H

GCSE (9–1)

Combined Science (Chemistry) A (Gateway Science)

J250/09: Paper 9 (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.

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:

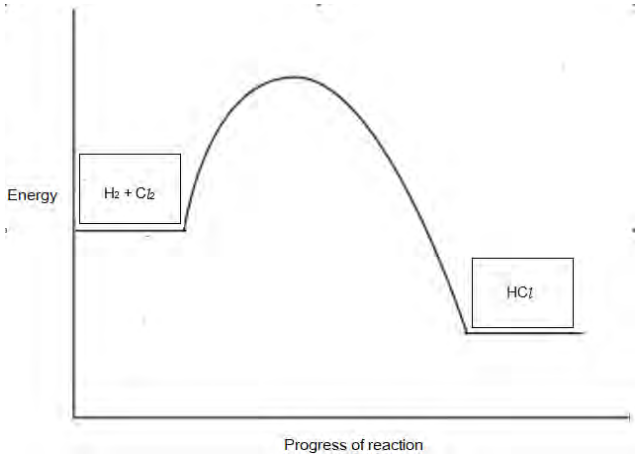
	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge 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			A ✓	1	2.2	
2			B ✓	1	2.1	
3			A ✓	1	1.1	
4			A ✓	1	1.1	
5			D ✓	1	1.1	
6			B ✓	1	1.1	
7			B ✓	1	2.2	
8			D ✓	1	1.1	
9			A ✓	1	2.2	
10			B ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
11	(a)		Formulation ✓	1	1.1	
	(b)		**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 4.75 (g) award 2 marks** % of water = (100 - 5.2 - 74.8 - 0.5 - 0.5) = 19(%) ✓ mass of water = $\frac{25 \times 19}{100}$ = 4.75 (g) ✓	2	2 x 2.2	**ALLOW** 4.8 **ECF** from incorrect % of water
	(c)	(i)	Idea that its boiling point is (very) low / requires (very) little energy to evaporate ✓	1	3.2b	**ALLOW** idea that intermolecular forces /forces between molecules are weak / require little energy to break
		(ii)	Idea that energy is required (for the alcohol to evaporate) ✓ Idea that energy is supplied by / absorbed from the skin ✓	2	2 x 3.2b	**ALLOW** 'body' for skin

Question			Answer	Marks	AO element	Guidance
12	(a)		$Mg(OH)_2$ ✓	1	2.1	
	(b)		$MgCO_3 + 2HCl \rightarrow MgCl_2 + CO_2 + H_2O$ Formulae ✓ Balancing ✓	2	1 x 1.1 1 x 2.2	**ALLOW** any correct multiple, including fractions **ALLOW** = / ⇌ instead of → **DO NOT ALLOW** and / & instead of '+' Balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae **IGNORE** state symbols
	(c)	(i)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 79.9 award 2 marks** 184.1 – 24.3 = 159.8 ✓ 159.8 ÷ 2 = 79.9 ✓	2	2 x 2.2	 **ALLOW ECF** from incorrect subtraction
		(ii)	Bromine/Br ✓	1	3.2b	**ECF** from 12(c)(i) if element correctly matched to an incorrect A_r in group 7

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>13</td><td>(a)</td><td></td><td> 

$H_2 + Cl_2$ ✓
HCl ✓</td><td>2</td><td>2 x 1.1</td><td>ALLOW words instead of symbols and if no other mark is scored allow ‘reactants’ in the left hand box and ‘products’ in the right hand box for 1 mark
State symbols and balancing not required for mark</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table>
<tr><th></th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Energy released 102 kJ/mol</td><td></td><td></td><td>✓</td></tr>
<tr><td>Activation energy 142 kJ/mol</td><td>✓</td><td></td><td></td></tr>
</table>
✓✓</td><td>2</td><td>2 x 3.1a</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
14	(a)		Base ✓	1	1.1	**IGNORE** alkali
	(b)		Wear gloves/goggles ✓	1	1.2	
	(c)		Idea that it ensures all hydrochloric acid has reacted ✓	1	2.2	**ALLOW** idea it produces maximum mass of salt
	(d)	(i)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 0.00629/6.29 x 10^{-3} (mol) award 3 marks** M_r of CuO = (63.5 + 16.0) = 79.5 ✓ moles CuO = 0.50 ÷ 79.5 = 0.006289/6.289 x 10^{-3} ✓ = 0.00629/ 6.29 x 10^{-3} (mol) ✓	3	3 x 2.2	**ALLOW ECF** from M_r of CuO if first mark not awarded **ALLOW ECF** from incorrect calculation for 3 sig fig mark
		(ii)	2.50 x 10^{-3} mol HCl reacts with 1.25 x 10^{-3} mol CuO ✓ 0.00629/6.29 x 10^{-3} mol is larger than 1.25 x 10^{-3} mol ✓	2	2 x 2.2	**ALLOW** reacting ratio of 2:1 **ORA** **ALLOW** 1 mark for idea that the calculated number of moles of CuO added is greater than the number of moles of CuO needed to neutralise the HCl, if no other mark awarded
	(e)	(i)	Idea that <u>excess/unreacted</u> copper oxide still present at end of stage 1 ✓	1	3.2b	
		(ii)	Filter to remove this coper oxide (before stage 2) ✓	1	3.3b	

