OCR
Oxford Cambridge and RSA

GCSE (9-1)

Chemistry A (Gateway)

Unit **J248F/02**: Foundation Tier – Paper 2

General Certificate of Secondary Education

Mark Scheme for June 2018

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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			D ✓	1	1.2	
2			A ✓	1	1.2	
3			A ✓	1	1.1	
4			C ✓	1	2.1	
5			D ✓	1	2.2	
6			D ✓	1	2.1	
7			A ✓	1	1.2	
8			C ✓	1	2.1	
9			C ✓	1	1.1	
10			**Award all candidates 1 mark ✓**	1	2.2	
11			B ✓	1	2.1	
12			B ✓	1	1.1	
13			A ✓	1	1.1	
14			D ✓	1	1.1	
15			C ✓	1	2.1	

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 / F_2 ✓	1	1.1	
	(b)	(i)	Solid ✓	1	2.1	
		(ii)	Any value in range 273 – 333 (°C) ✓	1	2.1	Unit not needed
	(c)	(i)	Sodium chloride ✓	1	2.1	**DO NOT ALLOW** sodium chlorine, but ignore other spelling errors **IGNORE** NaCl
		(ii)	2Na + Cl_2 → 2 NaCl Formulae ✓ Balancing ✓	2	2 x 2.2	**ALLOW** any correct multiple, including fractions **ALLOW** = / ⇌ instead of → **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 e.g 2Na + CL2 → 2 NACl
17	(a)		No magnesium was left (at the end of the reaction) / the magnesium was used up first ✓	1	3.1a	**ALLOW** the magnesium disappeared / all reacted/ dissolved / only the acid was left **IGNORE** All absorbed
	(b)		No more (hydrogen) gas is given off / idea that the reaction stop fizzing ✓	1	3.1a	**ALLOW** pH arguments

Question			Answer	Marks	AO element	Guidance
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 83.2(%) award 3 marks** (7.9 ÷ 9.5) × 100 **OR** (am÷pm) x 100✓ 83.15789…. ✓ 83.2 (3 sig figs) ✓	**3**	1.2 2 x 2.2	**ALLOW MAX** 2 marks for working if 83 / 83.1 / 83.15 / 83.157 / 83.158 / 83.16 etc (incorrect rounding or incorrect sig.figs.)
	(d)		Solution left in beaker/ Spitting (of solution) during evaporation ✓	**1**	3.1b	impurities / not all transferred IGNORE unspecified 'loss'
18	(a)		$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$ Formulae ✓ Balancing ✓	**2**	2 x 2.2	**ALLOW** any correct multiple, including fractions **ALLOW** = / ⇌ instead of → **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 e.g $CACO_3 + 2HCL \rightarrow CaCl2 + H_2O + CO2$
	(b)	(i)	48 (cm^3) ✓	**1**	2.2	
		(ii)	All points plotted correctly ✓ Line of best fit through the points ✓	**2**	2 x 2.2	**ALLOW** Points plotted to within ±2 cm^3 and ±0.1 minutes **DO NOT ALLOW** dot to dot **DO NOT ALLOW** line above 74 cm^3
		(iii)	(Graph) levels off at lower volume of gas / Gives off less carbon dioxide ✓	**1**	2.2	**Assume unqualified answer refers to tablet X** **ALLOW** ora for specific reference to tablet **Y** Eg **Y** gives more gas **IGNORE** references to rate / time / steepness **Answer must be a comparison, not just a statement of results** Because X **only** goes to 48 **but** Y goes to 72 = 1 Because X goes to 48 **and** Y goes to 72 = 0

