GCSE MARKING SCHEME

SUMMER 2019

GCSE (NEW)
CHEMISTRY - UNIT 2

3410U20-1
3410UB0-1

INTRODUCTION

This marking scheme was used by WJEC for the 2019 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.

GCSE CHEMISTRY UNIT 2 – CHEMICAL BONDING, APPLICATION OF CHEMICAL REACTIONS AND ORGANIC CHEMISTRY

MARK SCHEME

GENERAL INSTRUCTIONS

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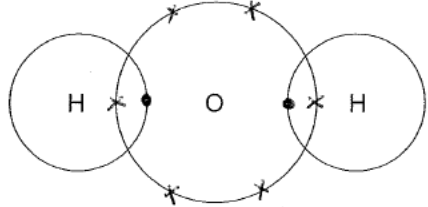
cao	=	correct answer only
ecf	=	error carried forward
bod	=	benefit of doubt

Foundation Tier only questions

Question				Marking details	AO1	AO2	AO3	Total	Maths	Prac
1	*(a)*			(baby bath) thermometer thermochromic pigment nappies hydrogel award (2) for all four correct award (1) for any two correct	2			2		
	(b)				2			2		
				Question 1 total	**4**	**0**	**0**	**4**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*			cryolite (1) (molten) aluminium (1) positive (1) bauxite (1) electrical (1)	5			5		
	(b)			$2Al_2O_3 \rightarrow$ **4**Al + $3O_2$		1		1		
	(c)			78 (2) if answer incorrect award (1) for $\frac{195}{250}$		2		2	2	
	(d)			The energy used to extract metals is greater than that used in recycling them ☐ The difference between the energy used to extract and the energy used to recycle is the greatest ✓ The energy used in recycling is less than for copper but greater than for steel ☐			1	1		
				Question 2 total	5	3	1	9	2	0

3

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)	oxygen accept O_2 / O	1			1		
		(ii)	speeds up the reaction	1			1		
		(iii)	water accept H_2O	1			1		
		(iv)	$2SO_2 + O_2 \rightleftharpoons \mathbf{2SO_3}$ award (1) for product award (1) for balancing **only** if product is correct		2		2	1	
	(b)		9 (2) if answer incorrect award (1) for 91 ECF possible from addition error		2		2	2	
	(c)		ammonia accept NH_3 / ammonium hydroxide do **not** accept ammonium		1		1	1	
			Question 3 total	**3**	**5**	**0**	**8**	**4**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*	(i)	award (1) for two shared pairs of electrons award (1) for complete octet in oxygen		2		2		
		(ii)	poor conductor of electricity ☐ colourless ☐ good conductor of heat ☐ low melting point and boiling point ✓	1			1		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
(b)	(i)	I	all points plotted correctly (1) tolerance ± ½ small square straight line passing through all points (1) do not penalise missing label		2		2	2	
		II	straight line passing through (0,0) and (10,25) do not penalise missing label			1	1	1	
		III	volume of hydrogen is double / twice the volume of oxygen (2) award (1) for either of following • as the volume of oxygen increases the volume of hydrogen increases • reading from graph given e.g. 50cm^3 of hydrogen formed with 25cm^3 of oxygen			2	2	2	2
	(ii)		**D**			1	1		
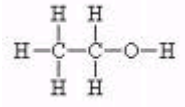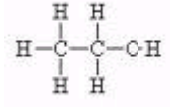
Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
(c)	(i)		plastics are (electrical) insulators / do not conduct (electricity)	1			1		2
	(ii)		it is negatively charged / it is the cathode (1) accept negative opposite charges attract / positive ions are attracted to negative electrode (1) neutral answer - it is attracted	2			2		2
	(iii)		$2Ag^+ + 2e^- \longrightarrow Ag$ ☐ $Ag^+ + e^- \longrightarrow Ag$ ✓ $Ag^+ - e^- \longrightarrow Ag$ ☐ $Ag^+ + 2e^- \longrightarrow Ag$ ☐		1		1		
			Question 4 total	4	5	4	13	5	6