Question			Answer	Marks	AO element	Guidance
15*			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)** Candidate supports the student's analysis of the conclusion **AND** applies detailed knowledge and understanding of structure and bonding to justify student's conclusion for both X/diamond and Y/chlorine. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Candidate supports the student's analysis of the conclusion **AND** Applies some knowledge and understanding of structure and bonding to justify student's conclusion for **EITHER** X/diamond **OR** Y/chlorine. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Candidate supports the student's analysis of the conclusion **OR** Applies some knowledge and understanding of **EITHER** structure **OR** bonding to justify student's conclusion for **EITHER** X/diamond **OR** Y/chlorine.	**6**	**2 x 1.1** **1 x 3.2b** **3 x 2.1**	**AO1.1 Demonstrates knowledge and understanding of the structure and bonding in covalent compounds** • Simple covalent compounds, eg **Y**/chlorine, have low melting points • Giant covalent molecules / macromolecules, eg **X**/diamond, have high boiling points **AO3.2b Analyses information to evaluate information about X and Y** • Student is correct / X is diamond and Y is chlorine **AO2.1 Applies knowledge and understanding to explain why X/diamond has a much higher melting point than Y/chlorine** **X**/Diamond: • every carbon atom bonded to four other carbon atoms • large amounts of energy needed to break many strong covalent bonds **Y**/Chlorine: • (covalent bonding between atoms but) weak intermolecular forces between molecules • more energy required to break covalent bonds in diamond than required to break intermolecular forces in chlorine / ORA • covalent bonds in diamond stronger than intermolecular forces in chlorine / ORA

Question			Answer	Marks	AO element	Guidance
			There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant. **0 marks** *No response or no response worthy of credit.*			**Any description of ionic bonding contradicts and so limits the response to level 2**

Question			Answer	Marks	AO element	Guidance
16	(a)		(Phosphoric acid) is fully ionised or completely dissociated (in aqueous solution) ✓	1	1.1	**ALLOW** all molecules release H^+ ions **ALLOW** $H_3PO_4 \rightarrow 3H^+ + PO_4^{3-}$ **DO NOT ALLOW** strong acids have many H^+ ions / strong acids have a high concentration of H^+ ions **IGNORE** strong acids are more ionised / dissociated than weak acids
	(b)		Idea that the solution contains a low ratio of hydrogen ions / acid to the volume of solution ✓	1	1.1	
	(c)		**2**H_3PO_4 + **3**$Ca(OH)_2$ → $Ca_3(PO_4)_2$ + **6**H_2O ✓✓ 1 mark for correct balancing of **2**H_3PO_4 + **3**$Ca(OH)_2$ 1 mark for correct balancing of **6**H_2O	2	2 x 2.2	**ALLOW** correct multiples e.g. **4**H_3PO_4 + **6**$Ca(OH)_2$ → **2**$Ca_3(PO_4)_2$ + **12**H_2O
	(d)		pH increases by a factor of 1, (as the hydrogen ion concentration decreases by a factor of 10) ✓ pH increases from 0.50 to 1.50, hydrogen ion concentration decreases from 0.32 to 0.032 / pH increases from 1.00 to 2.00, hydrogen ion concentration decreases from 0.10 to 0.01 ✓	2	2 x 3.2b	**ORA** for both points
	(e)		$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ Equation ✓ State symbols ✓	2	2 x 1.1	**ALLOW** any correct multiple, including fractions **ALLOW** = / ⇌ instead of → **DO NOT ALLOW** and / & instead of '+' **Mark for state symbols is dependent on correct species**

Question			Answer	Marks	AO element	Guidance
17	(a)		Idea of splitting up a chemical compound (into its elements) ✓ using an electric current/electricity ✓	2	2 x 1.2	
	(b)		Cations are positive **and** anions are negative ✓	1	1 x 1.1	
	(c)	(i)	$K^+ + e^- \rightarrow K$ ✓	1	1 x 2.2	**ALLOW** $K^+ \rightarrow K - e^-$
		(ii)	reduction ✓ (because it) involves the gain of electrons ✓	2	2 x 1.1	**Second mark is dependent on first mark**
	(d)		Hydrogen ✓ Potassium is more reactive than hydrogen / hydrogen ions are discharged more readily than potassium ions ✓	2	1 x 2.1 1 x 1.1	 **ALLOW** Reverse argument
	(e)		Chlorine ✓ Chloride ions are discharged more readily than hydroxide ions ✓	2	1 x 2.1 1 x 1.1	 **ALLOW** Reverse argument

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk