GCSE MARKING SCHEME

SUMMER 2018

GCSE (NEW)
SCIENCE (DOUBLE AWARD) - UNIT 2

3430U20-1
3430UB0-1

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 SCIENCE (DOUBLE AWARD) UNIT 2 – CHEMISTRY 1

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)		proton +1 (1) neutron 1 (1)	2			2		
		(ii)		6		1		1		
	(b)	(i)		lithium	1			1		
		(ii)		lithium oxide	1			1		
		(iii)		lithium / oxygen	1			1		1
		(iv)		Li_2O		1		1		
				Question 1 total	**5**	**2**	**0**	**7**	**0**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			award (1) each for any two of following • used equal volumes/amounts of each water sample • shook each water sample for an equal amount of time • used the same concentration of soap solution for each water sample	2			2		2
	(b)	(i)		$\frac{18 + 19 + 17}{3}$ (1) **must** show working 18 (1) award (1) max for 18 with no working		2		2	2	
		(ii)		**A** (1) needed highest volume/amount of soap solution (to form permanent lather) (1) ecf possible from part (i)			2	2		2
	(c)			all three of following for (2) award (1) for any one/two • wastes soap • forms a scum with soap • forms limescale when heated	2			2		
	(d)			Ca^{2+}	1			1		
				Question 2 total	**5**	**2**	**2**	**9**	**2**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			34		1		1	1	1
	(b)			award (2) for all three bars plotted correctly award (1) for any two bars plotted correctly tolerance ±½ square		2		2	2	
	(c)	(i)		8400 (2) if incorrect award (1) for correct substitution i.e. 100 × 4.2 × 20 no ecf possible		2		2	2	
		(ii)		120 (2) if incorrect award (1) for clear indication that formula contains one Mg, one S and four O atoms e.g. 24 + 32 + (4 × 16)		2		2	2	
				Question 3 total	**0**	**7**	**0**	**7**	**7**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			**D** (1) no change in appearance and no temperature change (when mixed) (1) do **not** credit reason if letter other than **D** is given	2			2		2
	(b)	(i)		limewater turns milky/cloudy	1			1		1
		(ii)		Na_2CO_3		1		1		
	(c)	(i)		**C**			1	1		1
		(ii)		orange/yellow	1			1		1
				Question 4 total	**4**	**1**	**1**	**6**	**0**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			H_2O_2			1	1		
	(b)	(i)		40 ±1		1		1	1	
		(ii)		lead oxide is the best catalyst – credit for reason any of following • it produces oxygen at a faster rate than the other catalysts • it produces more oxygen in 120s than the other catalysts • it gives a steeper curve than the other catalysts • it reacts fastest			1	1		1
		(iii)		the same mass of all catalysts is left over ✓	1			1		1

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)		mesh has greater surface area (1) more collisions (1)	2			2		2
		(ii)		they cause global warming ✓			1	1		
		(iii)		more nitrogen oxides are converted than carbon monoxide up to 100°C ✓			1	1		
		(iv)		award (1) for statement of opinion with basic reason e.g. not very effective because not all harmful gases are converted or effective because it removes most of the harmful gases award additional (1) for further detail from passage/data e.g. • it takes 30 minutes for a catalytic converter to work effectively • harmful gases can still escape in the first 30 minutes of a journey • catalytic converters are not effective for short journeys / journeys that take less than 30 minutes • pollutant gases / carbon monoxide and nitrogen oxides will not be converted into harmless gases at low temperatures • after 30 minutes up to 60-70% conversion of carbon monoxide and nitrogen oxides into “safe” gases			2	2		
				Question 5 total	**3**	**1**	**6**	**10**	**1**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**Indicative content** • respiration uses oxygen and produces carbon dioxide • this decreases oxygen levels and increases carbon dioxide levels • photosynthesis uses carbon dioxide and produces oxygen • this increases oxygen levels and decreases carbon dioxide levels • the two processes have taken place at broadly the same rate over a long period of time • deforestation is reducing the number of plants available to produce oxygen and reduce carbon dioxide in the atmosphere • combustion of more and more fossil fuels over the past 100-200 years is adding to the amount of carbon dioxide in the atmosphere • global warming	6			6		
				5-6 marks Good description of oxygen and carbon dioxide in respiration and photosynthesis; understanding of the changing balance *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 description of oxygen or carbon dioxide in respiration and photosynthesis; reference to deforestation or combustion of fossil fuels *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 reference to oxygen or carbon dioxide in respiration or photosynthesis *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	**6**	**0**	**0**	**6**	**0**	**0**

