OCR
Oxford Cambridge and RSA

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GCSE (9–1)

Chemistry A (Gateway Science)

J248/02: Paper 2 (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.

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

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:

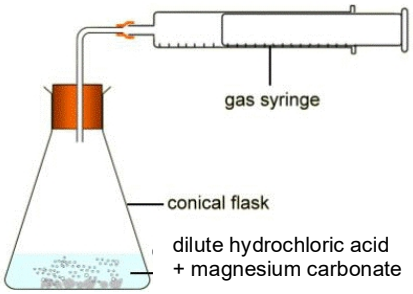
	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge 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			C ✓	1	1.2	
2			B✓	1	1.2	
3			D ✓	1	1.1	
4			D ✓	1	1.1	
5			D ✓	1	1.1	
6			A✓	1	1.1	
7			C ✓	1	1.1	
8			C ✓	1	1.1	
9			C ✓	1	1.2	
10			B ✓	1	2.1	
11			A ✓	1	2.2	
12			B ✓	1	2.2	
13			B ✓	1	2.1	
14			C ✓	1	2.2	
15			D ✓	1	2.2	

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

Question			Answer	Marks	AO element	Guidance
16	(a)		Fluorine – **gas** ✓ Astatine – Radius in the range **0.148 - 0.210** ✓	**2**	**1.1** **3.2a**	
	(b)	**(i)**	Iodine + sodium bromide ✓	**1**	**2.1**	**Both required for the mark** **ALLOW** answers in either order
		(ii)	Bromine is more reactive than iodine / ORA ✓	**1**	**1.1**	**ALLOW i**odine cannot displace bromine
		(iii)	$Cl_2 + 2NaI \rightarrow 2NaCl + I_2$ Formulae ✓ Balancing ✓	**2**	**1.1** **2.1**	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** and / & instead of '+' balancing mark is dependent on the correct formulae but **ALLOW** 1 mark for a balanced equation with a minor error in subscripts / formulae eg $CL_2 + 2NAI \rightarrow 2NaCl + I2$
	(c)	**(i)**	Idea of preventing potassium reacting with air or oxygen / idea of preventing potassium reacting with water ✓	**1**	**1.1**	**ALLOW** potassium reacts with air or oxygen / potassium reacts with water
		(ii)	(Sodium and potassium) both have 1 electron in their outer shell / both have the same number of electrons in their outer shell ✓	**1**	**1.1**	**ALLOW** both form 1+ ions

Question			Answer	Marks	AO element	Guidance
17	(a)		Potassium / K^+ ✓	1	1.2	
	(b)	(i)	Carbonate / CO_3^{2-} ✓	1	1.2	
		(ii)	(limewater) goes cloudy/milky/white ✓	1	1.2	
	(c)	(i)	Green ✓	1	3.2b	
		(ii)	Magnesium most reactive Zinc Iron Copper least reactive correct order – 2 marks magnesium as most reactive and copper as least – 1 mark	2	3.2b	
		(iii)	$Mg + CuSO_4 \rightarrow MgSO_4 + Cu$ ✓	1	2.2	**ALLOW** any correct multiple, including fractions **DO NOT ALLOW** and / & instead of '+' **ALLOW** a minor error in subscripts / formulae

Question			Answer	Marks	AO element	Guidance
18	(a)		Labelled diagram showing gas syringe connected to conical flask ✓  ✓ **And any three from:** Measure known volume of acid ✓ Add known mass of magnesium carbonate ✓ Measure volume of gas every 30 seconds ✓ Repeat with different concentrations of acid ✓	**4**	**3.3a**	**NB** Apparatus must work
	(b)	**(i)**	All points plotted correctly scores 2 marks **BUT** 3 or 4 points plotted correctly scores 1 mark Line of best fit through points ✓	**3**	**2x 2.2** **1.2**	**ALLOW** ± ½ square
		(ii)	42s ± 2s ✓	**1**	**2.2**	**ALLOW** answer ± 2s of graph

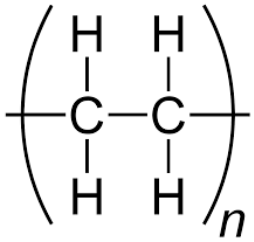
Question			Answer	Marks	AO element	Guidance
		(iii)	(Rate of reaction) increases ✓	1	3.1a	
		(iv)	**Any two from:** Idea that particles move faster / particles have more energy ✓ Idea of increased collisions (frequency) between acid and thiosulfate ✓ Idea of more successful collisions / collisions between acid and thiosulfate are more energetic ✓	2	2 x 2.2	**IGNORE** references to 'faster' collisions

