OCR
Oxford Cambridge and RSA

H

GCSE (9–1)

Chemisty B (Twenty First Century Science)

J258/03: Breadth in Chemistry (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for Autumn 2021

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

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**.

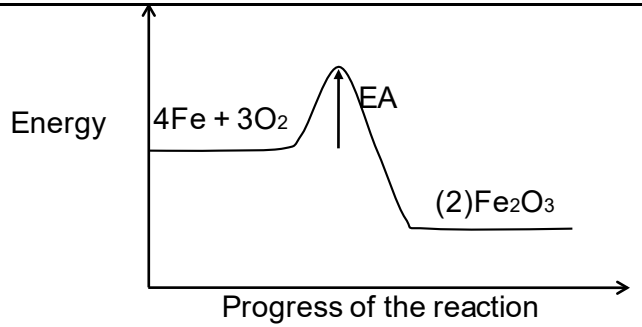
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

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

	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	(a)		kills microorganisms / bacteria ✓	1	1.1	**ALLOW** pathogens/viruses/fungi **IGNORE** sterilise/disinfect/removes bacteria/kills germs
	(b)		red ✓ white ✓	2	1.2	**ALLOW** colourless
	(c)	(i)	Brown/yellow colour ✓	1	1.2	**DO NOT ALLOW** red **ALLOW** orange
		(ii)	bromine (displaced) ✓	1	1.2	**ALLOW** Br_2
	(d)		Slower **AND** sodium is less reactive than potassium / idea of more reactive down the group ✓	1	2.1	Need explanation, not only the tick
	(e)		$CaCl_2$ ✓	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	**ALLOW** idea of (all) zinc has been used up **IGNORE** zinc is <u>being</u> used up **IGNORE** acid used up
	(b)		14 cm^3 per min ✓	1	2.2	
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.1 (g) award 2 marks** quotes 40 (from the graph) ✓ calculated mass = 0.1 (g) ✓	2	2.2	
	(d)		**Any two from:** Surface area (of metal) ✓ Temperature ✓ Amount/mass of metal ✓	2	3.3a	**ALLOW** 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 **ALLOW** symbols

Question			Answer	Marks	AO element	Guidance
3	(a)		Fe^{3+} ✓	1	2.2	
	(b)		Product line labelled with $2Fe_2O_3$ ✓ Reactants above products ✓ Activation energy curve and arrow ✓	3	2.2	 **DO NOT ALLOW** short arrow. Arrow needs to start at level of reactants and end at top of hump.
	(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	**ALLOW** more effective/successful collisions **IGNORE** more collisions

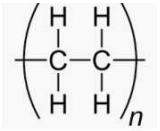
Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	$2Li + 2H_2O \rightarrow 2LiOH + H_2$ ✓	1	1.1	**ALL** correct
		(ii)	**Any two from:** Potassium 'disappears' faster ✓ Fizzes more vigorously ✓ Catches fire / shows a flame ✓	2	1.2	**ALLOW** potassium dissolves faster **IGNORE** colour of flame if 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	**ALLOW ECF** only if working is shown for mean

Question			Answer	Marks	AO element	Guidance
5	(a)		Alkane with 6 carbons is C_6H_{14} ✓ Benzene only has 6 hydrogens / alkanes are C_nH_{2n+2} / benzene is C_nH_n / 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/ $C_{20}H_{42}$ ✓	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)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 4.65 ×10^{-23} (g) award 3 marks** M_r of CO = 28 ✓ Mass = 28 ÷ 6.02 × 10^{23} = 4.651.. × 10^{-23} (g) ✓ Mass = 4.65 × 10^{-23} (g) (3sf) ✓	3	**2 × 2.2** **1.2**	

	(g)		**Any two from:** Gases in the air reacting together / oxidation of nitrogen / nitrogen and oygen react ✓ at high temperatures ✓	**2**	**1.1**	**ALLOW Max (1)** if states that nitrogen comes from fuel

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	**ALLOW** three electrons
	(c)	(i)	The 3D shape of the molecule ✓ The number of atoms in the molecule ✓	2	1.1	
		(ii)	C_2H_5✓	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	**ALLOW** 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 Rf values ✓	2	2.2 3.1b	
		(ii)	G / green ✓	1	3.2b	
		(iii)	it rises highest / travels furthest / has the highest R_f value✓	1	2.2	
		(iv)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.42 award 2 marks** = 2.2 ÷ 5.3 ✓ = 0.42 ✓	2	2.2	+/- 0.2 **ECF** on measurements quoted **IGNORE** incorrect rounding (assessed elsewhere on paper) Minimum of two significant figures
	(c)		Filter (to remove carbon) ✓ **AND any two from:** 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	**ALLOW max (2)** 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	**IGNORE** brackets and 'n' **DO NOT ALLOW** if continuation bonds are not shown
		(ii)	addition (polymer) ✓	1	1.1	**ALLOW** 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)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 21.6 (%) award 3 marks** Total = 510000 ✓ % = 11000 ÷ 510000 = 2.1568… (%) ✓ % = 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)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.64 (g) and 0 award 3 marks** Gradient = 64 ÷ 100 ✓ Gradient = 0.64 ✓ Intercept = 0 ✓	3	2.2	**IGNORE** units
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.5 (mol) award 3 marks** 25 – 16 = 9 (g) of water ✓ Mr of water = 18 ✓ n = 9 ÷ 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)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 5 award 2 marks** $CuSO_4$:H_2O is 1:5 / recognise that the values involve x 5 ✓ n = 5 ✓	2	2.2	

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