GCSE MARKING SCHEME

SUMMER 2018

GCSE (NEW)
CHEMISTRY - UNIT 2

3410U20-1
3410UB0-1

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.

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

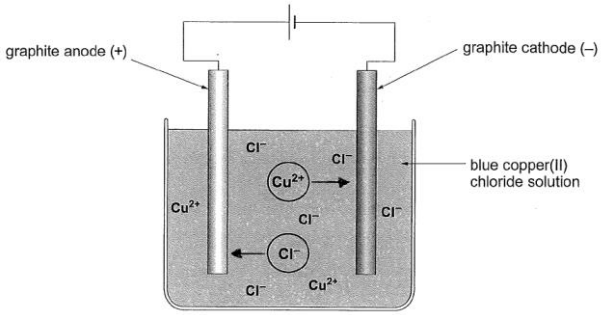
Marking abbreviations

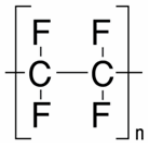
The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

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

Foundation Tier only questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		coke limestone iron ore **any** order all correct for (2) any one correct for (1) **B** slag **C** iron **both** needed for (1)	3			3		
		(ii)		oxygen		1		1		
	(b)			**F D E** award (2) for all three in correct order award (1) for any one in the correct box	2			2		2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		electrolysis (1) electrodes (1)	2			2		
		(ii)		Cu^{2+} ion to cathode **AND** Cl^- ion to anode  ignore arrows on all ions other than those circled		1		1		
		(iii)	I	electron ✓	1			1		
			II	the solution turns paler ✓			1	1		1
		(iv)		chlorine ✓	1			1		1
				Question 1 total	**9**	**2**	**1**	**12**	**0**	**4**

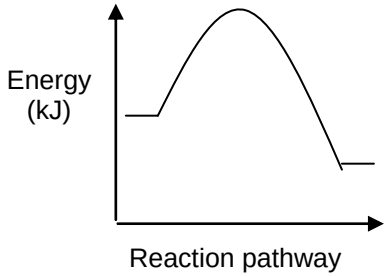
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			**A** (1) **C** (1)	2			2		
	(b)	(i)				1		1		
		(ii)		vinyl chloride / chloroethene		1		1		
	(c)	(i)		32 (2) if answer is incorrect award (1) for clear indication that the formula includes one carbon atom, four hydrogen atoms and one oxygen atom		2		2	1	
		(ii)		10500 (2) if answer is incorrect award (1) for temperature rise = 25		2		2	2	2
		(iii)		**C**			1	1		1
		(iv)		**A**	1			1		
				Question 2 total	**3**	**6**	**1**	**10**	**3**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		petrol / gasoline			1	1	1	
		(ii)		14 / C_{14}		1		1		
		(iii)		1 accept CH_4 / methane			1	1	1	
	(b)			petrol and diesel – both needed for (1) fuel for cars / lorries / transport (1) neutral answer – fuels / cars			2	2		
	(c)	(i)		any of following • litter • contributes to landfill • harms wildlife • toxic fumes on burning • carbon dioxide from burning / global warming from burning • other sensible suggestion neutral answer – vague reference to cost / manufacturing / global warming / habitat destruction / non-biodegradable	1			1		
		(ii)		95 (2) if answer is incorrect award (1) for 8900		2		2	2	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		the bags were made the same thickness but from a less dense plastic (1) the bags were made from the same plastic but were thinner (1)			2	2		
				Question 3 total	**1**	**3**	**6**	**10**	**4**	**0**

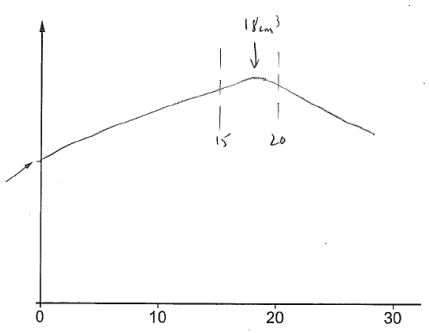
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		(2,8) (1) 2− accept −2 (1)		2		2		
		(ii)		Na_2O (1) 2 in the box (1) formula must be correct for balancing mark to be awarded		2		2	1	
	(b)			**C**		1		1		
	(c)	(i)		giant covalent	1			1		
		(ii)		diamond hard (1) graphite soft (1) fullerene hollow (1)	3			3		
				Question 4 total	**4**	**5**	**0**	**9**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5				**Indicative content** removal of air/oxygen, heat or fuel puts out a fire methods suitable for moorland fire removal of heat using water from fire engines / helicopters removal of air/oxygen using fire beaters / fire retardants removal of fuel by cutting fire breaks or back burning reference to CO_2 cylinders, fire blankets and/or foam extinguishers is irrelevant in this context	4	2		6		
				5-6 marks Principle of fire triangle stated and **three** suitable methods explained *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** Principle of fire triangle and **two** suitable methods explained *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** At least **one** suitable method explained *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 5 total	**4**	**2**	**0**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		2253 (2) if incorrect award (1) for indication of correct bonds to be broken e.g. 3(436) + 945		2		2	2	
		(ii)		2346 (2) if incorrect award (1) for indication of correct bonds to be made e.g. 6(391)		2		2	2	
		(iii)		93 / −93 ecf possible from parts (i) and (ii)		1		1	1	
	(b)				1			1		
	(c)	(i)		decreases		1		1	1	
		(ii)		30 %			1	1	1	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		nitric acid accept HNO_3	1			1		
		(ii)	I	turns blue	1			1		
			II	alkaline ignore reference to strength of alkali	1			1		
			III	ammonia accept NH_3	1			1		
		(iii)		any of following • runs off fields / farmland • aerial spraying of fertilisers	1			1		
				Question 6 total	**6**	**6**	**1**	**13**	**7**	**0**

