GCSE MARKING SCHEME

SUMMER 2022

GCSE
CHEMISTRY – UNIT 2
3410U40-1 AND 3410UD0-1 (CONTINGENCY)

INTRODUCTION

This marking scheme was used by WJEC for the 2022 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.

WJEC GCSE CHEMISTRY

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

SUMMER 2022 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	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			award (1) for each correct answer baby-feeding spoon thermochromic (pigment) summer T-shirts photochromic (pigment)	4			4		
	(b)			both wires reform into the shape of a paperclip ☐ only the nitinol wire reforms into the shape of a paperclip ☑ only the steel wire reforms into the shape of a paperclip ☐ neither wire reforms into the shape of a paperclip ☐	1			1		1
				Question 1 total	**5**	**0**	**0**	**5**	**0**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		sodium hydroxide is a strong alkali ✓ sodium hydroxide is a weak alkali sodium hydroxide is a strong acid sodium hydroxide is a weak acid		1		1		1
		(ii)		green neutral answer – 7		1		1		1
	(b)			award (1) for each correct answer nitric acid potassium chloride copper(II) oxide		3		3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		award (1) for each error identified step 1: test tube step 2: filter paper step 3: zinc (crystals)	3			3		3
		(ii)		$ZnCl_2$		1		1		
		(iii)		the gas pops with a lighted splint ✓ the gas turns limewater milky ☐ the gas relights a glowing splint ☐	1			1		1
				Question 2 total	**4**	**6**	**0**	**10**	**0**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		award (1) for each correct answer cryolite negative oxygen graphite	4			4		
		(ii)		$2Al_2O_3 \longrightarrow \boxed{4}\ Al + 3O_2$		1		1		
	(b)			102 (2) if answer incorrect award (1) for any of following 27 + 27 + 16 + 16 + 16 2(27) + 3(16) (2 × Al) + (3 × O)		2		2	2	
	(c)			award (1) for each correct answer low density resists corrosion		2		2		
				Question 3 total	**4**	**5**	**0**	**9**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			decreases	1			1		
	(b)	(i)		award (2) for all points plotted correctly – tolerance ±½ small square award (1) for any 4 points plotted correctly award (1) for smooth curve		3		3	3	3
		(ii)		40 s		1		1	1	1
		(ii)	I	award (1) for each product formula/symbol $ZnSO_4$ + Cu		2		2		
			II	displacement	1			1		
				Question 4 total	**2**	**6**	**0**	**8**	**4**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			**Indicative content** **visor** • made of polycarbonate • high impact strength – doesn't break when hit • transparent – can see through it **tent** • made of coated nylon • flexible – easier to handle/pack away • waterproof – keeps contents dry		3	3	6		

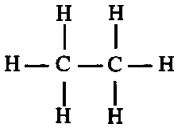
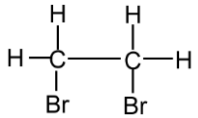
5-6 marks
Correct plastics named for both items; key properties identified with reasons for all
There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar.

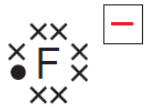
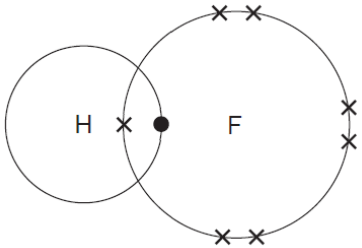
3-4 marks
Correct plastic named for both items; one key property identified with reason given
There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar.

