

GCSE (9–1)

Combined Science A (Chemistry) A (Gateway Science)

J250/10: Paper 10 (Higher 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 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

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			C ✓	1	1.1	
2			C ✓	1	1.1	
3			A ✓	1	2.1	
4			A ✓	1	2.1	
5			B ✓	1	1.1	
6			B ✓	1	2.2	
7			D ✓	1	2.1	
8			C ✓	1	2.2	
9			C ✓	1	1.1	
10			C ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
11	(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	3.2b 3.2b	ALLOW demand for petrol is higher 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. C ₇ H ₁₆ etc.

Question			Answer	Marks	AO element	Guidance
12	(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 = 0.1/0.07/0.0714/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 increases 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

Question			Answer	Marks	AO element	Guidance
13			There would be same/similar amount of fizzing in the test tube ✓	1	1.2	ALLOW the same/similar results obtained for 1 mark only for the first two marking points
			The glowing spill (also) relights (because oxygen is produced) / oxygen is (also) produced ✓	1	1.1	DO NOT ALLOW spill relights in hydrogen/hydrogen produced
			The manganese oxide/catalyst speeds up the reaction. ✓	1	1.1	IGNORE references to lowering the activation energy
			The manganese oxide/catalyst is unchanged/not used up at the end of the first reaction ✓	1	1.1	IGNORE references to manganese oxide still acting as a catalyst.

Question			Answer	Marks	AO element	Guidance
14	(a)	(i)	sensible scales so points cover at least half the grid ✓	1	2.2	DO NOT ALLOW if scales on axis aren't linear
			<u>all</u> points plotted correctly ✓	1	2.2	ALLOW points $\pm$ half a small square
			line of best fit is a curve ✓	1	2.2	DO NOT ALLOW double lines/feathering/line
		(ii)	Melting point decreases (rapidly then slows) as the atomic number increases	1	2.1	
	(b)	(i)	(metallic lattice) contains delocalised/free moving electrons ✓	1	1.1	IGNORE metallic bonding alone IGNORE electrons if not free moving/delocalised
			(strong) <u>electrostatic</u> forces of attraction (between sodium cations/ions/atoms and delocalised/free moving electrons) ✓	1	1.1	ALLOW (strong) <u>electrostatic</u> forces of attraction between sodium cations/ ions/atoms and electrons for one mark if no other mark awarded. DO NOT ALLOW electrostatic forces of attraction between molecules
		(ii)	(sodium has a lower melting point because) it has weaker (metallic) bonding/smaller (electrostatic) forces of attraction (between sodium cations/ions/atoms and electrons) ORA ✓	1	2.1	ALLOW ideas about less energy required to break the (metallic) bonding/forces of attraction DO NOT ALLOW weaker intermolecular forces

Question			Answer	Marks	AO element	Guidance
15	(a)		idea that some of the heat from the Sun is reflected off the Earth's surface (and back into the atmosphere) ✓	1	1.1	ALLOW answers based upon IR radiation/energy.
			idea that this heat is trapped /absorbed in the Earth's atmosphere by <u>greenhouse gases</u> ✓	1	1.1	ALLOW named greenhouse gases such as carbon dioxide etc.
	(b)		(more) carbon dioxide released (into the atmosphere) ✓ from use of fossil fuels ✓ OR more methane released (into the atmosphere) ✓ from increased farming of rice/cattle OR increase in landfill sites ✓ OR Less carbon dioxide absorbed (by plants) ✓ Due to deforestation ✓	1 1	2.1 2.1	If activity given does not relate to gas named then maximum 1 mark. ALLOW (human activity) is increasing amount of greenhouse gases in the atmosphere for the 1st mark only. ALLOW specific references to specific examples of burning fossil fuels e.g. cars use petrol IGNORE references to increases in temperature and more heat being trapped in the atmosphere.