Question			Answer	Marks	AO element	Guidance
19	(a)	(i)	Waxes and tar ✓	1	2.1	
		(ii)	Waxes and tar ✓	1	2.1	
	(b)	(i)	High temperature / catalyst ✓	1	1.1	**ALLOW** stated temperature above 500°C **IGNORE** temperature/heat without qualification **ALLOW** named catalyst eg zeolite / aluminium oxide / silicon oxide
		(ii)	product of cracking more in demand / makes up the shortfall / more useful ✓ gives examples from the table ✓	2	2.1	
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 124.49(%) award 3 marks** 11,000,000 – 4,900,000 = 6.1×10^6 ✓ 6,100,000 ÷ 4,900,000 = 1.244897959 ✓ 1.244897959 × 100 = 124.49(%) ✓	3	**2 x 2.2** **1.2**	**ALLOW** ECF from calculation

Question			Answer	Marks	AO element	Guidance
20	(a)		(acid + alkali →) **salt** ✓ + **water** ✓	2	1.2	**ALLOW** answers in either order
	(b)		**Any one from:** Use a single indicator / named single indicator eg methyl orange / phenolphthalein (instead of universal indicator)✓ Idea that universal does not give a sudden colour change / universal indicator gives a continuous colour change / ORA ✓ **OR** Fill the burette exactly to the 0.0 cm^3 line ✓ Idea that this will give accurate volume of acid ✓ **OR** Idea of adding acid to the alkali **slowly or dropwise** near the end point ✓ As indicator should change colour on addition of one drop (of acid) ✓ **OR** Idea of swirling the alkali while adding the acid ✓ To ensure mixing of acid and alkali ✓ **OR** Use a white tile under the conical flask ✓ To see the colour change easily / clearly ✓	2	3.3b	**Explanation must be linked to reason** **ALLOW** idea of using a pH probe or pH meter

Question			Answer	Marks	AO element	Guidance
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 23.65 (cm^3) award 2 marks** Use of volume of acid from only titrations 2 & 3 / Use of only 23.60 & 23.70 ✓ Accurate volume of acid = 23.65 (cm^3) ✓	**2**	**2.2**	**ALLOW** 1 mark for average calculated using all results, ie 24.35 (cm^3)

Question			Answer	Marks	AO element	Guidance
21	(a)		(Amount of carbon dioxide was reduced by) photosynthesis (by plants) ✓ Carbon dioxide dissolved into the oceans ✓ Shell formation by sea creatures ✓	1	1.1	
	(b)		(Amount of carbon dioxide) increases / AW ✓	1	3.1a	Must have the trend, not just the start and end amounts
	(c)	(i)	Burning fossil fuels ✓	1	1.1	**ALLOW** respiration / volcanic activity / production of cement or concrete **DO NOT ALLOW** deforestation
		(ii)	**Any one from:** Idea of reducing consumption of fossil fuels ✓ Use of biofuels ✓ Use renewable energy sources ✓ Idea of stopping carbon dioxide escaping when fuels are used ✓	1	1.1	**ALLOW** specific renewable energy sources eg wind / solar energy / tidal **ALLOW** use carbon capture (and storage)
	(d)	(i)	Any value <7 ✓	1	2.1	
		(ii)	**Any one from:** Acid rain ✓ erosion of stonework ✓ corrosion of metals ✓ kills trees or kills living things in rivers / lakes ✓ breathing difficulties ✓	1	1.1	

Question			Answer	Marks	AO element	Guidance
22	(a)		**Any two from:** Have the same general formula / both have the formula C_nH_{2n+2} ✓ Idea that they differ from each other by CH_2 ✓ They are both saturated / idea that their carbon atoms are joined to each other by (only) single (covalent) bonds ✓	2	1.1	**ALLOW** have similar chemical properties **ALLOW** show trends in physical properties
	(b)	(i)	(Ethene) molecules have a (carbon to carbon) double bond / (Ethane) molecules do not have a (carbon to carbon) double bond or only have single bonds ✓	1	2.2	
		(ii)	 Single bond between the carbon atoms ✓ Single bonds to the side of each carbon atom ✓	2	2.1	

