GCSE MARKING SCHEME

SUMMER 2018

GCSE
CHEMISTRY – COMPONENT 2

C410U20-1
C410UB0-1

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INTRODUCTION

This marking scheme was used by WJEC for the 2018 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

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GCSE CHEMISTRY COMPONENT 2: Applications in Chemistry

MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statements.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao	=	correct answer only
ecf	=	error carried forward
bod	=	benefit of doubt

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Foundation Tier Section A

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			**A** **F** **E** award (2) for all **three** correct award (1) for any **one** correct	2			2		2
	(b)			filtration (1) distillation (1) evaporation / crystallisation (1)	3			3		3
				Question 1 total	**5**	**0**	**0**	**5**	**0**	**5**

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<table>
<tr><th colspan="4">Question</th><th>Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th colspan="4"></th><th></th><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td></td><td>X oxygen / O_2 / O (1)
Y hydrogen / H_2 / H (1)</td><td></td><td>2</td><td></td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td><table><tr><th>Gas</th><th>Test they would carry out</th><th>Expected observation</th></tr><tr><td>carbon dioxide</td><td>bubble into / add limewater (1)</td><td></td></tr><tr><td>ammonia</td><td></td><td>goes blue (1)</td></tr></table></td><td>2</td><td></td><td></td><td>2</td><td></td><td>2</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>carbon dioxide B (1)
ammonia D (1)</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 2 total</td><td>2</td><td>4</td><td>0</td><td>6</td><td>0</td><td>4</td></tr>
</table>

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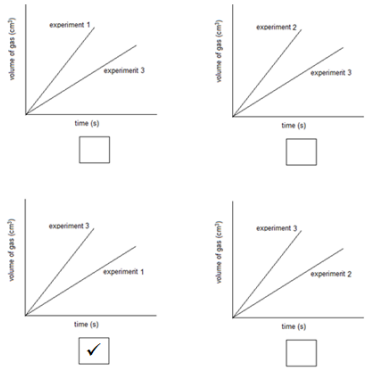
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		experiments 1 and 2 (1) award (1) for either of following increasing the concentration decreases the time taken decreasing the concentration increases the time taken accept reference to **rate** e.g. increasing the concentration increases the rate decreasing the concentration decreases the rate ignore any reference to temperature – neutral answer			2	2		2
		(ii)		mass / amount (1) particle size (e.g. use chips of same size) / surface area (1)	2			2		2
		(iii)		 (1)			1	1	1	1

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			any **two** of following for (1) each • no gas can escape / all the gas will be collected • readings are more precise / more accurate • easier to read the scale on the syringe / no bubbles to interfere with reading • carbon dioxide will not dissolve in water			2	2		2
	(c)	(i)		mass decreases / goes down (1) because gas escapes / leaves the flask (1)	2			2		2
		(ii)		award (1) for any of following • records continually • records automatically • records at exactly the right time • saves data • generates graph any reference to accuracy needs qualification human error – neutral answer	1			1		1
				Question 3 total	**5**	**0**	**5**	**10**	**1**	**10**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		copper(II) oxide / CuO / 2CuO (1) loses oxygen / has oxygen taken away (1) do not accept 'loses oxide' carbon more reactive than copper – neutral answer marking points are **not** linked so second mark to be awarded when 'copper' is named	2			2		2
		(ii)		<table><tr><td>copper and magnesium oxide</td><td></td></tr><tr><td>carbon and aluminium oxide</td><td></td></tr><tr><td>carbon and iron oxide</td><td>✓</td></tr><tr><td>gold and copper oxide</td><td></td></tr><tr><td>magnesium and copper oxide</td><td>✓</td></tr></table> award (1) for each correct answer award (1) if **two** correct and **one** incorrect box ticked		2		2		2