Question			Answer	Marks	AO element	Guidance
	(c)		**ANY FOUR FROM:** **More concentrated acid:** • idea of more crowded acid particles / more acid particles in same volume ✓ • idea of increased collisions (frequency / chance of collision) between acid and calcium carbonate ✓ **Increasing the temperature of the acid:** • idea that (particles) move faster / (particles) have more energy ✓ • idea of increased collisions (frequency / chance of collision) between acid and calcium carbonate ✓ • idea of more successful collisions / collisions between marble chips and acid are more energetic ✓	**4**	2 x 1.2 2 x 2.2	**IGNORE** 'more particles', more surface area **IGNORE** references to 'faster' collisions **ALLOW** 'more collisions' for one of the responses **ALLOW** More excited /move More energy to the reaction **IGNORE** references to 'faster' collisions **DOESN'T SPECIFY CONCN OR TEMP** eg 'more energy so more collisions' 1 mark for 'more collisions' as it is true for both. (Many think increasing concn increases energy)
19	**(a)**		(Reaction) goes both ways / Idea that reactants react to make products and products reform reactants ✓	**1**	1.1	**ALLOW** goes back to the start / to its original state **IGNORE** you can separate them
	(b)	**(i)**	Increases / AW ✓	**1**	2.1	
		(ii)	350°C **AND** 50 atmospheres / 400°C **AND** 80 atmospheres / 450°C **AND** 130 atmospheres ✓	**1**	2.1	**Both required for mark**

Question			Answer	Marks	AO element	Guidance
20	(a)		**ANY TWO FROM:** use of a flame test wire / splint / spatula (to hold the material)✓ place in flame ✓ **AND ONE FROM:** dip wire / splint in sample / sample onto rod (solution or solid) ✓ use blue flame ✓ (look for flame) colour / red flame ✓	**3**	3 x 1.2	**All marks can be awarded from a labelled diagram** **ALLOW** glass rod / metal rod **DO NOT ALLOW** incorrect use of splint, e.g. lighted splint **ALLOW** spray chemical use a spray **ALLOW** into flame (spray) into flame **ALLOW** burn it [as 'place in the flame']

Question			Answer	Marks	AO element	Guidance
20	(b)*		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)** Clearly explains if the student is correct by analysing the results to correctly identify all the ions present in solid X, with a correct explanation of all the observations. *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)** Explains if the student is correct by analysing the results to correctly identify the presence or absence of several ions in solid X, **but** explanation of observations is incomplete. *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)** Analyses results to correctly identify the presence of one ion in solid X, with some level of explanation. *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 1.2 4 x 3.2b	**AO1.2 Demonstrates knowledge and understanding of methods of testing for ions** • Red flame in flame test indicates Li^+ / lithium ions • Sodium hydroxide tests for metal ions • Silver nitrate tests for halide ions • Barium chloride tests for sulfate ions **AO3.2b Analyses information to draw conclusions about the ions** • Solid **X** contains Li^+ / lithium ions as red flame seen • Solid **X** contains Zn^{2+} / zinc ions as a white precipitate forms with sodium hydroxide, which re-dissolves in excess sodium hydroxide (**ACCEPT** Al / Pb etc) • Solid **X** contains Cl^- / chloride ions as a white precipitate forms with silver nitrate • Solid **X** does not contain SO_4^{2-} / sulfate ions as a white precipitate does not form with barium chloride

Question			Answer	Marks	AO element	Guidance
21	(a)		**ANY FOUR FROM:** Do a trial run/titration ✓ To get a general idea of the end point ✓ Add the sulfuric acid dropwise (towards the endpoint) ✓ As indicator should change colour on addition of one drop (of acid) ✓ Swirl the flask during the addition of sulfuric acid ✓ To ensure mixing of acid and alkali ✓	**4**	4 x 3.3b	**Explanation must match the experimental improvement** **ALLOW** repeat the titration as BOD **ALLOW** sensible suggestions not covered by the mark scheme
	(b)		Correct selection of results from titrations 2, 3 & 4 / the first value (26.4) is the outlier✓ (25.2 + 25.6 + 25.4) ÷ 3 ✓	**2**	2 x 2.2	**ALLOW** 1 mark ECF if calculation for overall mean ie (26.4 + 25.2 + 25.6 + 25.4) / 4 [=102.6/4=25.65]
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 79.8(%) award 3 marks** atom economy = $\frac{142}{178}$ x 100 ✓ Atom economy = 79.775…. ✓ Atom economy = 79.8 (%) (1 decimal place) ✓	**3**	2.2 2.2 1.2	**ALLOW ECF** for 1 decimal place **if** a candidate's (incorrect) calculation should give as result which has to be rounded down to one decimal place.
22	(a)		Gr'house gases such as carbon dioxide and **<u>methane</u>** absorb **<u>infrared</u>** radiation radiated by the **<u>Earth's</u>** surface, then emit it in all directions. This greenhouse effect keeps the Earth and its atmosphere **<u>warm</u>** enough for living things to exist. **ALL FOUR CORRECT = 2 MARKS** **THREE OR TWO CORRECT = 1 MARK**	**2**	2 x 1.1	