Common questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7/1	(a)	(i)		all points plotted correctly (2) 5/6 points plotted correctly (1) tolerance ±½ small square suitable curve (1)		3		3	3	
		(ii)		increase until 1980/1990/late 1980s (allow specified year e.g.1987) (1) decrease after 1980/1990/late 1980s (allow specified year e.g.1987) (1) award (1) only for simple statement referring to an initial increase followed by a decrease			2	2		
		(iii)		award (1) for any of following • only one reading every 10 years • 10 years between every reading • graph does not go up one year at a time • emissions very similar in 1980 and 1990 and there is no way of knowing what happened in between • there could have been a lag in the reduction of sulfur dioxide emissions after the regulation came into force			1	1		
	(b)			$SO_2 + 2H_2S \rightarrow 3S + 2H_2O$ H_2O (1) balancing (1) balancing mark only awarded if H_2O correct		2		2	1	
				Question 7/1 total	**0**	**5**	**3**	**8**	**4**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8/2	(a)	(i)		increase down the group / decrease up the group		1		1	1	
		(ii)		liquid (1) award (1) for either of following • 400°C is higher than its melting point but lower than its boiling point • 400°C is between its melting point and boiling point		2		2		
		(iii)		either of following • it has metal and non-metal properties • it has a high boiling point/is a semi conductor (metal properties) **but** it has a low melting point/has a low density (non-metal properties)			1	1		
	(b)	(i)		173		1		1	1	
		(ii)		45.7 / 46 (2) if incorrect award (1) for $\frac{79}{173}$ ecf possible from part (i)		2		2	2	
				Question 8/2 total	**0**	**6**	**1**	**7**	**4**	**0**