Question			Answer	Marks	AO element	Guidance
	(c)		idea that electric cars will reduce the amount of (fossil) fuels burnt / don't use (fossil) fuels ✓	1	2.1	ALLOW answers based upon ideas that electric cars reduce the amount of carbon dioxide / greenhouse gases produced / don't produce carbon dioxide/greenhouses gases
			idea that electricity for (charging) electric vehicles may come from burning fossil fuels ✓	1	2.1	ALLOW ideas that the increased use of electric cars may be so small that the reduction in burning fossil fuels/production of carbon dioxide would be so small compared with all other activities. IGNORE production of electric vehicles
	(d)	(i)	nitrogen (in air) <u>reacts</u> with oxygen ✓	1	2.1	ALLOW answers based upon a correct equation.
			at <u>high</u> temperatures in a car engine ✓	1	2.1	
		(ii)	named effect eg corrosion, lake acidification, respiratory issues. ✓	1	1.1	ALLOW acid rain

Question		Answer	Marks	AO element	Guidance
16*		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 the relationship between pressure and percentage of ammonia made and temperature and percentage of ammonia made. AND Explains how BOTH the pressure and temperature affects the percentage of ammonia made. <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) Describes the relationship between pressure and percentage of ammonia made and temperature and percentage of ammonia made. AND Gives an explanation of how either pressure or temperature affects the percentage of ammonia made. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i>	6	2 x 2.1 4 x 3.1a	AO3.1a Analyse information and ideas to interpret. Describes how the percentage of ammonia made changes with temperature and pressure e.g. - increasing pressure from 2.5 to 40.0 Mpa increases percentage of ammonia - e.g. from 92 to 99% at 100 °C - increasing temperature from 100 to 500 °C decreases percentage of ammonia - e.g. from 92 to 3% at 2.5 Mpa AO2.1 Apply knowledge and understanding of scientific ideas Explains using Le Chatelier's principle the changes in the percentage of ammonia made - increasing the pressure increases the amount of ammonia made as equilibrium moves to favour the side with fewest moles - increasing temperature decreases amount of ammonia made because equilibrium moves to favour the backward endothermic reaction

Question			Answer	Marks	AO element	Guidance
			Level 1 (1–2 marks) Describes the relationship between pressure and percentage of ammonia made or temperature and percentage of ammonia made. AND Gives an explanation of how either pressure or temperature affects the percentage of ammonia made. <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>			

Question			Answer	Marks	AO element	Guidance
17	(a)		(hexane molecules are smaller)			
			so have weaker <u>intermolecular</u> forces ORA✓	1	1.1	
			which require less energy to break/overcome ORA✓	1	1.1	2 nd mark dependent on the first IGNORE reference to speed
	(b)		water boils at 100 °C ✓	1	3.2b	
			this is (greater than the boiling point of hexane and) below the boiling point of octane ORA✓	1	3.2b	ALLOW so all water would have evaporated off before octane boils

Question			Answer	Marks	AO element	Guidance
18	(a)		$2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$ one mark for correct formula of reactants and products ✓ one mark for the correct balancing ✓	2	2 x 2.2	ALLOW = for arrow IGNORE state symbols DO NOT ALLOW 'and' or & for + ALLOW any correct multiples e.g. $4\text{KBr} + 2\text{Cl}_2 \rightarrow 4\text{KCl} + 2\text{Br}_2$ ALLOW one mark for correct balanced equation with minor errors in case, subscript and superscript e.g. $2\text{KBr} + \text{Cl}_2 \rightarrow 2\text{KCl} + \text{Br}_2$
	(b)		bromine ✓	1	2.1	ALLOW Br/Br ₂
	(c)	(i)	$\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$ ✓	1	1.2	
		(ii)	(chlorine is) reduced because it gains an electron(s) ✓	1	1.1	IGNORE reduction unless electron gain also given. - answer is for reduction and correct explanation
	(d)		<u>outer</u> electrons/shell closer to the nucleus ✓ more attraction from nucleus/protons ✓ gains electrons more easily ✓	1 1 1	1.1 1.1 1.1	ALLOW smaller atoms/less energy levels/less electron shells/ <u>outer</u> electron in a lower energy level DO NOT ALLOW less outer shells ALLOW less shielding DO NOT ALLOW gains electrons faster. ALLOW answers in terms of Bromine

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