7

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)	NaCl + AgNO$_3$ → **NaNO$_3$** + **AgCl**		1		1		1
		(ii)	silver is more dense than sodium ☐ silver chloride is soluble ☐ silver chloride is insoluble ✓ silver is below sodium in the reactivity series ☐	1			1		1
		(iii)	filtration accept filter / filtering / decanting	1			1		1
	(b)		170 (2) if answer incorrect award (1) for 108 + 14 + (3 × 16)		2		2	2	
	(c)		39.3 (2) if answer incorrect award (1) for $\frac{23}{58.5}$ / 39.316 / 39.32 / 39		2		2	2	
			Question 5 total	**2**	**5**	**0**	**7**	**4**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*			**Indicative content** **Advantages (relevant to context)** mouldable light transparent thermal insulator easily coloured non-toxic doesn't break / durable / tough waterproof **Disadvantages (relevant to context)** non-biodegradable relies on crude oil / non-renewable raw material difficult to dispose of / causes litter / pollutes rivers / pollutes sea need for landfill sites / burning forms toxic gases not all can be recycled softens / melts when holding hot food Do **not** credit irrelevant properties e.g. good electrical insulator	3	3		6		

5-6 marks
Several advantages described; ideas linked in description of disadvantages showing understanding of environmental issues
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
Reference to two advantages and knowledge of environmental concerns over waste plastic
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
Reference to any advantage and disadvantage
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			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
(b)	(i)		less than 10 mm ☐ between 5 mm and 10 nm ✓ greater than 5 mm and less than 10 nm ☐ between 5 mm and 10 mm ☐	1			1		
	(ii)		plastic production has remained constant ✓ plastic production has increased ☐ plastic production has decreased ☐			1	1		
	(iii)		rayon			1	1		
	(iv)		the quantity of microplastics found in the Earth's oceans is increasing ☐ microplastics carry contaminants from sea water into animals ☐ microplastics cause tissue damage in marine animals ✓ microplastics are a greater problem near land than in deep water ☐			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(v)		any sensible media platform e.g. • TV • newspapers • websites • radio • posters • social media • teachers / schools			1	1		
				Question 6 total	**4**	**3**	**4**	**11**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			CH_3OH (1) accept CH_4O (1) propanol / propan-1-ol (1) do **not** accept: propan-2-ol	3			3		
	(b)	(i)		 award (1) for formula award (1) for balancing **only** if formula is correct		2		2		2
		(ii)		it is not used up / it doesn't change (in the reaction)	1			1		1

12

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			award (1) for any advantage and explanation • less carbon dioxide per 1 dm³ burned - lower contribution to global warming • cleaner - less soot / less toxic fumes • renewable source - less reliant on fossil fuel / will never run out / obtained from crops annually accept other sensible answers award (1) for any disadvantage and explanation • sugar cane grown to make fuel - less food / more expensive food • land used to grow sugar cane - habitat destruction / deforestation • less energy released per 1dm³ burned - more needed to do same mileage / more CO_2 released to get same energy accept other sensible answers award (1) for advantage and disadvantage with no explanation			2	2		
				Question 7 total	**4**	**2**	**2**	**8**	**0**	**3**

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Common questions
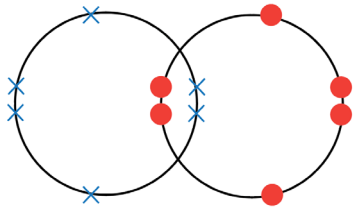
Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
8/1	(a)	(i)	6.5		1		1	1	1
		(ii)	1365 (2) if answer incorrect award (1) for 50 × 4.2 × 6.5 ECF possible from incorrect temperature rise		2		2	2	2
		(iii)	21.5 - it has returned to initial / room temperature **both** needed			1	1		
	(b)		all points plotted correctly (1) tolerance ± ½ small square smooth line passing through the points (1)		1	1	2	2	2
	(c)		hydrochloric acid - greater temperature rise **both** needed			1	1		1
	(d)	(i)	award (1) for either of following • heat still lost (to the surroundings) • wouldn't stop heat being lost (to the surroundings) neutral answer - no lid used			1	1		1
		(ii)	award (1) for any of following • lid • stacked polystyrene cups • lag the polystyrene cup			1	1		1
			Question 8/1 total	**0**	**4**	**5**	**9**	**5**	**8**

14

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/2	*(a)*	(i)		award (1) for either of following magnesium oxide magnesium hydroxide accept MgO / Mg(OH)$_2$ do **not** accept magnesium / magnesium carbonate		1		1		1

