OCR
Oxford Cambridge and RSA

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GCSE (9–1)

Combined Science B (Twenty First Century Science)

J260/02: Chemistry (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for Autumn 2021

Oxford Cambridge and RSA Examinations

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.

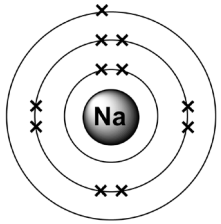
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

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

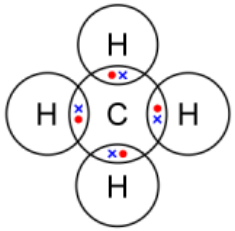
The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science B:

	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)	Relative atomic mass ✓	1	1.1	
		(ii)	He thought more elements would be discovered / Elements fitted into groups with similar properties ✓	1	1.1	
	(b)	(i)	number of electrons in the outer = group number number of electron shells = period number total number of electrons = atomic number ✓✓	2	1.1	3 correct = 2 marks 2 or 1 correct = 1 mark
		(ii)	metal **AND** non-metal loses **AND** gains positive **AND** negative ✓✓	2	1.1	3 correct = 2 marks 2 or 1 correct = 1 mark

Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	Bohr – electrons are arranged in shells Rutherford – atoms contain a nucleus Thompson – an atom is like a 'plum pudding' ✓✓	2	1.1	3 correct = 2 marks 2 or 1 correct = 1 mark
		(ii)	Experiments discovered more information ✓	1	1.1	**ALLOW** (Chadwick) discovered/discovery of neutrons
	(b)	(i)	Negative/-1 Positive/+1 neutral/no charge/0 ✓	1	1.1	All correct = 1 mark
		(ii)	in the nucleus ✓	1	1.1	
		(iii)	15 15 16 ✓✓	2	2.1	All correct = 2 marks Any 2 correct = 1 mark
	(c)		 11 electrons ✓ 2.8.1 configuration ✓	2	2.1	

Question			Answer	Marks	AO element	Guidance
3	(a)		fractional distillation ✓	1	1.1	
	(b)	(i)	**Any two from:** gas ✓ petrol ✓ diesel ✓	2	2.2	
		(ii)	Petrol **AND** naphtha **AND** paraffin ✓	1	2.1	
		(iii)	cracking ✓	1	1.1	
		(iv)	petrol more in demand than in supply in crude oil / more petrol needed than is in crude oil✓ crude oil has more naphtha than is needed ✓	2	3.2b	**ALLOW** 1 mark for 'more petrol is needed than naphtha'
		(v)	C_2 ✓ H_4 ✓	2	1.2	
	(c)	(i)	C ✓ E ✓	2	2.1	
		(ii)	D ✓ has a double bond ✓	2	2.1 1.1	
	(d)		It will run out ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
4	(a)		element **AND** compound ✓ covalent ✓ ionic ✓ high ✓	4	2.1	
	(b)	(i)	Carbon surrounded by 4 hydrogens ✓ 4 bonded pairs of electrons only ✓ 	2	2.2	
		(ii)	Shape of molecule – shown only by 3d structure ✓ Number of bonds - shown by 3D structure and by dot and cross structure✓ Number of electrons in bonds – shown only by dot and cross structure ✓	3	1.1	
	(c)		All bonds in diamond are strong ✓ Forces between methane molecules are weak ✓	2	1.1	

Question			Answer	Marks	AO element	Guidance
5*			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 a suitable method of how to use the apparatus to make dry crystals, including most fine detail AND steps are mostly in correct sequence.** *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 a suitable method of how to use the apparatus to make crystals including some fine detail OR describes basic ideas with most in correct sequence.** *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 some basic ideas of how to use the apparatus to make crystals** *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**	**2.2**	**Basic ideas of how to use the apparatus** • acid in beaker • add carbonate to acid • stir • filter • heat/boil **Fine detail of how to use the apparatus** • measure acid in measuring cylinder • add excess copper carbonate/keep adding until no more fizzing • filter to remove excess copper carbonate • collect solution of copper sulfate • heat to evaporate water • only evaporate some of the water • leave to crystallise • dry between filter papers **Idea of sequence** • measuring • mixing • filtering to remove excess carbonate • evaporating • crystallising • filtering to obtain crystals • drying