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			79.9 / 79.87 % (2) if incorrect award (1) for M_r (Cu_2S) = 159 greater percentage of metal by mass than in haematite (and sphalerite) but less than in galena (1) ecf possible if incorrect percentage calculated sensible calculation required for final mark to be awarded		2	1	3	2	
				Question 4 total	**2**	**4**	**1**	**7**	**2**	**4**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		<table><tr><td>1</td><td>0.08</td><td>0.10</td><td>0.06</td><td>0.08</td></tr><tr><td>2</td><td>0.14</td><td>0.15</td><td>0.16</td><td>0.15</td></tr><tr><td>3</td><td>0.25</td><td>0.23</td><td>0.27</td><td>0.25</td></tr><tr><td>4</td><td>0.39</td><td>0.31</td><td>0.33</td><td>0.32</td></tr><tr><td>5</td><td>0.40</td><td>0.38</td><td>0.33</td><td>0.39</td></tr></table> **both** needed for (1)		1		1		1
		(ii)		award (1) for any of following • most consistent results • smallest variation • smallest range • all measurements within the smallest range • all results closest to the mean		1		1		1

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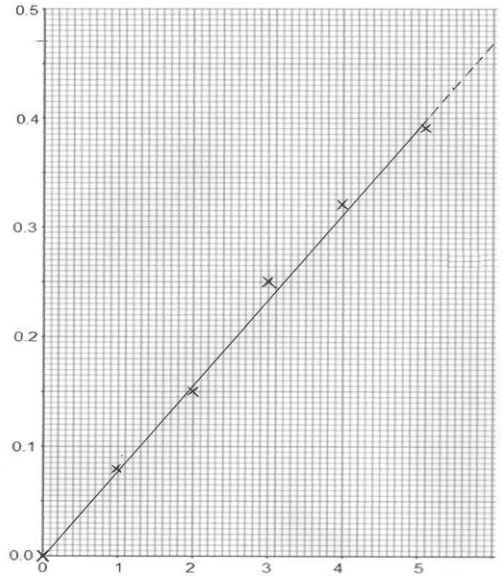
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		 all points plotted correctly (2) tolerance ±½ square any 3/4 points plotted correctly (1) straight line through origin (by eye) (1) do not accept 'point to point' line		3		3	3	3
		(iv)	I	0.195 accept 0.20 ecf possible from incorrect graph		1		1	1	1
			II	any answer in the range 0.46-0.48 (accept with or without working on graph) ecf possible from incorrect graph			1	1	1	1

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<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>award (1) for any of following
some of the silver left on the rod
some of the silver left in the beaker
some of the silver left on the filter paper

'not all collected' – neutral answer</td><td></td><td></td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>the silver was not dried / was still wet</td><td></td><td></td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td></td><td><table><tr><th>Variable</th><th>Description</th></tr><tr><td>independent variable</td><td>length of copper rod</td></tr><tr><td>dependent variable</td><td>mass of silver deposited</td></tr></table>
both needed for (1)</td><td></td><td></td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>award (1) for any of following
• time
• volume of silver nitrate (solution)
• concentration of silver nitrate (solution)
• temperature
• diameter of rod / circumference of rod</td><td></td><td></td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 5 total</td><td>0</td><td>6</td><td>5</td><td>11</td><td>5</td><td>11</td></tr>
</table>

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**Indicative content** ***AO1 allocation*** flame test – gives a yellow flame / same colour for all solutions add hydrochloric acid – gives a reaction / produces carbon dioxide with the carbonate add silver nitrate solution – gives a cream precipitate with the bromide add sodium hydroxide – no observation for any of the solutions ***AO2 allocation*** no one test can be used to identify all three neither the flame test nor the sodium hydroxide test is effective carbonate identified by the hydrochloric acid bromide by the silver nitrate sulfate identified by a process of elimination	4	2		6		2
				5-6 marks Identification of two tests as useful and two as not; correct observations and conclusions *There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.* **3-4 marks** Identification of one test as useful test and one as not; some correct observations and conclusions *There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.* **1-2 marks** Appropriate comment on one test with observation / conclusion *There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure*. *The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.* **0 marks** *No attempt made or no response worthy of credit.*						
				Question 6 total	**4**	**2**	**0**	**6**	**0**	**2**

