GCSE MARKING SCHEME

SUMMER 2019

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

3430U20-1
3430UB0-1

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 SCIENCE (DOUBLE AWARD) UNIT 2 – CHEMISTRY 1

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				award (1) for each correct answer						
				E (accept calcium)	1					
				A (accept hydrogen)		1				1
				C (accept silicon)		1				
				D (accept chlorine)		1				
				B (accept neon)	1			5		1
				Question 1 total	**2**	**3**	**0**	**5**	**0**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*	(i)		**C** (1) neutral answer - hydrogen it contains one type of atom only (1)		2		2		
		(ii)		**D**			1	1		
		(iii)					1	1		
	(b)	(i)		52.5		1		1	1	
		(ii)		50 (2) if answer incorrect award (1) for $\frac{32}{64}$		2		2	2	
	(c)			**2**P + **3**H$_2$ → **2**PH$_3$		1		1		
				Question 2 total	**0**	**6**	**2**	**8**	**3**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			beta-carotene, chlorophyll and betalain **and** each one has only one spot on the chromatogram	1			1		
	(b)			award (1) for each correct answer chlorophyll is not present in carrot, tomato or beetroot extracts ✓ beta-carotene is present in carrot extract but not present in tomato extract ☐ both beta-carotene and betalain are present in beetroot extract ✓ betalain is present in tomato extract but not present in carrot extract ☐ both carrot and beetroot extracts contain a pigment other than beta-carotene, chlorophyll and betalain ☐ max (1) if three boxes ticked 0 if four or more boxes ticked		2	2		2
	(c)			0.55　(2) if answer incorrect award (1) for $\frac{4.4}{8}$	1	1		2	2	2
	(d)			one pigment in beetroot extract is insoluble (in the solvent used)		1		1		1
				Question 3 total	**1**	**3**	**2**	**6**	**2**	**5**

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Question				Marking details	Marks available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
4	*(a)*			magma rises through the gap (1) award (1) for any of following • magma then cools to form new rock / mid-ocean ridge • magma then forms a volcano	2			2		
	(b)	(i)		oceanic plate is denser/heavier than the continental plate	1			1		
		(ii)		oceanic plate melts / turns to magma / turns to molten rock earthquakes occur / new mountain ranges form - neutral answers	1			1		
		(iii)		destructive	1			1		
	(c)			0.895 / 0.90 / 0.9 (2) if answer incorrect award (1) for $\frac{537}{600}$	1	1		2	2	
				Question 4 total	**6**	**1**	**0**	**7**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			its density is 1.7 g/cm³ ☐ its melting point is 650 °C ☐ it fizzes vigorously with sulfuric acid ✓ it is malleable ☐			1	1		1
	(b)			it does not react with sulfuric acid ☐ it is ductile ☐ it would melt when it lands on planet **J** ✓ its density is 11.3 g/cm³ ☐			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			award (1) for each correct answer it does not react with sulfuric acid ✓ it is expensive ☐ it is a good conductor of heat ☐ it is non-magnetic ☐ it has a melting point much higher than the temperature on planet **J** ✓ it is shiny so will reflect the sun's rays ☐ if three boxes ticked each incorrect answer negates a correct one 0 if four or more boxes ticked			2	2		
	(d)			$2Na + H_2SO_4 \rightarrow Na_2SO_4 + H_2$ award (1) for correct formula Na_2SO_4 award (1) for balancing **only** if Na_2SO_4 given		2		2	1	
1				**Question 5 total**	**0**	**2**	**4**	**6**	**1**	**1**

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Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
6	**Indicative content** Benefit - fluoride reduces tooth decay / results in less fillings in teeth Reasons to oppose • can have possible side effects on health e.g. brittle bones, infertility, kidney problems, stomach cancer, birth defects • can cause fluorosis - teeth going yellow • unethical - fluoride added to drinking water without public consent / mass medication • fluoride is toxic in high concentrations	6			6		

5-6 marks
Detailed description of benefit and peoples' concerns; includes at least two health side effects; describes ethical argument
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
Good description of benefit and peoples' concerns; mentions one health side effect; mentions ethical argument
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
Brief description of benefit; mentions one health side effect or ethical argument
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**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			mass decreases (with time) (1) due to carbon dioxide / gas being released (and lost to the atmosphere) (1)			2	2		2
	(b)	(i)		3 minutes		1		1	1	1
		(ii)		from 0 – 0.5 minutes ✓ from 1 – 1.5 minutes ☐ from 2 – 2.5 minutes ☐ from 3 – 3.5 minutes ☐			1	1		1
	(c)			1.5 (2) if answer incorrect award (1) for 100 – 97		2		2	2	
	(d)			curve drawn above / to the right of original curve does not have to reach 96.8 if still falling must start at 100 and not go below 96.8			1	1		1
				Question 7 total	**0**	**3**	**4**	**7**	**3**	**5**