Common questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7/1	(a)			$HCl + NaOH \rightarrow NaCl + H_2O$ reactants (1) products (1) ignore any attempt at balancing		2		2		
	(b)	(i)		pipette	1			1		1
		(ii)		any of following • identify the end point • identify when neutralisation has taken place • identify when all the alkali has been used up	1			1		1
		(iii)		18.0 accept 18 / 17.9		1		1	1	
		(iv)		 award (1) for shape rising from starting temperature line and falling award (1) for peak maximum in range 15-20			2	2		2
		(v)		36.0 accept 36 ecf possible from part (iii)			1	1		
				Question 7/1 total	**2**	**3**	**3**	**8**	**1**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8/2	(a)	(i)		either of following • (reaction) temperature above melting point of iron • melting point of iron below reaction temperature / 2500°C			1	1		1
		(ii)		Al_2O_3 (1) 2 Fe (1) product **must** be correct for balancing mark to be awarded		2		2	1	
		(iii)		aluminium is oxidised because it gains oxygen do not accept aluminium oxide is oxidised accept 'aluminium is oxidised because it loses electrons'	1			1		
		(iv)		magnesium aluminium iron **must** be in correct order			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		What are the positions of the four metals in the reactivity series? ✓			1	1		1
		(ii)		**D**		1		1		1
		(iii)		any of following for (1) • copper in copper(II) sulfate • tin in tin(II) sulfate • iron in iron(II) sulfate • zinc in zinc sulfate • metal in its own sulfate solution • metals in their own sulfate solutions metals do not displace themselves from solution / metals do not react with their own sulfate (1)	2			2		2
	(c)	(i)		any of following • silvery/grey solid formed • (brown) copper turns silvery/grey • (colourless) solution turns blue neutral answer – 'metal changes colour' or 'solution changes colour'	1			1		1
		(ii)		$Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$ products (1) balancing (1) reactants and products **must** be correct for balancing mark to be awarded		2		2		2
				Question 8/2 total	**4**	**5**	**3**	**12**	**1**	**8**

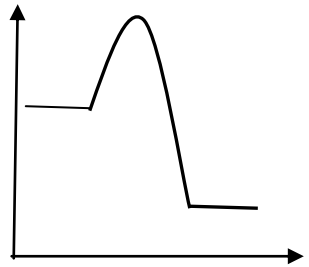
Higher Tier only questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		up to C_{13}-C_{16} demand is greater than supply (1) from C_{17}-C_{20} upwards supply is greater than demand (1) award (1) for 'at first demand is greater than supply then supply becomes greater than demand'			2	2		
		(ii)	I	C_4H_{10}		1		1		
			II	butane	1			1		
			III	any of following • used to make polythene • used to make polymers • used to make other monomers • used to make plastics • used to make ethanol	1			1		
		(iii)		C_3H_8 + **5** O_2 → **3** CO_2 + **4** H_2O		1		1	1	
	(b)	(i)		shale gas and contaminated water ✓			1	1		
		(ii)		fracking produces vast quantities of contaminated water ✓			1	1		
				Question 3 total	**2**	**2**	**4**	**8**	**1**	**0**

