓ Idea that (some alpha particles were deflected by large amounts due to) positive charges repelling ✓	4	1.1	IGNORE references to electron shells / energy levels / Bohr models ALLOW marks to be awarded for an appropriately labelled diagram

Question			Answer	Marks	AO element	Guidance
13	(a)		All points plotted correctly scores 2 marks BUT 4 or 5 points plotted correctly scores 1 mark	2	2.2	ALLOW $\pm \frac{1}{2}$ square
	(b)	(i)	Two straight lines of best fit through points ✓	1	1.2	Lines do not have to be extrapolated to score the mark
		(ii)	FIRST CHECK ANSWER ON ANSWER LINE If answer = 60 (%) award 2 marks Lines of best fit extended until they cross ✓ Value of percentage of tin read from intersection of lines of best fit ✓	2	3.1a	ALLOW answer $\pm 1\%$ of their own graph
	(c)		(Solder contains) delocalised electrons ✓ (which are) free to move ✓	2	1.1	
	(d)	(i)	Alloy ✓	1	1.1	ALLOW phonetic spellings of alloy
		(ii)	Harder ✓ Idea that layers / ions less able to slide past each other ✓ as the lattice has been distorted (by different size atoms) ✓	3	1 x 3.2b 2 x 1.1	Mark M2 and M3 independently of M1

Question	Answer	Marks	AO element	Guidance
14*	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) Analyses the information to provide both similarities and differences between the two structures of boron nitride AND applies this knowledge to diamond and graphite <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) Analyses most of the information to provide both similarities OR differences between the two structures of boron nitride AND applies this knowledge to diamond OR graphite <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) Analyses some of the information to provide EITHER similarities OR differences between the two structures of boron nitride OR only applies their knowledge to diamond and graphite <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>	6	2 x 2.1 4 x 3.2b	AO3.2b Analyse information and ideas to draw conclusions Similarities • both macromolecules • both covalently bonded • both have high melting point Differences • structure 1 - every nitrogen atom bonded to 4 boron atoms but in structure 2 - every nitrogen atom bonded to 3 boron atoms • structure 1 is not layered / structure 2 is layered • structure 1 is hard / structure 2 is soft • structure 1 does not conduct electricity / structure 2 does conduct electricity. AO2.1 Apply knowledge and understanding of scientific ideas • structures 1 & 2 have many strong covalent bonds, which need lots of energy to break so high melting points • structure 2 has weak forces between the layers so the layers can slide past each other • structure 1 has no delocalised electrons so does not conduct electricity • structure 2 has delocalised electrons so does conduct electricity

Question			Answer	Marks	AO element	Guidance
15	(a)		Shared electrons ✓ A pair of / two (electrons) ✓	2	1.1	Reference to ionic bonding / ions / transfer of electrons scores 0
	(b)		 Two shared pairs of electrons between the C atom and each of the O atoms ✓ Rest of outer shell of O atoms correct ✓	2	2.2	ALLOW diagrams using all dots or all crosses or mixture of the two ALLOW electrons shown inside the overlap or on lines, as shown If inner shells are added / shown, they must be correct Ionic structure = 0 marks for the question
	(c)		FIRST CHECK ANSWER ON ANSWER LINE If answer = -168 (kJ/mol) award 3 marks Energy to break bonds = $(1070 + (496 \div 2)) = 1318$ ✓ Energy to make bonds = $743 \times 2 = 1486$ ✓ Energy change = $(1318 - 1486) = -168$ (kJ/mol) ✓	3	2.2	ALLOW 2 marks for +168 (kJ/mol) / if no sign is given ALLOW ECF
	(d)	(i)	Minimum ✓ energy needed for a reaction to occur / AW ✓	2	1.1	
		(ii)	1318 (kJ/mol)	1	2.1	ECF from M1 of (c)

Question			Answer	Marks	AO element	Guidance
16	(a)		The amount of a substance that contains the same number of atoms / entities ✓ as there are in 12 g of carbon-12 ✓	2	1.1	ALLOW one mole contains exactly 6.02×10^{23} elementary entities for 2 marks
	(b)	(i)	Moles Fe = $1.67/55.8 = 0.03$ ✓ Moles of H ₂ O = $0.72/18 = 0.04$ AND Moles H ₂ = $0.08/2 = 0.04$ ✓ All answers to 2 decimal places ✓	3	2 x 2.2 1 x 1.2	
		(ii)	$3\text{Fe(s)} + 4\text{H}_2\text{O(g)} \rightarrow \text{Fe}_x\text{O}_y\text{(s)} + 4\text{H}_2\text{(g)}$ ✓ Fe ₃ O ₄ ✓	2	2.2	ALLOW correct multiples e.g. $6\text{Fe(s)} + 8\text{H}_2\text{O(g)} \rightarrow 2\text{Fe}_x\text{O}_y\text{(s)} + 8\text{H}_2\text{(g)}$ ALLOW ECF from part (b)(i) for both marks

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