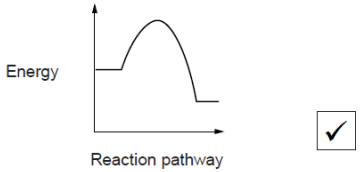
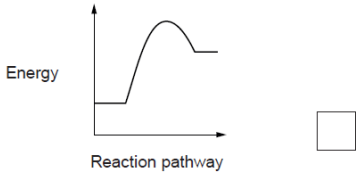
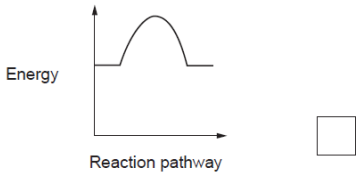
1-2 marks
Some key properties identified with attempt at reasons
There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure. *The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and 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)		all plastics are easy to recycle ☐ PET, HDPE and PP are easy to recycle ✓ PET, HDPE and PVC are difficult to recycle ☐ PVC, LDPE and PS cannot be recycled ☐			1	1		
		(ii)		the plastic items still contain food waste ✓ not enough plastic items have been collected to make recycling worthwhile ☐ the plastic item is made up of more than one type of plastic ✓ too many plastic items have been collected for recycling ☐ the plastic items are too large to fit in the incinerator ☐			2	2		
		(iii)		clear and colourless HDPE			1	1		
				Question 5 total	**0**	**3**	**7**	**10**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		award (1) for each correct answer methane  C_3H_8	3			3		
		(ii)		award (1) for both elements named hydrogen **and** carbon neutral answer – symbols or formulae, H / H_2 / C	1			1		
		(iii)		C_6H_{14}	1			1		
	(b)	(i)			1			1		
		(ii)		award (1) for each correct answer orange …. colourless answers not linked but no credit for colourless → colourless	2			2		2
	(c)			addition	1			1		
				Question 6 total	**9**	**0**	**0**	**9**	**0**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		award (1) each for charge and electronic structure  fluoride ion (2,8)		2		2		
		(ii)		$2Na + F_2 \rightarrow$ **2** NaF award (2) for correct equation if incorrect award (1) for correct formula of product		2		2		
	(b)			 award (1) for shared pair award (1) for fluorine octet		2		2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		award (1) for any of following 436 + 154 add the bond energies 436 and 154 add H—H and F—F		1		1	1	
		(ii)		1130		1		1	1	
		(iii)		 ✓  ☐  ☐		1		1		
				Question 7 total	**0**	**9**	**0**	**9**	**2**	**0**

COMMON QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8/1	(a)	(i)		naphtha			1	1		
		(ii)		20 accept C_{20} / $C_{20}H_{24}$			1	1		
	(b)	(i)		C_5-C_8 accept petrol			1	1	1	
		(ii)		supply is greater than demand for all fractions ☐ supply is greater than demand up to C_{16} after which demand is greater than supply ☐ demand is greater than supply up to C_{16} after which supply is greater than demand ✓ the difference between supply and demand increases up to C_{16} after which it decreases ☐			1	1		
		(iii)	I	C_8H_{18}			1	1		
			II	(addition) polymerisation	1			1		

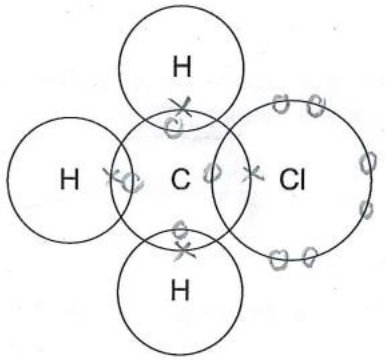
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			award (1) for each correct method **and** factor removed water – heat removed 'beating' – air/oxygen removed accept foam – air/oxygen removed accept dropping powder (from aeroplane) – air/oxygen removed do not accept CO_2 / fire blanket / any fire extinguisher fire breaks – fuel removed accept bulldozing trees / cutting down trees / back burning award (1) for three correct methods if no other mark awarded		3		3		
				Question 8/1 total	**1**	**3**	**5**	**9**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/2	(a)	(i)		**A** sulfur / S (1) **B** water / H_2O (1)	2			2		
		(ii)		catalyst / speeds up the reaction	1			1		
		(iii)		2 ..... SO_2 + O_2 $\rightleftharpoons$ $2SO_3$ award (2) for correct equation if incorrect award (1) for correct formula of reactant		2		2		
		(iv)	I	decreases			1	1		
			II	300 to 500			1	1	1	
		(v)		$H_2S_2O_7$ accept atoms listed in any order e.g. $S_2H_2O_7$			1	1		
	(b)	(i)		carbon / C (1) steam / water (vapour) / H_2O (1)	2			2		2
		(ii)		dehydration / dehydrating accept removes water / removes the elements of water	1			1		1
				Question 9/2 total	**6**	**2**	**3**	**11**	**1**	**3**