Question			Answer	Marks	AO element	Guidance
	(b)		**ANY TWO FROM:** Idea of reducing consumption of fossil fuels / use of alternative fuels (eg biofuels) ✓ Idea of using renewable energy resources (eg wind / solar energy) ✓ Idea of using carbon capture / stopping carbon dioxide escaping when fuels are used ✓ Reduce emissions of other greenhouse gases, eg methane from agriculture	**2**	2 x 1.1	**ALLOW ANY VALID ANSWER NOT ON THE MARK SCHEME** **ALLOW** 'electric cars' is the first marking point **ALLOW** 'plant more' as the third marking point
23	**(a)**		Brass – **copper and zinc** ✓ Bronze – **copper and tin** ✓ Duralumin – **aluminium and copper** ✓	**3**	3 x 1.1	
	(b)		Solder has a lower melting point (than copper or lead) ✓ Solder is quite hard (whereas copper & tin are soft) ✓	**2**	2 x 2.1	**IGNORE references to density**
	(c)		iron + oxygen + water → hydrated iron(III) oxide Reactants ✓ Product ✓	**2**	2 x 1.1	**ALLOW 'air' instead of oxygen** **ALLOW** hydrated iron oxide **ALLOW** Iron hydroxide **DO NOT ALLOW** iron(III) oxide / iron oxide

Question			Answer	Marks	AO element	Guidance
	(d)	(i)	**ANY TWO FROM:** zinc (acts as a barrier) to prevent water / oxygen / air reaching / reacting (with the iron) ✓ zinc reacts instead of iron / zinc reacts first / zinc is more reactive / ora ✓ detail - zinc acts as a sacrificial metal / loses electrons more easily (than iron) / ora ✓	**2**	2 x 1.1	**IGNORE** 'Protects the iron' This is insufficient**,** too close to stem, there must be some indication of what the barrier is against **IGNORE** zinc rusting
		(ii)	Idea that tin won't prevent rusting when scratched ✓	**1**	1.1	Must be a disadvantage of Sn, not an advantage of Zn **IGNORE** tin scratches (more) easily

Question			Answer	Marks	AO element	Guidance
24	(a)		(Electric car) uses Less energy (needed to make it) ✓ Causes less global warming / less greenhouse gases produced ✓ Causes less ozone ✓	3	3 x 3.1b	**IGNORE** just a restatement of the data; must be a comparison **IGNORE** references to carbon footprint **DO NOT ALLOW** eg less greenhouses gases so less acid rain **ALLOW** less water pollution **than** (making) **a diesel car** / produces the second least water pollution **IGNORE** less (water) pollution
	(b)		**MAX TWO FROM:** Idea that (fractionating) column has a temperature gradient ✓ Idea that crude oil contains a range of molecular sizes ✓ Idea that molecules or fractions or hydrocarbons or alkanes have different boiling points ✓ Idea that molecules or fractions or hydrocarbons or alkanes condense at different levels (in the fractionating column) ✓ **PLUS** **AT LEAST ONE FROM:** Larger molecules have higher boiling points / ORA ✓	3	3 x 1.1	**DO NOT ALLOW** just idea that molecules or fractions have different **melting** points **NB This marking point gains TWO MARKS as it also includes M3 above** **ALLOW** longer chains molecules for larger molecules

