OCR
Oxford Cambridge and RSA

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GCSE (9–1)

Chemisty B (Twenty First Century Science)

J258/02: Depth in chemistry (Foundation 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

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	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 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.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>✓✓
<table><tr><th></th><th>Element (✓)</th><th>Compound (✓)</th></tr><tr><td>carbon dioxide</td><td></td><td>✓</td></tr><tr><td>chlorine</td><td>✓</td><td></td></tr><tr><td>hydrogen</td><td>✓</td><td></td></tr><tr><td>water</td><td></td><td>✓</td></tr></table></td><td>2</td><td>1.1</td><td>All correct = 2 marks
Two or three correct = 1 mark</td></tr>
<tr><td></td><td>(b)</td><td></td><td>They bond by sharing electrons ✓

They contain only a few atoms ✓</td><td>2</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>Four electrons between carbon and oxygen ✓

Idea that one bond has two electrons ✓</td><td>2</td><td>1.1</td><td>ALLOW bond is a pair of electrons</td></tr>
<tr><td></td><td>(d)</td><td></td><td><table><tr><th>Atom</th><th>Number of bonds</th></tr><tr><td>hydrogen</td><td>1</td></tr><tr><td>oxygen</td><td>(2)</td></tr><tr><td>carbon</td><td>4</td></tr><tr><td>chlorine</td><td>1</td></tr></table>✓✓</td><td>2</td><td>1.1</td><td>All correct = 2 marks
Two correct = 1 mark</td></tr>
<tr><td></td><td>(e)</td><td></td><td>How - Argon is a single atom / is unreactive / does not form bonds / does not form molecules ✓

Why - Argon has a full outer shell (of electrons) ✓</td><td>2</td><td>1.1</td><td>ALLOW ‘Argon has 8 electrons in the outer shell so the atom is stable’ for two marks</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td>(i)</td><td>To avoid contamination / so that solutions do not mix ✓</td><td>1</td><td>3.3b</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><th></th><th>pH meter 1</th><th>pH meter 2</th><th>pH meter 3</th></tr><tr><td>Accurate</td><td>✓</td><td>✓</td><td></td></tr><tr><td>Not accurate</td><td></td><td></td><td>✓</td></tr></table>✓✓</td><td>2</td><td>3.2a</td><td>All three correct = 2 marks
pH Meter 2 AND PH meter 1 ✓
pH meter 3 ✓</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Use universal indicator ✓</td><td>1</td><td>1.2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>checking or comparing results ✓

to increase confidence in the data / to see if they agree ✓</td><td>2</td><td>2.1</td><td>DO NOT ALLOW improved accuracy

ALLOW identify anomalies</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
3	(a)		Only ✓ contains hydrogen and carbon ✓	2	1.1	ALLOW Symbols H and C
	(b)		C_8H_{18} is because hydrogen atoms are 2n+2 the number of carbon atoms / fits the general formula ✓ C_3H_8S is not because it contains sulfur / is not a hydrocarbon ✓ C_6H_{12} is not because it has too few hydrogen atoms ✓	3	2.1	ALLOW one mark for each molecule and a reason, or three decisions correct with all incorrect reasons ✓

Question			Answer	Marks	AO element	Guidance
4	(a)		hydrogen ✓	1	2.1	ALLOW correct formula H_2
	(b)		shows water in trough and cylinder ✓ delivery tube and bung (with no leaks and no seals across the gas flow) ✓	2	1.2 3.3a	
	(c)	(i)	faster when concentration increases (Shorter time indicates a faster reaction) ✓ <u>fastest / most difference in time</u> taken when temperature is higher ✓ faster when surface area is greater (Shorter time indicates a faster reaction and more of an impact on rate of reaction than concentration of acid) ✓	3	3.2b	ALLOW faster / shorter time when temperature is higher if no other points ✓
		(ii)	1.0 mol/dm^3 ✓ 20 °C ✓ large pieces of zinc ✓	3	3.1b	
	(d)		<75 s ✓ decrease ✓	2	2.2 1.2	

Question			Answer	Marks	AO element	Guidance
5	(a)*		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 change in terms of number of electrons gained or lost for both ions and links this with an explanation to the charge on both ions. *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) Describes the changes in terms of number of electrons gained or lost for both ions. OR Describes the change in terms of number of electrons gained or lost for one ion and links this with an explanation to the charge on the ion. *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) Describes that one ion has lost or gained electrons (no numbers needed). *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.*	6	2 x 1.1 4x 2.1	AO1.1 Demonstrates knowledge and understanding of what happens when ionic bonds are formed • magnesium has two electrons in its outer shell • oxygen has six electrons in its outer shell. • atoms try to gain a full shell of electrons AO2.1 Applies knowledge and understanding to explain electronic changes shown on the diagram <u>Description of what happens</u> • magnesium loses electrons • oxygen gains electrons • Idea that magnesium gives electrons to oxygen <u>Number of electrons gained or lost</u>. <u>Charges on ions.</u> • magnesium ion has a +2 charge and oxygen has a -2 charge / idea that they have opposite charges • electrons are negatively charged. • links charges to number of electrons gained or lost • two electrons gained give a 2- charge • two electrons lost give a 2+ charge.