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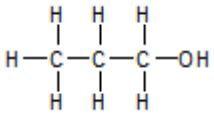
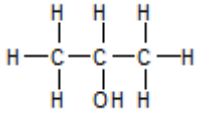
Foundation Tier Section B / Higher Tier Section A

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7/**1**	(a)			—OH / hydroxyl		1		1		
	(b)			  (1) C_3H_7OH / C_3H_8O (1) ecf possible from incorrect displayed formula	1	1		2		
	(c)			350 million barrels is 57 % of total world production (1) total world production $\frac{100}{57}$ × 350 million = 614 million barrels (1) Brazil production $\frac{27}{100}$ × 614 million barrels 166 million barrels (1) accept any value from 165-168 million		3		3	2	

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			heat has been lost to the environment (1) award (1) for any of following • use a draft excluder • use a calorimeter / copper can • insulate the flask			2	2		2
	(e)			in general, the energy content increases as the C:H ratio decreases (1) ethanol does not fit this trend (as its energy content is lower than coal/petroleum) (1) hydrogen cannot be included in this trend as it has no carbon present (1)			3	3		

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(f)			evidence to agree with statement • hydrogen has a higher energy content (than ethanol) (1) • hydrogen does not produce CO_2 so will not contribute to the greenhouse effect / global warming (as ethanol does) (1) evidence to disagree with statement • hydrogen requires specialist fuel cell technology (but ethanol can be used in traditional petrol engines with minimal conversion) (1) • hydrogen costs a lot to more to produce (than ethanol) / ethanol can be produced from crops (1) • hydrogen is a gas – collection / storage / transport is more difficult (than it is for ethanol) (1) • hydrogen requires a lot of infrastructure investment / does not have fuelling stations available at the moment (but ethanol can be sold in traditional petrol stations) (1) comparison can be inferred – direct reference to both hydrogen and ethanol is **not** required award max (2) for advantages and max (2) for disadvantages	2	2		4		
				Question 7/1 total	**3**	**7**	**5**	**15**	**2**	**2**

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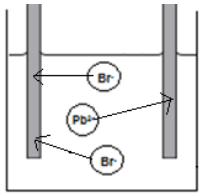
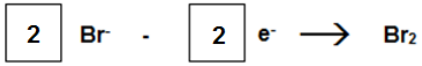
Higher Tier Section B

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		so that the ions (are free to) move	1			1		1
		(ii)		 arrows showing all ions correctly moving to the correct electrode accept arrow on just one bromide ion	1			1		1
		(iii)		 Both numbers correct for 1 mark		1		1		

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		as time increases, the mass of lead formed increases (1) there is a linear relationship / it increases in regular intervals each minute (1) award (2) for time and mass are directly proportional			2	2		2
		(ii)		weigh the electrode at start and finish (1) calculate the difference / increase (in mass) (1) award max (1) for 'scrape off and weigh' ignore any reference to cooling – neutral			2	2		2
				Question 2 total	**2**	**1**	**4**	**7**	**0**	**6**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			graph with smaller gradient but still increasing **or** finished at 100cm^3 of gas (1) rate of reaction is lower / reaction not as fast **because** particles have less (kinetic) energy (1) award (1) for either of following • lower **chance** / **frequency** of successful collisions • fewer particles overcome activation energy	2	1		3	1	3
	(b)			0.0084g / 0.00834g of hydrogen gas formed (2) if incorrect award (1) for 0.0042 / 0.00417 mol of hydrogen gas the change would be too small to measure using the balance / balance is not to enough decimal places / balance is not precise enough (1) reference to 'accuracy' requires explanation		2	1	3	2	3
				Question 3 total	**2**	**3**	**1**	**6**	**3**	**6**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			add each halogen to the solutions of the other halides (1) award (1) each for up to **two** of following • chlorine displaces both bromine (from bromide) and iodine (from iodide) • iodine doesn't displace either of the others • bromide displaces iodine (from iodide) but not chlorine (from chloride) chlorine more reactive than bromine and bromine more reactive than iodine (1) displace ≡ react ≡ change colour	4			4		4
	(b)			the halogens all need to gain one electron to make outer shell full (1) the further the outer shell from the nucleus, the more difficult it is to gain one electron / the smaller the atom, the stronger the attractive force (1)	2			2		
				Question 4 total	**6**	**0**	**0**	**6**	**0**	**4**