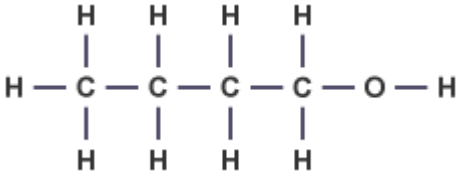
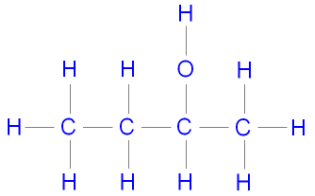
Question			Answer	Marks	AO element	Guidance
						ALLOW bitumen or fuel oil as a named large molecule / LPG or petrol as a named small molecule
			Intermolecular forces between larger molecules are strong(er) / ORA / larger molecules have more intermolecular forces / ORA✓			**ALLOW** bonds between molecules for forces between molecules
			The stronger the intermolecular forces the higher the boiling point or more energy is required to break these forces / ORA ✓			**ALLOW** heat for energy
			During boiling intermolecular forces are broken ✓			**BUT** the larger the molecule the stronger the intermolecular forces therefore the higher the boiling point **scores** 3 / ORA

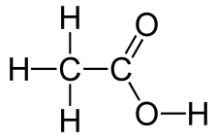
Question			Answer	Marks	AO element	Guidance
	(c)		**A** ✓	**2**	3.2b	**Second mark is dependent on correct choice of A** **ALLOW** -2(°C)
			Idea that (LPG fraction) has the lowest boiling point ✓		1.1	**ALLOW** A / LPG is a gas at room temperature **ALLOW** idea that LPG is collected at the top of the tower so must have the lowest (boiling) temperature **IGNORE** just quoting data from the table
	(d)		**ANY TWO Advantages of fuel cell:** Refuelling time (for a fuel cell) is less / ORA ✓ Fuel cell emits less CO_2 / ORA ✓ Mass (of car) is less (with fuel cell) / ORA ✓ **AND** **Disadvantage of fuel cell:** Cost of refuelling is more / ORA ✓	**3**	3 x 3.1b	**Assume unqualified answer refers to fuel cell** **IGNORE** just a restatement of the data; must be a **comparison** **ALLOW** fuel cell takes 356 minutes less to refuel / ORA **ALLOW** fuel cell **only** takes 4 minutes to refuel **ALLOW** fuel cell emits 12kg less CO_2 / ORA **ALLOW** fuel cell **only** emits 36 kg CO_2 **ALLOW** mass of car with fuel cell is 350(kg) less than electric car / ORA **ALLOW** mass of car with fuel cell is **only** 1200(kg) **IGNORE** electric car is faster **ALLOW** cost of refuelling car with fuel cell is £1 more than an electric car / ORA **ALLOW** cost of refuelling electric car is **only** £3.20 **ALLOW** costs more to run

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>25</td><td>(a)</td><td></td><td>All points plotted correctly scores 2 marks ✓✓

Straight line of best fit through the points ✓</td><td>3</td><td>3 x 2.1</td><td>ALLOW ± ½ square
3 or 4 points plotted correctly scores 1 mark

ALLOW correctly drawn line of best fine through incorrectly plotted points; this may be a curve

<table>
<tr><th>Name</th><th>Number of carbon atoms</th><th>Boiling point (°C)</th></tr>
<tr><td>methanol</td><td>1</td><td>65</td></tr>
<tr><td>ethanol</td><td>2</td><td>79</td></tr>
<tr><td>propanol</td><td>3</td><td>97</td></tr>
<tr><td>pentanol</td><td>5</td><td>138</td></tr>
<tr><td>hexanol</td><td>6</td><td>156</td></tr>
</table>
</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Answer ± 2°C of their own graph ✓</td><td>1</td><td>2.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>  ✓</td><td>1</td><td>2.1</td><td>ALLOW diagram with –OH
BUT DO NOT ALLOW -HO
ALLOW diagram showing butan-2-ol
eg
  </td></tr>
<tr><td></td><td>(c)</td><td></td><td>-OH ✓</td><td>1</td><td>1.1</td><td>ALLOW hydroxy / hydroxyl</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
	(d)		CH_3COOH ✓	1	2.2	**ALLOW** $C_2H_4O_2$ **ALLOW** displayed formula, ie  **DO NOT ALLOW** CH^3COOH / CH3COOH

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