HIGHER TIER ONLY QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		award (1) for each correct formula **A** H_2 **B** $NaNO_3$ **C** $Zn(NO_3)_2$ **D** H_2SO_4		4		4		
		(ii)		filter (1) wash (with water) **and** dry (to constant mass) (1) accept wash (with water) **and** evaporate to dryness	2			2		2
	(b)	(i)		$NaOH + HCl \rightarrow NaCl + H_2O$ award (1) for correct reactants award (1) for correct products ignore incorrect balancing		2		2		
		(ii)	I	add an indicator (to alkali) (1) add acid (dropwise) until indicator / it changes colour (1) accept named indicator, ignore incorrect colour change answers not linked so award (1) for 'add acid until it changes colour'	2			2		2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
			II	award (1) for either of following add recorded acid volume (to 25.0 cm^3 alkali) add same volume of acid and alkali as used in stage 1 without indicator (1)	2			2		2
			III	award (1) for any reference to evaporation of water e.g. allow solution to evaporate to dryness leave to evaporate until dry evaporate the water heat to dryness	1			1		1
				Question 3 total	**7**	**6**	**0**	**13**	**0**	**7**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			transfer of one electron from calcium to each chlorine atom (1) can be implied by electrons being in correct place in chloride ions octet in each chloride ion (1) ignore octet included in calcium ion correct charge on all ions – Ca^{2+} and Cl^{-} (1)		3		3		
	(b)			 four shared pairs (1) octet around Cl atom (1)		2		2		

