OCR
Oxford Cambridge and RSA

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GCSE (9–1)

Combined Science A (Gateway Science)

J250/04: Paper 4 (Foundation 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.

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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.

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 A:

	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			D ✓	1	1.1	
2			B ✓	1	1.1	
3			A ✓	1	1.2	
4			B ✓	1	1.1	
5			B ✓	1	1.1	
6			D ✓	1	1.1	
7			B ✓	1	1.2	
8			D ✓	1	2.2	
9			C ✓	1	2.2	
10			B ✓	1	2.2	

Question			Answer	Marks	AO element	Guidance
11	(a)		7✓	1	2.1	
	(b)		Less reactive✓	1	2.1	
	(c)		Solid ✓	1	2.1	
	(d)		Higher ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
12	(a)		Potassium✓	1	1.1	
	(b)	(i)	Oxygen/O_2 ✓	1	1.1	**DO NOT ALLOW** just O **ALLOW** water <u>vapour</u>
		(ii)	Sodium oxide ✓	1	1.1	**ALLOW** sodium hydroxide <u>only</u> if water vapour given above
		(iii)	Idea of <u>longer</u> time for lithium ✓ Lithium is less reactive than sodium ✓	2	2.1 1.1	**ORA ALLOW** slower **ORA**
	(c)		Sodium ✓ Has a higher density than potassium ✓ **OR** Potassium ✓ Has a lower density than sodium✓	2	3.2a 3.2b	Explanation must match the chosen metal for the mark **ALLOW** density increases down the group but density of potassium falls

Question			Answer	Marks	AO element	Guidance
13	(a)		Fractional distillation ✓	1	1.2	**DO NOT ALLOW** just distillation
	(b)		Y W Z X ✓	1	1.2	
	(c)	(i)	Alkanes ✓	1	1.1	
		(ii)	C_nH_{2n+2} ✓	1	1.1	
		(iii)	Any value between -25 and 0°C ✓	1	3.1a	
	(d)	(i)	Carbon monoxide ✓	1	1.1	**ALLOW** CO
		(ii)	It's toxic/poisonous ✓	1	1.1	**ALLOW** answer in terms of prevents oxygen transport in blood **DO NOT ALLOW** just hazardous to health

Question			Answer	Marks	AO element	Guidance
14	(a)		(74.2 – 73.4 =) 0.8 (g) ✓	1	1.2	
	(b)		Ideas based on heat the reaction for longer/until no more steam produced/ until more of the solid turns white/no further colour change ✓	1	3.3b	**ALLOW** ideas based on heating to constant mass
	(c)	(i)	$CuSO_4$ ✓ 5 ✓	2	2 x 2.2	
		(ii)	(White solid) turns blue ✓ Reaction is reversible ✓	2	2 x 3.1a	**ALLOW** (whiter solid) returns to original colour
		(iii)	Exothermic ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
15	(a)		**2**Al_2O_3 ✓ **4**Al and **3**O_2 ✓	**2**	**2 x 2.2**	**ALLOW** any correct multiples if applied correctly to all three chemicals
	(b)	**(i)**	So ions are free to move ✓ And conduct electricity/carry the electric current/charge✓	**2**	**2 x 1.1**	
		(ii)	Al^{3+}ions are positive and cathode is negative/ aluminium ions and cathode are oppositely charge ✓	**1**	**1.1**	
	(c)		**Any two from:** less energy needed to melt aluminium (than aluminium oxide) ✓ electricity (for electrolysis) expensive ✓ no need to buy cryolite ✓ electrolysis cell not needed✓ less mining of aluminium oxide needed ✓	**2**	**2 x 2.1**	

Question			Answer	Marks	AO element	Guidance
16*			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)** Detailed description of the trends in the graphs **AND** how they are linked. **AND** Detailed explanation of the trends in the graphs. *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)** Detailed description of the trends in the graphs **AND** how they are linked. **OR** Describes the trends in the graphs. **AND** Explains the trends in the graphs. *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)** description of the trends in the graphs **AND** how they are linked. **OR** Describes the trends in the graphs. **OR** Explains the trends in the graphs.	**6**	**3 x 2.1** **3 x 3.1a**	**Description of trends** **AO3.1a Analyse information and ideas to interpret data in Fig. 16.1 and Fig. 16.2** • carbon dioxide concentration increases as consumption of oil/coal/gas increases • carbon dioxide concentration increases steadily but fossil fuel consumption dips in the late 2000s • carbon dioxide concentration increases steadily but coal/oil/gas consumption do not **Explanation of trends** **AO2.1 Apply knowledge and understanding of the link between fossil fuel use and levels of atmospheric CO_2** • fossil fuels contain carbon/are hydrocarbons/ alkanes • burning of oil/coal/gas/fossil fuels releases carbon dioxide into the atmosphere • fossil fuels are not the only source of carbon dioxide

Question			Answer	Marks	AO element	Guidance
			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.*			

Question			Answer	Marks	AO element	Guidance
17	(a)		**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = between 16.5 and 16.9 award 3 marks** use of correct figures from graph for calculating gradient e.g. 50 ÷ 3. ✓ correct answer e.g. 16.66•/16.67 ✓ answer to 1 decimal place e.g. 16.7 ✓	**3** **2 x 2.2** **1 x 1.2**		
	(b)		Rate decreases ✓ (as reaction progresses) There are fewer reactant (magnesium/acid) particles ✓ The <u>frequency</u> of collisions decreases ✓	**3**	**3 x 2.1**	**IGNORE** less collisions
	(c)	**(i)**	(gradient increases) as the rate of reaction increases/faster reaction ✓	**1**	**3.2b**	**IGNORE** gradient increase / increase alone **ALLOW** answers based on ideas of increased number or increased frequency of collisions
		(ii)	40 (cm^3) ✓	**1**	**3.2b**	

Question			Answer	Marks	AO element	Guidance
18			S is the catalyst ✓ speeds up the reaction **AND** remains unchanged ✓ R and T are not catalysts ✓ R reacts/ T does not speed up reaction ✓	4	2.1 1.1 2.1 1.1	

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