

GCSE (9–1)

Chemistry B (Twenty First Century Science)

J258/01: Breadth in Chemistry (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for November 2020

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.

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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

1. 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

2. 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.

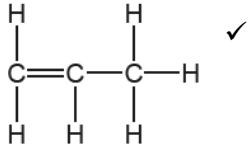
You should ensure that you have copies of these materials.

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:

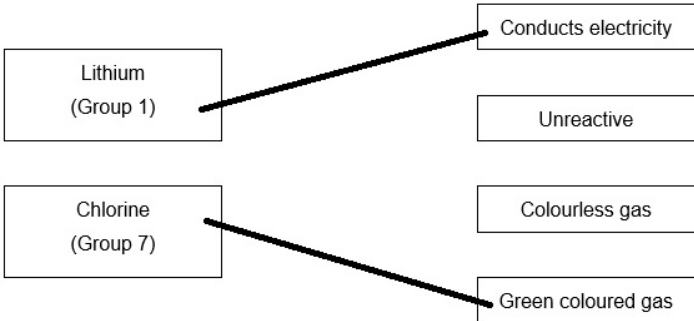
	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge 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)	(i)		1	1.1	
		(ii)	CH ₃ ✓	1	2.1	
	(b)	(i)	metal/positive ions (top box) ✓ electrons (bottom box) ✓	2	1.1	DO NOT ALLOW answers in any other order
		(ii)	(delocalised) electrons ✓	1	1.1	
	(c)		ANY ONE FROM: • flexible ✓ • better insulator ✓ • lighter ✓	1	2.1	ALLOW any valid point

Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	13.7-13.8 (°C) ✓	1	3.1a	
		(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.3/0.31/0.32 award 2 marks 14.38/14.39/14.4 in 1980 and 14.7 in 2000 ✓ 0.3/0.31/0.32 (°C) ✓	2	2.2	
		(iii)	1920 – 1940 ✓ 1980 – 2000 ✓	2	3.2b	
	(b)	(i)	They absorb infrared radiation and re-emit it. ✓	1	1.1	
		(ii)	<div> <div> <p>Question</p> <p>What can directly increase the amount of carbon dioxide in the air?</p> <p>What can reduce the amount of carbon dioxide in the air?</p> </div> <div> <p>Answer</p> <p>People burning more fossil fuels.</p> <p>People recycling less.</p> <p>People changing to electric cars.</p> <p>People throwing away plastics.</p> </div> </div> <p>✓✓</p>	2	1.1	

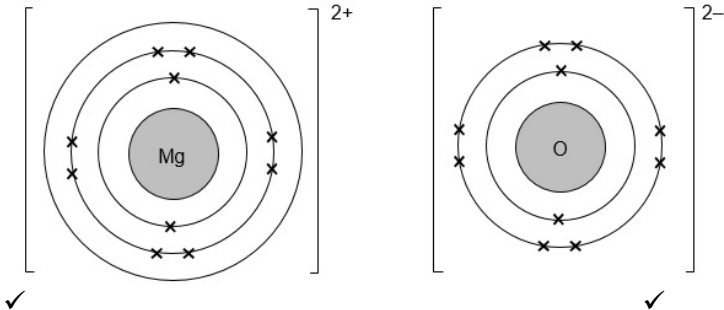
Question			Answer	Marks	AO element	Guidance
3	(a)		Carbon AND hydrogen ✓	1	1.1	
	(b)		CH ₂ ✓	1	2.2	
	(c)		Alkenes ✓	1	1.1	
	(d)		addition ✓ colourless ✓ double ✓	3	1.1	DO NOT ALLOW answers in any other order

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	Carbon / C <u>atoms</u> ✓	1	1.1	
		(ii)	covalent (bonds) ✓	1	1.1	ALLOW 'shared electron(s)'
	(b)		<p>Similarity – any one from: High m.p. or b.p. ✓</p> <p>Both can conduct electricity (depending on state) / AW ✓</p> <p>Both solids at room temperature ✓</p> <p>Difference – any one from: Graphite is “greasy” / slippery ✓</p> <p>Graphite conducts electricity when solid OR with sodium chloride / sodium chloride only conducts when liquid or dissolved in water ✓</p>	2	1.1	<p>IGNORE descriptions of structure</p> <p>ALLOW any suitable properties</p>

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	 <p> Lithium (Group 1) connects to Conducts electricity and Unreactive. Chlorine (Group 7) connects to Colourless gas and Green coloured gas. </p> <p>✓✓</p>	2	1.1	
		(ii)	<p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 28.4 (g) award 2 marks</p> <p>$(71 \div 14) \times 5.6$ ✓ $= 28.4$ (g) ✓</p>	2	2.2	
		(iii)	Reaction with chlorine is more vigorous / faster ✓	1	1.1	
	(b)		<p>anode: chlorine_✓</p> <p>cathode: Lithium ✓</p>	2	2.2	
	(c)		A chemical cell produces a voltage until the reactants are used up ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	zinc reacts (instead of iron)/is sacrificial ✓ (zinc) more reactive (than iron and transfers electrons to the oxygen) ✓	2	2.1	
		(ii)	More slowly than ✓	1	3.2b	
		(iii)	less water / air / oxygen can reach/touch nail ✓	1	3.2b	ALLOW less water/air/oxygen reacting with nail
	(b)		iron(III) hydroxide ✓	1	2.2	
	(c)		iron + hydrochloric acid → iron chloride ✓ + hydrogen ✓	2	2.2	ALLOW iron nail + hydrochloric acid → iron chloride + hydrogen for both marks IGNORE oxidation state of iron