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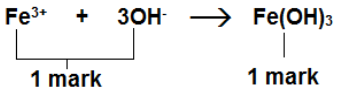
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			add sodium hydroxide (solution) (1) Fe^{3+} ions give a brown **precipitate** / **solid** (1) do **not** award credit without reference to sodium hydroxide do **not** award credit without reference to precipitate or solid  correct left hand side (1) correct product (1) ignore state symbols	2	2		4		4
	(b)			add barium chloride (solution) (1) produces a white precipitate / solid (1) do **not** award credit without reference to barium chloride barium sulfate and iron(III) chloride formed – both needed (1) do **not** accept iron chloride / iron(II) chloride	2	1		3		3
				Question 5 total	**4**	**3**	**0**	**7**	**0**	**7**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		mass of Na = 1.61g mass of O = 0.37g (1) moles Na = $\frac{1.61}{23}$ / 0.07 moles O = $\frac{0.37}{16}$ / 0.023 (1) ratio of 3:1 therefore simplest formula is Na_3O (1) award max (1) for correct answer with no working		3		3	3	3
		(ii)		get another group/person to carry out the same experiment / compare the results of another group (1) repeat the experiment – neutral answer but allows access to second mark if the experiment is reproducible the results/calculation would be similar / same (1) 'same pattern in results' is too vague – neutral answer	2			2		2
	(b)			award (1) each for any **two** of following • sodium not completely oxidised / not enough oxygen • sodium was already oxidised / not pure • other products formed / side reactions taking place • insufficient time			2	2		2
				Question 6 total	**2**	**3**	**2**	**7**	**3**	**7**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			**Indicative content** reactions both produce salt + water + carbon dioxide reactions are both exothermic reactions of strong acid (hydrochloric acid) is faster and more exothermic than weak acid (ethanoic acid) hydrochloric acid has more dissociation of H^+ ions than ethanoic acid products of both reactions word equations symbol equations	4	2		6		6

5-6 marks
Similarities and difference given; strong and weak acids in terms of dissociation; products named and good attempt at symbol equations
There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

3-4 marks
Similarities given; recognition of strong and weak acids; some products named and good attempt at word equations
There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

1-2 marks
Simple description of acid/carbonate reactions or give the names of the products formed.
There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure.
The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar.

0 marks
No attempt made or no response worthy of credit.

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		mean volume of sodium hydroxide = 25/25.0 cm^3 (1) do **not** credit 25.46 cm^3 ecf possible number of moles NaOH = 0.20 × 25/1000 = 0.005 mol (1) (credit 0.0051 mol if ecf from 25.46 cm^3) number of moles of ethanoic acid = 0.005 mol (1) (0.0051 mol ecf) conc^n of ethanoic acid = 0.005 ÷ 20/1000 = 0.25 mol/dm^3 (1) (0.255 mol/dm^3 ecf) accept alternative method		3	1	4	3	4
		(ii)		$M_r(CH_3COOH)$ = 60 (1) mass of CH_3COOH in 1 dm^3 = (0.25 × 60) = 15 g mass of CH_3COOH in 100 cm^3 = 1.5 g therefore **label is correct** (1) accept alternative method using number of moles do **not** credit random guess at label being correct		2		2	2	2
				Question 7 total	**4**	**7**	**1**	**6**	**5**	**12**

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FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	0	0	5	0	5
2	2	4	0	6	0	4
3	5	0	5	10	1	10
4	2	4	1	7	2	4
5	0	6	5	11	5	11
6	4	2	0	6	0	2
7	3	7	5	15	2	2
TOTAL	21	23	16	60	10	38

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HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	3	7	5	15	2	2
2	2	1	4	7	0	6
3	2	3	1	6	3	6
4	6	0	0	6	0	4
5	4	3	0	7	0	7
6	2	3	2	7	3	7
7	4	7	1	6	5	12
TOTAL	23	24	13	60	13	44

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