		(ii)		**B** copper(II) chloride / copper chloride (1)
				       accept CuCl$_2$
				
				C carbon dioxide (1)
				       accept CO$_2$
						2		2		2

	(b)			Zn + 2HCl → ZnCl$_2$ + H$_2$ award (1) for products award (1) for balancing only if all reactants and products correct		2		2		
	(c)			award (1) for any difference • bubbles / gas formed faster • magnesium disappears faster award (1) for sensible explanation • magnesium more reactive (than zinc) • magnesium above zinc in reactivity series neutral answer - gets hotter	2			2		2
				Question 9/2 total	**2**	**5**	**0**	**7**	**0**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10/3	*(a)*			C_nH_{2n+2}	1			1		
	(b)			CO_2 and H_2O **both** needed - either order	1			1		
	(c)				1			1		
	(d)			orange to colourless neutral answers - decolourises / orange to clear	1			1		1
				Question 10/3 total	**4**	**0**	**0**	**4**	**0**	**1**

16

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*	(i)	sodium is above hydrogen in reactivity series / sodium is more reactive than hydrogen / hydrogen is below sodium in reactivity series / hydrogen is less reactive than sodium	1			1		
		(ii)	$2Cl^- \rightarrow Cl_2 + \mathbf{2e^-}$ accept 2e		1		1		
		(iii)	award (1) for any of following • sodium hydroxide is formed / present • hydroxide is formed • OH^- ions are formed sodium hydroxide is a (strong) alkali (1)		2		2		2
	(b)	(i)	Cu^{2+} / copper ions gain (two) electrons accept $Cu^{2+} + 2e^- \rightarrow Cu$	1			1		
		(ii)	use copper electrodes / use copper anode (1) award (1) for explanation • Cu^{2+} ions coming out of solution are replaced • number of Cu^{2+} ions present (in solution) stays the same • concentration of Cu^{2+} ions (in solution) stays the same			2	2		1

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		award (1) for two shared pairs award (2) for two full octets		2		2		
				Question 4 total	**2**	**5**	**2**	**9**	**0**	**3**

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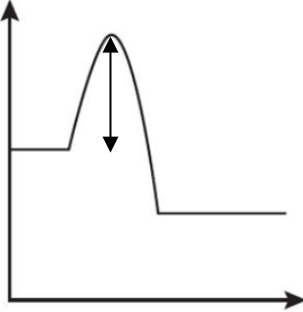| Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac

5	*(a)*			frames
				shape memory alloy / SMA - regains shape after bending
				    both needed for (1)
				
				lenses
				photochromic pigment) - changes colour with changing light (intensity) / sunlight
				    both needed for (1)
				    do **not** accept sun
				
				award (1) for both names if both properties incorrect
					2			2		

	(b)	(i)		transparent rather than white /opaque (when applied) accept clear rather than white	1			1		
		(ii)		can / could pass through the skin / get into bloodstream / get into the body (1) long-term effect is unknown / could be toxic build-up over time (1) neutral answer - toxic / poisonous	2			2		
		(iii)		10^3 / 1000 (2) accept 1.2×10^3 / 1200 if answer is incorrect award (1) for $\dfrac{3 \times 10^{-7}}{2.5 \times 10^{-10}}$		2		2	2	
				Question 5 total	**5**	**2**	**0**	**7**	**2**	**0**

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)	$CO_2 + C \rightarrow 2CO$ award (1) for reactants and products award (1) for balancing only if reactants and products correct	2			2		
		(ii)	award (1) for any of following • limestone forms lime / quicklime • calcium carbonate forms calcium oxide / • $CaCO_3$ forms CaO • $CaCO_3 \rightarrow CaO + CO_2$ award (1) for any of following • lime / quicklime reacts with sand (to form slag) • calcium oxide reacts with silicon dioxide to form slag • $CaO + SiO_2 \rightarrow CaSiO_3$ award (1) for identification of one of the reaction types e.g. • thermal decomposition / breaks down with heat • neutralisation	3			3		
	(b)	(i)	$Fe_2O_3(s) + \mathbf{6}HCl(aq) \rightarrow \mathbf{2}FeCl_3(aq) + \mathbf{3}H_2O(l)$		1		1	1	
		(ii)	$3OH^-(aq) + Fe^{3+}(aq) \rightarrow Fe(OH)_3(s)$ award (1) for product award (1) for balancing **only** if all formulae are correct		2		2		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
(c)	(i)		high purity oxygen is used ☐ impurities are oxidised forming heat ☐ oxygen is blasted in at supersonic speed ☐ scrap steel is used in the process ✓			1	1		
	(ii)		ductility increases, hardness increases ☐ tensile strength increases, ductility increases ☐ ductility decreases, tensile strength increases ✓ hardness increases, tensile strength decreases ☐			1	1		
	(iii)		0.2 ☐ 0.6 ☐ 1.0 ✓ 1.5 ☐			1	1		
	(iv)		low carbon steel			1	1		
			Question 6 total	**5**	**3**	**4**	**12**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	*(a)*			higher yield would be formed using a lower temperature (1) however lower temperatures result in a lower reaction rate (1) use of catalyst increases rate compensating for use of a moderately low temperature (1)	3			3		
	(b)			$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$ award (1) for product award (1) for balancing **only** if all formulae are correct		2		2		