Higher Tier only questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		**A**, **D** and **E** – all **three** needed (1) they have equal numbers of protons and electrons (1)		2		2		
		(ii)		**B** and **F** – both needed for (1) **B** has a +/+1/1+ charge and **F** has a +2/2+ − both needed for (1) award (2) for $\mathbf{B}^{+}$ and $\mathbf{F}^{2+}$		2		2		
	(b)			any of following for (1) • atoms having the same number of protons but different number of neutrons • same atomic number but different mass number • atoms of the same element having different number of neutrons / different mass number award (1) for comparison of ^{12}C and ^{14}C e.g. • ^{12}C has 6 protons and 6 neutrons **and** ^{14}C has 6 protons and 8 neutrons • ^{14}C has two more neutrons than ^{12}C	2			2		
				Question 3 total	**2**	**4**	**0**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			6.21×10^4 (3) if answer incorrect award (1) for each of following $(2.85 \times 10^6) + (2.25 \times 10^6) + (1.30 \times 10^6) = 6.40 \times 10^6$ $6.40 \times 10^6 \times 0.0097$ or $6.40 \times 10^6 \times \frac{0.97}{100}$ max (2) marks if answer not in standard form ecf possible e.g. if incorrect total distance calculated but correct use of 0.97%		3		3	3	
	(b)	(i)		the Earth's crust is divided into tectonic plates (1) these plates move very slowly (1) due to convection currents in the mantle (1)	3			3		
		(ii)		North American Plate and Eurasian Plate have moved apart (accept arrows on the diagram) (1) Mid-Atlantic Ridge has formed as more and more magma has risen through the gap and cooled creating new igneous rock as it cools (1)	2			2		
				Question 4 total	**5**	**3**	**0**	**8**	**3**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			**higher** temperature (1) higher rate is due to more successful collisions per second / greater frequency of successful collisions / more particles having required activation energy (1) at higher temperature particles have more (kinetic) energy / move faster so more of the collisions that occur are successful (1) **larger** surface area means that more particles are able to be involved in collisions (1)	4			4		4
	(b)			either of following • equal volume of gas produced in both experiments • graphs level off at the same volume in both experiments			1	1		1
				Question 5 total	**4**	**0**	**1**	**5**	**0**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6				**Indicative content** • reactivity increases down Group 1 • Group 1 elements lose the one electron in their outer shell when they react (to form +1 ions) • it becomes easier to lose the electron on going down the group because it is further away from the nucleus and the attractive power of the nucleus becomes less effective • reactivity decreases down Group 7 • Group 7 elements gain one electron when they react (to form −1 ions) • it becomes more difficult to gain an electron on going down the group because the attractive power of the nucleus becomes less effective	6			6		2
				5-6 marks Good explanation of why the ease/difficulty of losing/gaining an electron changes down the groups *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 description of both trends and explanation of one in terms of ease/difficulty of losing/gaining an electron *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** Correct description of at least one of the trends *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	**6**	**0**	**0**	**6**	**0**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		add soap solution to each sample and shake (1) the sample that produces a lather is soft water (1) boil the remaining samples (1) the sample that now gives a lather is temporary hard water and the one that still does not give a lather is permanent hard water (1)	2		2	4		4
		(ii)		**Z** is temporary hard water / has significant temporary hardness with a small amount of permanent hardness (1) it has a high concentration of hydrogencarbonate ions / it has a high concentration of hydrogencarbonate ions and a small concentration of sulfate ions (1) ignore reference to high magnesium ion concentration			2	2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		hard water contains magnesium ions / calcium ions / Mg^{2+} / Ca^{2+} (1) swap places with two sodium ions (1) accept replace / exchange for swap must be one reference to **ions** for full credit	2			2		2
		(ii)		either of following • all sodium ions have been used up • no more sodium ions left	1			1		1
	(c)			0.00135 / 1.35×10^{-3} (2) if answer incorrect award (1) for M_r $CaSO_4$ = 136 award (1) only if answer not given to three significant figures ecf possible from incorrect M_r		2		2	2	
				Question 7 total	**5**	**2**	**4**	**11**	**2**	**7**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		metallurgists, physicists and chemists are concerned with different properties of heavy metals ✓			1	1		
		(ii)		water becomes contaminated with toxic lead that builds up in body / bioaccumulates			1	1		
		(iii)		lead contamination in road-side soil at all distances is much greater in towns than in the country ✓ lead contamination in road-side soil decreases between 12m and 42m from the centre of the road in the countryside ✓			2	2		
		(iv)		it took 15 years for paint and petrol to become lead free ✓			1	1		
	(b)	(i)		**6** $PbCO_3$ + O_2 → **2** Pb_3O_4 + **6** CO_2		1		1	1	
		(ii)		Pb_2O_3 (3) if answer incorrect award (1) for each of following mass of oxygen = 1.18 g Pb : O ratio is 0.0491 : 0.07375 ecf possible		3		3	3	
				Question 8 total	**0**	**4**	**5**	**9**	**4**	**0**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	2	0	7	0	1
2	5	2	2	9	2	4
3	0	7	0	7	7	1
4	4	1	1	6	0	5
5	3	1	6	10	1	4
6	6	0	0	6	0	0
7	0	5	3	8	4	0
8	0	6	1	7	4	0
TOTAL	23	24	13	60	18	15

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	0	5	3	8	4	0
2	0	6	1	7	4	0
3	2	4	0	6	0	0
4	5	3	0	8	3	0
5	4	0	1	5	0	5
6	6	0	0	6	0	2
7	5	2	4	11	2	7
8	0	4	5	9	4	0
TOTAL	22	24	14	60	17	14