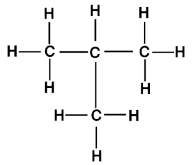
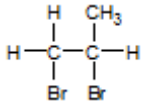
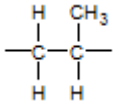
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		transfer of electrons – one calcium atom loses two electrons **AND** one oxygen atom gains two electrons (1) ions – one Ca^{2+} ion **AND** one O^{2-} ion with eight electrons around it (1) if inner shells drawn all atoms and ions must be correct		2		2		
		(ii)		any of following for (1) • strong bonds between ions • strong ionic bonds • strong electrostatic forces between ions neutral answer 'strong bonds' either of following for (1) • attraction between ions with greater charge is greater • 2+/2– attraction is greater than +/– attraction	2			2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		(each carbon atom) only bonded to 3 other carbon atoms (1) do not award first mark if any reference to metallic bonding delocalised electrons able to move (through structure) (1)	2			2		
		(ii)		9.1×10^{-10} (3) accept 0.91×10^{-9} if incorrect award (1) for each of following $11 \times 0.26 = 2.86$ diameter = circumference $\div \pi$ / $\frac{2.86}{3.14}$ ecf possible		3		3	3	
				Question 4 total	**4**	**5**	**0**	**9**	**3**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			**Indicative content** sulfur burns in air forming sulfur dioxide $S + O_2 \rightarrow SO_2$ sulfur dioxide converted to sulfur trioxide in a reversible reaction 1 atm – low pressure favours high yield 450°C – low temp favours high yield but rate is low V_2O_5 catalyst compensates for low rate sulfur trioxide added to conc. sulfuric acid forming oleum $SO_3 + H_2SO_4 \rightarrow H_2S_2O_7$ exothermic reaction oleum diluted with water to form sulfuric acid	6			6		
				5-6 marks Full description and explanation of each stage; attempt at explaining conditions *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 at least one stage *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)		495 / −495 (2) if incorrect award (1) for indication of 4 S=O bonds to be broken e.g. 4(523) / 2092 ecf possible		2		2	2	
		(ii)		551 / −551 (2) if incorrect award (1) for indication of correct bonds to be made e.g. 6(523) / 3138 ecf possible		2		2	2	
		(iii)			1			1		
				Question 5 total	**7**	**4**	**0**	**11**	**4**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		NH_4NO_3 $\frac{34}{100} \times 690 = 234.6$ $CO(NH_2)_2$ $\frac{46}{100} \times 560 = 257.6$ award (1) for one of calculations award (2) for both calculations **and** urea given as answer do not credit 'urea' with no working ecf possible only for minor slip in calculations		1	1	2	2	
		(ii)		ammonium nitrate is better suited to British weather conditions than urea ✓			1	1		
	(b)	(i)		either of following $(NH_4)_2SO_4 + \mathbf{2}NaOH \rightarrow Na_2SO_4 + \mathbf{2}H_2O + \mathbf{2}NH_3$ $(NH_4)_2SO_4 + \mathbf{2}NaOH \rightarrow Na_2SO_4 + \mathbf{2}NH_4OH$ products (1) balancing (1) – reactants and products must be correct for balancing mark to be awarded		2		2		2
		(ii)		$Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$ reactant ions and product (1) state symbols (1) – ions and product must be correct for state symbol mark to be awarded	1	1		2		
				Question 6 total	**1**	**4**	**2**	**7**	**2**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			C_nH_{2n+2}	1			1		
	(b)			 (1) award (1) for any of following 2-methylpropane methylpropane	2			2		
	(c)			**A** **B**  (1)  (1) ignore brackets and/or 'n'	2			2		
	(d)			(add acidified potassium) dichromate(VI) solution (1) orange to green (1)	2			2		2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(e)			ethanol **A** (1) ethanoic acid **C** (1)			2	2		
				Question 7 total	**7**	**0**	**2**	**9**	**0**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			appropriate scales (1) all points plotted correctly (2) any three points plotted correctly (1) tolerance ±½ square straight line of best fit through origin (1) drawn using a ruler; judgement by eye		3	1	4	4	4
	(b)			accept answers in range 1.03 to 1.05			1	1	1	
	(c)			Cu^{2+} concentration stays the same (1) $Cu - 2e^- \rightarrow Cu^{2+}$ (1) $Cu^{2+} + 2e^- \rightarrow Cu$ (1) Cu^{2+} ions leave and enter at same rate / same number of Cu^{2+} ions leave and enter (1)	4			4		
				Question 8 total	**4**	**3**	**2**	**9**	**5**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)			0.0152 (2) if incorrect award (1) for $\frac{15.2}{1000}$		2		2	2	
	(b)			0.0076 ecf possible		1		1	1	
	(c)			760 (3) if incorrect award (1) for any of following M_r = 100 0.0076 × 100 / 0.76 ecf possible throughout		3		3	3	
	(d)			tablet also contains magnesium carbonate / another carbonate (which also reacts with the acid) neutral answer – 'tablet contains other substances' do not accept a list of two or more other ingredients			1	1		
				Question 9 total	**0**	**6**	**1**	**7**	**6**	**0**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	9	2	1	12	0	4
2	3	6	1	10	3	3
3	1	3	6	10	4	0
4	4	5	0	9	1	0
5	4	2	0	6	0	0
6	6	6	1	13	7	0
7	2	3	3	8	1	4
8	4	5	3	12	1	8
TOTAL	33	32	15	80	17	19

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	2	3	3	8	1	4
2	4	5	3	12	1	8
3	2	2	4	8	1	0
4	4	5	0	9	3	0
5	7	4	0	11	4	0
6	1	4	2	7	2	2
7	7	0	2	9	0	2
8	4	3	2	9	5	4
9	0	6	1	7	6	0
TOTAL	31	32	17	80	23	20