

**GCSE (9–1)**

**Chemistry B (Twenty First Century Science)**

**J258/03: Breadth in Chemistry (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).

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

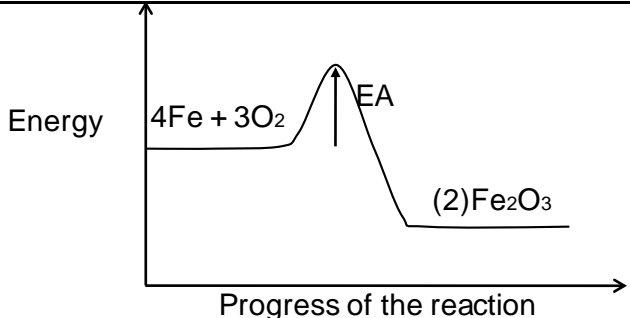
The breakdown of Assessment Objectives for GCSE (9-1) in Chemistry B:

	<b>Assessment Objective</b>
<b>AO1</b>	<b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
<b>AO2</b>	<b>Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.</b>
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
<b>AO3</b>	<b>Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.</b>
<b>AO3.1</b>	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
<b>AO3.2</b>	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.
<b>AO3.3</b>	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	(a)	kills microorganisms / bacteria ✓	1	1.1	<b>ALLOW</b> pathogens/viruses/fungi <b>IGNORE</b> sterilise/disinfect/removes bacteria/kills germs
	(b)	red ✓ white ✓	2	1.2	<b>ALLOW</b> colourless
	(c) (i)	Brown/yellow colour ✓	1	1.2	<b>DO NOT ALLOW</b> red <b>ALLOW</b> orange
	(ii)	bromine (displaced) ✓	1	1.2	<b>ALLOW</b> Br <sub>2</sub>
	(d)	Slower <b>AND</b> sodium is less reactive than potassium / idea of more reactive down the group ✓	1	2.1	Need <u>explanation</u> , not only the tick
	(e)	CaCl <sub>2</sub> ✓	1	1.2	
	(f)	Its atoms are larger than atoms of iodine ✓ It is a solid at room temperature ✓	2	3.2a	

Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	Slope = 0 / zero ✓	1	2.2	
		(ii)	Reaction has finished / Rate is zero ✓	1	2.1	<b>ALLOW</b> idea of (all) zinc has been used up <b>IGNORE</b> zinc is <u>being</u> used up <b>IGNORE</b> acid used up
	(b)		14 cm <sup>3</sup> per min ✓	1	2.2	
	(c)		<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> If answer = 0.1 (g) award 2 marks  quotes 40 (from the graph) ✓  calculated mass = 0.1 (g) ✓	2	2.2	
	(d)		<b>Any two from:</b> Surface area (of metal) ✓ Temperature ✓ Amount/mass of metal ✓	2	3.3a	<b>ALLOW</b> volume/amount of acid / concentration of acid
	(e)		A = magnesium B = zinc C = iron ✓✓	2	3.2b	All three correct = 2 marks One or two correct = 1 mark <b>ALLOW</b> symbols



Question		Answer	Marks	AO element	Guidance
3	(a)	$\text{Fe}^{3+}$ ✓	1	2.2	
	(b)	Product line labelled with $2\text{Fe}_2\text{O}_3$ ✓ Reactants above products ✓ Activation energy curve and arrow ✓	3	2.2	 <p><b>DO NOT ALLOW</b> short arrow. Arrow needs to start at level of reactants and end at top of hump.</p>
	(c) (i)	Speeds up reaction / hand warmer needs to act quickly / to provide heat quickly / AW ✓	1	1.1	
	(ii)	Needs less activation energy ✓	1	1.1	
	(d)	Large(r) surface area (of iron) ✓ high(er) frequency of particle collisions ✓	2	1.1	<b>ALLOW</b> more effective/successful collisions <b>IGNORE</b> more collisions

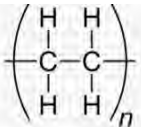
Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	$2\text{Li} + 2\text{H}_2\text{O} \rightarrow 2\text{LiOH} + \text{H}_2$ ✓	1	1.1	<b>ALL</b> correct
		(ii)	<b>Any two from:</b> Potassium 'disappears' faster ✓ Fizzes more vigorously ✓ Catches fire / shows a flame ✓	2	1.2	<b>ALLOW</b> potassium dissolves faster <b>IGNORE</b> colour of flame if stated
	(b)		atomic number ✓	1	1.1	
	(c)		Mean of N and As is 44.5 (allow 45) ✓ P = 31 so not a triad ✓	2	1.2 3.2b	<b>ALLOW ECF</b> only if working is shown for mean