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(c)			**Indicative content** place sulfuric acid in burette measure 25 cm^3 of ammonium hydroxide (into conical flask) add few drops of indicator e.g. phenolphthalein add acid steadily until end-point approaches and drop-wise near end-point record volume of acid needed to just change indicator colour solution is neutral - but contaminated with indicator repeat without indicator - measure 25 cm^3 of ammonium hydroxide (to clean flask) and add exactly the volume of sulfuric acid required to neutralise the alkali solution is neutral - only ammonium sulfate and water present boil off some of the water and leave to cool forming crystals / leave solution to evaporate slowly to form crystals overnight dry crystals (if necessary) sequenced labelled diagrams and appropriate equations should be credited marks limited to lower band if insoluble oxide/carbonate method given	6			6		6
				5-6 marks Full description and explanation of each stage; good attempt at 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** Description and partial explanation of at least two stages *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** Basic description of neutralisation and crystallisation *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.*						
7				**Question 7 total**	9	2	0	11	0	6

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			**Advantages** award (1) each for up to **two** of following • cane sugar is a renewable raw material / sustainable • plant photosynthesis uses CO_2 and fermentation produces CO_2 making it carbon neutral • low pressure making it cheaper to operate / safer to operate **Disadvantage** award (1) each for up to **two** of following • dilute solution of ethanol formed / ethanol not pure - therefore needs further processing / distillation • carbon dioxide formed - contributes to global warming • batch process so labour intensive / inefficient / time consuming • crops used therefore less land for food production / more expensive food	2		2	4		
	(b)			$C_2H_5OH \ + \ O_2 \ \rightarrow \ \textbf{CH}_3\textbf{COOH} \ + \ \textbf{H}_2\textbf{O}$ **both** products needed		1		1		
	(c)	(i)		498 (2) if answer incorrect award (1) for either of following 5616 – (2 × 2061) 1494		2		2	2	
		(ii)		6932 (2) if answer incorrect award (1) for (4 × 805) + (8 × 464)		2		2	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		award (1) for any of following • energy released > energy needed • energy out > energy in • overall energy change has a negative value • overall energy change is = –1316	1			1		
		(iv)			1			1		
	(d)			butan-1-ol **C** butan-2-ol **B** 2-methylpropan-1-ol **D** 2-methylpropan-2-ol **A** award (2) for all **four** correct award (1) for any **two** correct	2			2		
				Question 8 total	**5**	**6**	**2**	**13**	**4**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	*(a)*			**A** iron(II) sulfate / $FeSO_4$ **B** ammonium carbonate / $(NH_4)_2CO_3$ **C** barium bromide / $BaBr_2$ award (3) for **all** correct award (2) for any **four** ions correct award (1) for any **two** ions correct			3	3		3
	(b)	(i)		0.0625 (2) if answer incorrect award (1) for $\frac{0.25 \times 250}{1000}$		2		2	2	2
		(ii)		20.6875 (2) if answer incorrect award (1) for 331 as $M_r(Pb(NO_3)_2$ ECF possible from part (i)		2		2	2	2
		(iii)		20.69 ECF possible from part (ii)		1		1	1	1
				Question 9 total	**0**	**5**	**3**	**8**	**5**	**8**

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FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	0	0	4	0	0
2	5	3	1	9	2	0
3	3	5	0	8	4	0
4	4	5	4	13	5	6
5	2	5	0	7	4	3
6	4	3	4	11	0	0
7	4	2	2	8	0	3
8	0	4	5	9	5	8
9	2	5	0	7	0	5
10	4	0	0	4	0	1
TOTAL	32	32	16	80	20	26

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	0	4	5	9	5	8
2	2	5	0	7	0	5
3	4	0	0	4	0	1
4	2	5	2	9	0	3
5	5	2	0	7	2	0
6	5	3	4	12	1	0
7	9	2	0	11	0	6
8	5	6	2	13	4	0
9	0	5	3	8	5	8
TOTAL	32	32	16	80	17	31