Question	Answer	Marks	AO element	Guidance
(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 how incomplete combustion of hydrocarbons such as propane happens. **AND** Describe the problems of incomplete combustion for campers, including a correct balanced symbol equation. *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 how incomplete combustion of hydrocarbons such as propane happens. **AND** Attempts to describe the problems of incomplete combustion for campers. **OR** Includes a correct balanced symbol equation. *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 how incomplete combustion of hydrocarbons such as propane happens. **OR** Attempts to describe the problems of incomplete combustion for campers. **OR** Attempts a correct balanced symbol equation. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.*	**6**	**2 x 1.1** **4 x 2.1**	**AO1.1 Knowledge and understanding of why incomplete combustion happens** • Insufficient oxygen / air • This can happen if there is not enough ventilation, such as in a caravan • Not enough oxygen / air for complete combustion **AO2.1 Application of knowledge and understanding of sources of CO and the associated problems** • Carbon monoxide gas is produced, which is toxic • Carbon monoxide combines with haemoglobin / red blood cells • So less oxygen can be carried / there is a lack of oxygen to cells • Can cause unconsciousness / death • Carbon particles / soot produced • Cause blackening of the inside of the caravan • Less energy produced so wastes camping gas / fuel • Takes longer to heat the caravan / to cook food **AO2.1 Application of knowledge and understanding to produce a balanced symbol equation** Eg $C_3H_8 + 3½O_2 \rightarrow 3CO + 4H_2O$ OR $C_3H_8 + 3O_2 \rightarrow 2CO + C + 4H_2O$ Other balanced equations are possible

Question			Answer	Marks	AO element	Guidance
			0 marks *No response or no response worthy of credit.*			

Question			Answer	Marks	AO element	Guidance
23	(a)		**Any three from:** (Metal wire is made of metal because) it is a good conductor (of electricity) ✓ it is flexible ✓ (Metal wire is coated with a polymer because) it is an insulator or poor conductor (of electricity) ✓ it is flexible ✓	3	3.2a	**IGNORE** references to other properties
	(b)		**Any one from:** Aluminium is higher in the reactivity series than carbon / aluminium is more reactive than carbon / ORA ✓ Carbon cannot displace aluminium (from bauxite) / bauxite cannot be reduced by carbon ✓	1	2.2	**Assume unqualified answers refer to aluminium** **IGNORE** aluminium is very reactive **Answers must be comparative** **ALLOW** bauxite does not react with carbon
	(c)	(i)	**Any two from:** Aluminium (metal) is sorted from other metals / materials ✓ Idea that aluminium/metal is shredded or crushed into smaller pieces ready for processing ✓ Idea that aluminium/metal is melted (by heating) ✓ Molten aluminium/metal is poured into moulds ✓	2	1.1	**DO NOT ALLOW** references to electrolysis **ALLOW** idea of cooling to form a solid (again)

Question			Answer	Marks	AO element	Guidance
		(ii)	**Any three from:** Idea that recycling aluminium saves energy (compared to extracting aluminium from bauxite) / ORA ✓ Idea that recycling makes more aluminium (than extraction from bauxite) ✓ Aluminium isn't wasted ✓ Use of data to back up either idea ✓ Idea of finite resource ✓ Idea of aluminium not being biodegradable, so recycling reduces landfill ✓ Idea that recycling aluminium produces less waste material (than extraction from bauxite) / ORA ✓ Idea that recycling aluminium produces less greenhouse gas emissions (than extraction from bauxite) / ORA ✓	3	3.2b	**IGNORE** just quoting numbers; answer must be comparative **IGNORE** references to cost **ALLOW** idea that recycling aluminium uses less raw materials

Question			Answer	Marks	AO element	Guidance
24	(a)		**Any two from:** Fertilisers increase crop yields ✓ Idea that growing populations mean that farmers need to grow more crops ✓ Idea that fertilisers provide essential elements for crops ✓ Idea that the quality of crops will be reduced without fertilisers ✓ Idea that fertilisers allow farmers to use the same land over and over again ✓	2	1.1	**IGNORE** just references to good / increased / faster growth **ALLOW** specific examples of essential elements, ie nitrogen / potassium / phosphorus **IGNORE** references to providing nutrients / minerals **ALLOW** specific example of reduced crop quality eg poor (root or fruit) growth / discoloured or yellow leaves etc **IGNORE** idea of controlling pests
	(b)		Sulfur (for sulfur trioxide) ✓ Air (for nitrogen) ✓	2	1.1	**IGNORE** sulfur dioxide
	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 120 (tonnes) award 3 marks** M_r of NH_3 = 17 **AND** M_r of NH_4NO_3 = 80 ✓ Mass of ammonium nitrate = $\frac{80}{17}$ x 25.5 / 1.5 x 80 ✓ = 120 (tonnes) ✓	3	2.1	**ALLOW** ECF from incorrect RMMs

Question			Answer	Marks	AO element	Guidance
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 10(g) award 2 marks** Actual mass = $\frac{80 \times 12.5}{100}$ ✓ = 10 (g) ✓	**2**	**1.2** **2.2**	**ALLOW** % yield = (am ÷ pm) x 100 **OR** 80 = (am ÷ 12.5) x 100 for 1 mark if no other mark awarded

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