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	lilac ✓	1	1.2	
		(ii)	Nitrogen / phosphorous ✓	1	1.1	
	(b)		K ₂ SO ₄ ✓	1	2.1	
	(c)	(i)	White AND solid / precipitate / insoluble ✓	1	1.2	
		(ii)	potassium chloride ✓	1	1.1	
	(d)	(i)	potassium ✓	1	3.2b	
		(ii)	4 x 10 ⁻⁷ (m) ✓	1	1.2	DO NOT ALLOW 0.0000004
	(e)		Advantage – cheaper / equipment is readily available / quick / convenient to do / AW ✓ Disadvantage – Lack of sensitivity / not accurate (on small amounts) ✓	2	3.2a	

Question			Answer	Marks	AO element	Guidance
8	(a)		transition metal ✓	1	1.1	
	(b)		titanium ✓ titanium oxide ✓ titanium ✓	3	2.1 2.2 x2	
	(c)		$(24.3 + 16.0 =) 40.3$ ✓	1	1.2	DO NOT ALLOW 40/40.0
	(d)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 60 (%) award 2 marks $(24/40) \times 100$ ✓ $= 60$ (%) ✓	2	2.2	
	(e)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 59.9 (%) award 3 marks $(47.9/79.9) \times 100$ ✓ $= 59.94993742$ ✓ $= 59.9$ (%) (1dp) ✓	3	2.2 x2 1.2	DO NOT ALLOW answers to any other rounded value
		(ii)	Reactants now include 2 Mg ✓ (Total) mass of atoms in reactants / bottom of fraction / denominator is larger ✓	2	2.2	ALLOW mass of other product is greater
	(f)	(i)		2	1.2	
		(ii)	$2 \text{ (Mg)} + \text{(O}_2\text{)} \rightarrow 2 \text{ (MgO)}$ ✓	1	1.2	

Question			Answer			Marks	AO element	Guidance
9	(a)			True	False	3	1.2	
			2 moles of nitrogen react with 3 moles of hydrogen .		✓			
			The reaction can reach 100% yield.		✓			
			At equilibrium, the forward reaction is faster than the backward reaction.		✓			
	(b)		1. Put some sulfuric acid in a beaker 2. Add ammonia until the solution is alkaline 3. Slowly evaporate the solution until most of the solution has gone 4. Wait for the crystals to form after the solution has cooled down 5. Filter the solution 6. Wash and dry the crystals ✓✓			2	3.3a	One mark for any three steps in the correct order
	(c)		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 75 (%) award 2 marks $(9.9 \div 13.2) \times 100$ ✓ = 75 (%) ✓			2	2.2	
	(d)		Sundip is wrong because it is a mixture / impurities aren't always visible / maybe same colour as desired substance ✓ Jack is wrong because the elements are: combined/reacted / understands that ammonium sulfate is made of (different) elements / ammonium sulfate has a fixed formula and elements are not easily separated ✓			2	3.1b	ALLOW a pure substance contains one chemical for either Sundip or Jack's answer. DO NOT ALLOW same reason for both Sundip and Jack.

Question			Answer	Marks	AO element	Guidance
10	(a)		An acid is reacting with an alkali (to form a salt plus water) / AW ✓	1	1.2	ALLOW the reaction between acid and a base
	(b)	(i)	an indicator ✓ <u>changes</u> colour ✓	2	1.2	ALLOW named acid-base indicator IGNORE details of any quoted colour change
		(ii)	Take readings at eye level / take readings from (bottom of) meniscus / make sure no air in burette / add (the NaOH) drop by drop ✓	1	3.3b	ALLOW AW for any of the points ALLOW repeat and look for a similar value ;
	(c)	(i)	$(25.80 - 0.90) = 24.9(0)$ ✓	1	2.2	
		(ii)	24.95 not used/is an outlier ✓ Mean = $(24.55 + 24.65 + 24.6) \div 3 = 24.6(0)$ ✓	2	3.2a 1.2	ALLOW Mean = $(24.55 + 24.65) / 2 = 24.6(0)$ ALLOW 1 mark for correct calculation of a mean using all 4 values (= 24.7 / 24.6875)
		(iii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.0037 or 3.7×10^{-3} (g) award 4 marks Rearrange to mass of acid = $0.0908 \div \text{volume of acid}$ ✓ $= 0.0908 \div 24.6$ ✓ $= 0.00369\dots$ (g) ✓ $= 0.0037$ or 3.7×10^{-3} (g) (2sf) ✓	4	1.2 2×2.2 1.2	ALLOW rearrangement mark if it is clear that 0.0908 is being divided by a volume, even if volume is incorrect. ALLOW ECF if incorrect volume is calculated in (ii) and used in (iii) ALLOW sf mark on incorrect calculation

Question			Answer	Marks	AO element	Guidance
11	(a)	(i)	When the fizzing stops ✓	1	3.3a	
		(ii)	(broken-up tablet) greater surface area (of solid) (AW) ✓ more solid particles can react (in the same time) / more (successful / frequent) collisions ✓	2	1.1	
	(b)		Particles gain <u>activation</u> energy (AW) / <u>frequency</u> of collisions is greater / more <u>successful</u> collisions ✓	1	1.1	
	(c)	(i)	(the fizz means) a gas is being given off/made / carbon dioxide is being given off/made ✓	1	2.2	
		(ii)	Gradient/slope decreasing ✓	1	2.2	ALLOW idea that the curve is less steep (as time increases) IGNORE time increases and mass decreases
		(iii)	(Rate of reaction decreases as): number of (reactant) particles decreases / particles further apart ✓	1	2.2	ALLOW reactants/tablet/water used up IGNORE particles have less energy

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