Question			Answer	Marks	AO element	Guidance
	(b)	(i)	✓✓ Oxide: magnesium oxide; carbon monoxide; water State: gas; liquid; solid State symbol: (s); (l); (g)	2	2.1 1.1	LHS (Oxide to State) correct = 1 mark RHS (State to State Symbol) correct = 1 mark
		(ii)	magnesium oxide carbon monoxide ✓ weak intermolecular forces ✓ covalent ✓	3	2.1 2 x 1.1	

Question			Answer	Marks	AO element	Guidance
6	(a)		oxygen ✓ 2(Mg) AND 2(MgO) ✓	2	1.1 2.1	DO NOT ALLOW O_2
	(b)	(i)	(21.6 – 17.9 =) 3.7 ✓	1	2.2	
		(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 93(%) award 3 marks (3.7/4.0)x100 ✓ = 92.5 ✓ = 93 (%) (2sf) ✓	3	 2.2x2 1.2	ALLOW ECF from (i)
	(c)	(i)	All points correctly plotted ✓✓ Best fit line using three or more correctly plotted points ignoring outlier ✓ Appropriate scales for axes ✓	4	2.1	ALLOW one mark if three points are correctly plotted
		(ii)	Reaction 2 ✓ Because it is too low on the graph and/or it's an outlier/anomalous result in the graph ✓	2	2.2	ALLOW ECF if graph shows a point below best fit line. IGNORE references to data table

Question			Answer	Marks	AO element	Guidance
7	(a)		The energy change of reaction is negative. ✓ The reactants have more energy than the products. ✓	2	1.1	
	(b)	(i)	measure temperature of water <u>before</u> adding solid ✓ add solid to water (stir/dissolve) and measure the temperature ✓ temperature should increase ✓	3	2x3.1a 1x2.2	ALLOW this mark if implication is clear
		(ii)	Idea of harm to skin and eyes /keep it away from skin and eyes /it is corrosive ✓	1	2.2	ALLOW 'hands' for 'skin'

Question			Answer	Marks	AO element	Guidance
8	(a)		Idea of cross checking data / look for anomalies / take a mean / idea of repeating readings ✓	1	3.3a	
	(b)	(i)	vehicles produce sulfur dioxide ✓ which would make it impossible to measure how much sulfur dioxide came from the power station / idea that you cannot tell what the source of sulfur dioxide is ✓	2	3.3a	
		(ii)	distance from power station /different directions around power station ✓	1	3.3a	IGNORE costs / references to avoiding other roads.

8	(c)*		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 changes in detail (general trend or Thursday increase) AND Justifies the changes in terms of at least two weather conditions. *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) Describes some changes during the 6 day period AND Justifies at least one change in terms of a weather condition. *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) Describes a change in sulfur dioxide concentration during the 6 day period. OR Links a weather condition to a concentration change. *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.*	6	2 x 2.1 4 x 3.2a	AO3.2a Justifies reasons for the changes. • concentration is higher in dry weather • rain decreases concentration • wind decreases concentration • rain has more effect than wind • heavy rain causes the biggest decrease • sunny or cloudy weather does not have a large impact on concentration AO 2.1 Describes a change in sulfur dioxide concentration • sulfur dioxide concentration (generally) decreases • identifies two days and comments on the relative sulfur dioxide concentration (e.g. Tuesday is higher than Wednesday) • Thursday concentration is higher than Wednesday

Question			Answer	Marks	AO element	Guidance
9	(a)		Any two from: (Symbol) can (easily) separate / can identify / gives recycling instructions ORA ✓ symbol is international / people overseas can read it / people might not know what symbol means ✓ ORA ✓ don't need words / no need to read / name very long / visual symbols are easier to read ORA ✓	2	2.1	
	(b)	(i)	UV does not go through glass / is absorbed by glass ✓	1	2.1	ALLOW reflects off glass
		(ii)	chlorine / Cl_2 ✓	1	1.1	ALLOW ozone DO NOT ALLOW chloride
	(c)	(i)	Stage 3 / shredding and separation ✓	1	2.1	
		(ii)	Stage 2 / washing and drying ✓	1	2.1	
	(d)		Links reusing as a bottle (to clean water)/using the bottles again and recycling to padding/using it to make it into different product ✓ Reusing uses the bottle in its same form idea / not changed / recycled polymer is processed/shredded/melted/shaped ✓	2	1.1 2.1	IGNORE wear jacket several times
	(e)		Any two from: Using bottles to treat water does not need any processing / process is different / only need washing (and drying) / padding has been processed/shredded/melted/shaped ✓ Different life spans ✓ Bottles reused many times ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
			Jackets thrown away after use ✓ Different disposal or waste implications / different waste produced / more packaging for jackets ✓ Different energy use ✓ Different water use ✓			

Question			Answer	Marks	AO element	Guidance
10	(a)	(i)	Copper chloride: (Positive electrode -) chlorine (gas) AND (negative electrode -) copper (metal) ✓ Sodium sulfate: (Positive electrode -) oxygen (gas) ✓ (Negative electrode -) hydrogen (gas) ✓	3	2.1	DO NOT ALLOW one mark for any other permutation DO NOT ALLOW chloride ALLOW correct formula i.e. Cl_2, Cu, O_2, H_2
		(ii)	✓✓ Gas: chlorine, oxygen, hydrogen Test and result: relights a glowing splint; makes a lighted splint go 'pop'; turns lime water milky; turns blue litmus paper red and then bleaches it; turns red litmus paper blue and then bleaches it	2	1.2	All correct = 2 marks 2 correct = 1 mark
		(iii)	Idea that copper is less reactive (than hydrogen) ORA ✓ Sodium is more reactive than hydrogen ORA ✓	2	2.1	ALLOW (1) for copper is less reactive than sodium / copper is unreactive

Question			Answer	Marks	AO element	Guidance
	(b)		2 correctly labelled apparatus: electrodes, battery, beaker, solution ✓ Shows battery connected to leads connected to electrodes AND electrodes are at least partially submerged into solution ✓	2	1.2 3.3a	ALLOW anode and cathode for electrodes ALLOW NaCl (aq) for solution ALLOW correct symbol for battery without label DO NOT ALLOW circuit unless current can flow

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

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