Question		Answer	Marks	AO element	Guidance
5	(a)	Alkane with 6 carbons is C <sub>6</sub> H <sub>14</sub> ✓ Benzene only has 6 hydrogens / alkanes are C <sub>n</sub> H <sub>2n+2</sub> / benzene is C <sub>n</sub> H <sub>n</sub> / number of carbon atoms and hydrogen atoms are the same / has 6 carbon atoms and 6 hydrogen atoms AW ✓	2	2.2	
	(b) (i)	icosane/ C <sub>20</sub> H <sub>42</sub> ✓	1	2.1	
	(ii)	melts above 25 ✓	1	2.1	
	(c)	as melting point increases, so does boiling point (ORA) ✓	1	3.1a	
	(d) (i)	Plot at 226, 287 ✓	1	1.2	ALLOW +/- ½ square
	(ii)	line of best fit ✓	1	1.2	
	(iii)	Shows mark on graph to show reading 210±10 ✓	1	2.2	
	(e)	boiling point ✓	1	1.1	
	(f) (i)	incomplete combustion / burning in insufficient/limited oxygen ✓	1	1.1	
	(ii)	toxic/poisonous (to humans) ✓	1	1.1	ALLOW explanation based on binding to haemoglobin
	(iii)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 4.65 × 10<sup>-23</sup> (g) award 3 marks</b>  Mr of CO = 28 ✓ Mass = 28 ÷ 6.02 × 10 <sup>23</sup> = 4.651... × 10 <sup>-23</sup> (g) ✓ Mass = 4.65 × 10 <sup>-23</sup> (g) (3sf) ✓	3	2 × 2.2  1.2	

	(g)	<b>Any two from:</b> Gases in the air reacting together / oxidation of nitrogen / nitrogen and oxygen react ✓ at high temperatures ✓	2	1.1	<b>ALLOW Max (1)</b> if states that nitrogen comes from fuel
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Question		Answer	Marks	AO element	Guidance
6	(a)	Neutrons ✓	1	1.1	
	(b) (i)	Li/lithium ✓	1	1.2	
	(ii)	Three protons / atomic number is 3 ✓	1	1.2	<b>ALLOW</b> three electrons
	(c) (i)	The 3D shape of the molecule ✓ The number of atoms in the molecule ✓	2	1.1	
	(ii)	C <sub>2</sub> H <sub>5</sub> ✓	1	2.2	
	(d) (i)	A ✓ D ✓	2	1.1	
	(ii)	B ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	Line must be above water level / line or spots are in the water / too much water / water too deep (AW) ✓	1	3.2a	<b>ALLOW</b> places filter paper in 2cm of water (identifies incorrect instruction)
		(ii)	Spots/food colour/dyes will dissolve in water/will not rise up the paper ✓	1	3.2a	
	(b)	(i)	(No because) there are 5 dyes/ 2 red dyes ✓ (Red dyes) move to different places/ have different R <sub>f</sub> values ✓	2	2.2 3.1b	
		(ii)	G / green ✓	1	3.2b	
		(iii)	it rises highest / travels furthest / has the highest R <sub>f</sub> value ✓	1	2.2	
		(iv)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 0.42 award 2 marks</b>  = $2.2 \div 5.3$ ✓  = 0.42 ✓	2	2.2	+/- 0.2  <b>ECF</b> on measurements quoted <b>IGNORE</b> incorrect rounding (assessed elsewhere on paper) Minimum of two significant figures
	(c)		Filter (to remove carbon) ✓  <b>AND any two from:</b> Heat copper sulfate / evaporate the water ✓ To crystallisation point / to reduce the volume of water ✓ Leave to cool / leave solution for a long time ✓	3	1.2	<b>ALLOW max (2)</b> for heat until <u>all</u> water is removed

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	 no double bond ✓ completely correct ✓	2	1.2	<b>IGNORE</b> brackets and 'n' <b>DO NOT ALLOW</b> if continuation bonds are not shown
		(ii)	addition (polymer) ✓	1	1.1	<b>ALLOW</b> additional
	(b)	(i)	$C_{10}H_{22} \rightarrow C_2H_4 + C_8H_{18}$ decane and ethene ✓ $C_8H_{18}$ (and all correct) ✓	2	1.2	
		(ii)	bromine (water) ✓ goes (from orange to) colourless /decolorised ✓	2	1.2	
	(c)	(i)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> <b>If answer = 21.6 (%) award 3 marks</b>  Total = 510000 ✓ % = $11000 \div 510000 = 2.1568\dots$ (%) ✓ % = 2.2 (%) (1 dp) ✓	3	2.2 x 2 1.2	
		(ii)	Processing – disagree, different process ✓ Transport – disagree: transport of waste bag must be added ✓	2	3.2a	
	(d)		they will never / very slowly break down/decay ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	Yes, there is still water present/yes as mass is too high (AW) ✓	1	3.2a	
		(ii)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> If answer = 0.64 (g) and 0 award 3 marks  Gradient = $64 \div 100$ ✓ Gradient = 0.64 ✓ Intercept = 0 ✓	3	2.2	IGNORE units
	(b)	(i)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> If answer = 0.5 (mol) award 3 marks  $25 - 16 = 9$ (g) of water ✓ Mr of water = 18 ✓ $n = 9 \div 18 = 0.5$ ✓	3	2.2	ALLOW ECF on error in calculated value of Mr of water Do not allow ECF on incorrect method
		(ii)	<b>FIRST CHECK THE ANSWER ON ANSWER LINE</b> If answer = 5 award 2 marks  CuSO <sub>4</sub> :H <sub>2</sub> O is 1:5 / recognise that the values involve x 5 ✓ n = 5 ✓	2	2.2	



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