Question			Answer	Marks	AO element	Guidance
6	(a)		**Any two from:** Add a catalyst ✓ Increase the concentration of sulfuric acid ✓ Use powdered/smaller lumps of zinc ✓ Increase the temperature/warm the sulfuric acid ✓	**2**	**3.3b**	
	(b)	**(i)**	30(s) ✓	**1**	**1.2**	
		(ii)	It slows down ✓	**1**	**2.2**	
		(iii)	94 ✓	**1**	**1.2**	
		(iv)	reaction stops/all acid used up/no more hydrogen produced ✓	**1**	**2.2**	
	(c)	**(i)**	All points correct ✓ Line of best fit ✓	**2**	**1.2** **2.2**	**DO NOT ALLOW** 'dot to dot'
		(ii)	slower ✓ less ✓	**2**	**2.2**	

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	Mg **AND** H_2O ✓ MgO ✓ H_2 ✓	3	1.2	
		(ii)	It gains oxygen ✓	1	2.1	
	(b)	(i)	hydrogen gas – pops a lighted splint Alkali – turns Universal Indicator blue ✓	1	1.2	
		(ii)	Sodium is more reactive than magnesium/sodium higher in the reactivity series/sodium loses electrons more easily ✓	1	2.2	
	(c)	(i)	Ions cannot move in solid ✓ ions free to move in liquid/movement of charge is electricity ✓	2	1.2	
		(ii)	positive electrode – chlorine negative electrode - sodium ✓	1	2.2	**DO NOT ALLOW** chlor**IDE** **BOTH** elements required

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>8</td><td>(a)</td><td></td><td>magnesium chloride ✓</td><td>1</td><td>2.2</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>Any two from:
add acid drop by drop/dropwise ✓
swirl between drops ✓
stop when indicator just changes colour ✓
read the burette with meniscus on the line ✓</td><td>2</td><td>3.3a</td><td>IGNORE references to mass of tablet, powdering the tablet, concentration of acid. Marks here are for how to use the burette accurately.</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>FIRST CHECK THE ANSWER ON ANSWER LINE
If answer = 58.3 award 2 marks

24.3 + 32 + 2 ✓
= 58.3 ✓</td><td>2</td><td>2.2</td><td>ALLOW 58 for 2 marks

ALLOW 24.3 + 16 + 1 (=41.3) for 1 mark</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>FIRST CHECK THE ANSWER ON ANSWER LINE
If answer = 595(mg) award 2 marks

10.2 x 58.3 = 594.66 ✓
= 595 (mg) (to 3sf) ✓</td><td>2</td><td>

2.2
1.2</td><td>ALLOW 592(mg) if 58 used
ALLOW ECF for incorrect answer in (i)</td></tr>
<tr><td></td><td>(d)</td><td></td><td>✓✓<table><tr><th></th><th>Meets standard</th><th>Does not meet standard</th></tr><tr><td>Pack A</td><td>✓</td><td></td></tr><tr><td>Pack B</td><td></td><td>✓</td></tr><tr><td>Pack C</td><td>✓</td><td></td></tr></table></td><td>2</td><td>3.2a</td><td>3 correct = 2 marks
2 correct = 1 mark</td></tr>
<tr><td></td><td>(e)</td><td>(i)</td><td>mixture AND fixed ✓</td><td>1</td><td>1.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>chromatography ✓</td><td>1</td><td>1.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	27(%) ✓	1	2.1	
		(ii)	(particles) slower ✓ (particles) closer together ✓ becomes liquid/condensed ✓	3	1.1	**ALLOW** forms clouds/rain
	(b)		carbon dioxide decreases **AND** oxygen increases ✓ plants formed which absorb carbon dioxide ✓ for photosynthesis, and emit oxygen ✓	3	3.2b 1.1 x 2	**ALLOW** carbon dioxide dissolved in the oceans
	(c)	(i)	4 **AND** 3 ✓	1	2.1	
		(ii)	No oxygen ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
10	(a)		nanoparticles bigger than (all the) atoms/ORA✓ nanoparticles bigger than water molecules/ORA✓ nanoparticles smaller than/not larger than polymer molecules/ORA✓	3	3.1b	
	(b)	(i)	(nanoparticles) because largest surface area to volume ratio ✓	1	2.1	**DO NOT ALLOW** answers that simply quote the values from the table, needs to be a comparative statement.
		(ii)	(no) Not proportional/use of word proportional ✓ As size increases particles have smaller surface area to volume ratios ✓	2	3.1a	
	(c)		atoms arranged in balls – carry medicines into the body atoms arranged in tubes – molecular sieves high surface area to volume ratio – catalysts ✓✓	2	1.1	3 correct = 2 marks 2 or 1 correct = 1 mark
	(d)		Catalysts decrease the activation energy of the reaction ✓ Catalysts reduce the energy needed to break the bonds in the reactants ✓	2	1.1	

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