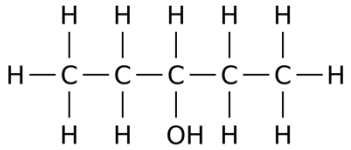
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			**Indicative content** calcium has metallic bonding / is a metal delocalised/free electrons between positive ions electrons move towards positive terminal electric current is the movement of electrons / electrons carry electricity calcium chloride has ionic bonding / is an ionic substance solid cannot conduct electricity because ions cannot move ions become free when calcium chloride is molten or in solution charged ions travel towards oppositely charged electrodes	6			6		
				5-6 marks Good understanding of the different structures and that electrons move in metals whilst ions move when ionic compounds are melted/dissolved *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** Basic understanding of one of the structures and idea that electrons/ions move when a substance conducts electricity *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** Some knowledge of metallic or ionic bonding and structure *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 4 total	**6**	**5**	**0**	**11**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		iron(III) oxide		1		1		
		(ii)		award (1) for either of following this happens as a lower temperature than the melting point of aluminium oxide the melting point of cryolite is lower than the melting point of aluminium oxide accept lowers the melting point of aluminium oxide accept increases conductivity of the electrolyte neutral answer – lowers energy cost	1			1		
		(iii)		award (1) for either of following anode / graphite reacts with oxygen / air anode / graphite is burnt away / used up award (1) for either of following forms carbon dioxide $C + O_2 \rightarrow CO_2$	2			2		
		(iv)		$2Al_2O_3 \longrightarrow$ [4] $Al + 3$ O_2 balancing aluminium atoms (1) product (1) discrete marks		2		2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			award (1) for any of following extraction (of aluminium) is very expensive extraction is much more expensive than recycling recycling is much cheaper than extraction award (1) for reasoning because much larger amounts of electricity/energy needed award (1) for reference to conserving the ore if no other mark awarded	2			2		
	(c)	(i)		<table><tr><th>Left-hand side of the membrane</th><th>Right-hand side of the membrane</th></tr><tr><td>Na^+ Cl^- H^+ OH^-</td><td>Cl^- H^+ OH^-</td></tr><tr><td>H^+ OH^- Cl^-</td><td>Na^+ H^+ OH^-</td></tr><tr><td>Na^+ Cl^- H^+ OH^-</td><td>Na^+ H^+ OH^-</td></tr><tr><td>Na^+ Cl^-</td><td>Na^+ OH^-</td></tr></table> ☐ ☐ ✓ ☐			1	1		
		(ii)		titanium burns in chlorine in aqueous conditions ☐ titanium doesn't react with chlorine under any conditions ☐ aqueous conditions prevent chlorine from reacting with titanium ✓ aqueous conditions prevent chlorine from reacting with sodium chloride ☐			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		sodium hydroxide and magnesium hydroxide ✓ sodium hydroxide and sodium bromide sodium hydroxide and magnesium bromide magnesium chloride and sodium			1	1		
				Question 5 total	**5**	**3**	**3**	**11**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			award (1) for either of following $C_nH_{2n+1}OH$ $C_nH_{2n+2}O$	1			1		
	(b)	(i)		$C_6H_{12}O_{6\,(aq)} \longrightarrow 2\ C_2H_5OH_{(aq)} + \boxed{2}\ CO_{2\,(g)}$ award (2) for correct equation if incorrect award (1) for correct formula of ethanol – accept C_2H_6O mark state symbols separately award (1) for all three correct	1	2		3		
		(ii)		enzyme neutral answers – named enzyme e.g. zymase, biological catalyst	1			1		
	(c)	(i)		butan-1-ol ☐ 2-methylpropan-1-ol ☑ butan-2-ol ☐ 2-methylpropan-2-ol ☐	1			1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(ii)			1			1		
				Question 6 total	**5**	**2**	**0**	**7**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		award (1) for any of following no magnesium remains all the magnesium reacts no silver/grey solid remains only copper can be seen only brown solid can be seen solution is still blue accept all the magnesium dissolves / disappears		1		1		1
		(ii)		award (2) for all points plotted correctly – tolerance ±½ small square award (1) for any 3 points plotted correctly award (1) for straight line		3		3	3	
		(iii)	I	0.07 ecf possible from incorrectly plotted graph			1	1	1	
			II	award (1) for any sensible method e.g. find mass of copper formed when 0.10g of magnesium is added and multiply value by 3 find mass of copper formed when 0.15g of magnesium is added and multiply value by 2 find the mass of copper formed when 0.10g and 0.20g of magnesium are added and add values			1	1	1	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		0.0200 (2) if answer incorrect award (1) for $M_r(CuSO_4)$ = 159.5		2		2	2	2
		(ii)		0.0400 (2) ecf possible from part (i) if answer incorrect award (1) for volume in dm^3 0.5 $\frac{500}{1000}$		2		2	2	2
				Question 7 total	**0**	**8**	**2**	**10**	**9**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		945 (2) if answer incorrect award (1) for either of following 3 × 436 1308 ecf possible		2		2		
		(ii)		2346		1		1		
	(b)	(i)		percentage yield decreases as temperature increases do not accept percentage yield decreases with temperature			1	1		
		(ii)		40%			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			**A** ammonium chloride / NH_4Cl **B** copper(II) sulfate / $CuSO_4$ accept copper sulfate **C** potassium carbonate / K_2CO_3 accept potassium hydrogencarbonate / $KHCO_3$ award (1) for each compound correctly identified if all compounds not correctly identified award (2) for any four ions identified award (1) for any two ions identified accept ions correctly identified in cases where incorrect formulae are given	3			3		3
				Question 8 total	**3**	**3**	**2**	**8**	**0**	**3**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	0	0	5	0	1
2	4	6	0	10	0	6
3	4	5	0	9	2	0
4	2	6	0	8	4	4
5	0	3	7	10	0	0
6	9	0	0	9	0	2
7	0	9	0	9	2	0
8	1	3	5	9	1	0
9	6	2	3	11	1	3
TOTAL	31	34	15	80	10	16

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	1	3	5	9	1	0
2	6	2	3	11	1	3
3	7	6	0	13	0	7
4	6	5	0	11	0	0
5	5	3	3	11	0	0
6	5	2	0	7	0	0
7	0	8	2	10	9	5
8	3	3	2	8	0	3
TOTAL	33	32	15	80	11	18