Common questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8/1	*(a)*			2,8,7　(1) phosphorus (1) 4　　　(1)		3		3		
	(b)	(i)		award (1) for any of following • lilac flame • moves • floats • melts / forms ball • bubbles of gas / effervescence	1			1		1
		(ii)		award (1) for any of following • use a safety screen • add only a small piece of potassium • use excess water • use tongs to hold potassium	1			1		1
		(iii)		KOH		1		1		
		(iv)		11/12/13/14 accept any value 8-14		1		1		1
		(v)		award (1) for any of following • rubidium • caesium • francium	1			1		
				Question 8/1 total	**3**	**5**	**0**	**8**	**0**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/2	*(a)*	(i)		temperature decreased (1) water vapour condensed to form oceans (1)	2			2		
		(ii)		award (1) each for any two of following • (green) plants evolved which carried out photosynthesis • carbon dioxide absorbed by the oceans • carbon dioxide absorbed by shells of marine organisms / trapped in limestone rock • carbon dioxide trapped in fossil fuels	2			2		
	(b)			increase in percentage of carbon dioxide due to burning of fossil fuels / deforestation (1) award (1) for any of following • climate change • <u>more</u> extreme weather • <u>more</u> drought conditions • polar ice caps melting at a <u>higher rate</u> • rising sea levels • <u>more</u> flooding • loss of wildlife habitat accept other sensible answers	2			2		
	(c)			$4NH_3 + 3O_2 \rightarrow 2N_2 + 6H_2O$		1		1	1	
				Question 9/2 total	**6**	**1**	**0**	**7**	**1**	**0**

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Higher Tier only questions

Question				Marking details	Marks available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
3	*(a)*			**A** – barium bromide (1) **B** – lithium chloride (1) **C** – sodium iodide (1) accept correct formulae if not all correct award (2) for any four correct ions award (1) for any two correct ions			3	3		3
	(b)			$MgCl_2 + \mathbf{2}AgNO_3 \rightarrow \mathbf{2}AgCl + Mg(NO_3)_2$ award (1) for correct formulae of products award (1) for balancing **only** if correct formulae given		2		2		
	(c)			$M_r(AgNO_3) = 170$ (1) $\frac{0.103}{170}$ (1) 6.06×10^{-4} mol (1) award (2) for 0.000606 mol ecf from incorrect M_r value		3		3	3	
				Question 3 total	**0**	**5**	**3**	**8**	**3**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*			award (1) for any of following • getting crystals to form • temperature below room temperature • cooling to 4°C / 10°C place the boiling tube in ice (1)			2	2		2
	(b)	(i)		all points plotted correctly (2) 4/5 points plotted correctly (1) 　　　　tolerance ±½ small square suitable straight line / curve drawn (1)		3		3	3	
		(ii)		no - maximum of around 4.9 g will dissolve at this temperature accept any sensible explanation using graph ecf possible from incorrect graph plotting / poor line			1	1		1
	(c)			put 5.0 g sample in 50 g of water and mix/stir well (1) accept any volume which will not dissolve all of the solid filter off undissolved solid, dry and weigh (1) work out how much dissolved and hence value for solubility (1)	1	1	1	3		3
				Question 4 total	**1**	**4**	**4**	**9**	**3**	**6**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*			mixture is heated until one liquid boils / evaporates then condenses and is collected in a different container (1)						
				liquids must have different boiling points (1)						
				liquid **E** has the lower boiling point so is the one removed / liquid **F** has the higher boiling point so is the one left in the flask (1)	3			3		3
	(b)			74 / 74.1 (2)						
				if answer incorrect award (1) for $\frac{32}{43.2} \times 100$		2		2	2	
				Question 5 total	**3**	**2**	**0**	**5**	**2**	**3**

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Question				Marking details	Marks available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
6				**Indicative content** • removal of temporary hardness by boiling • hydrogencarbonate ions are not thermally stable and decompose easily on heating • this forms a layer of calcium carbonate (inside kettles) • calcium hydrogencarbonate → calcium carbonate + water + carbon dioxide • $Ca(HCO_3)_2 \rightarrow CaCO_3 + H_2O + CO_2$ • boiling does not remove permanent hardness • removal of permanent hardness by adding washing soda/sodium carbonate • this forms a (white) precipitate • sodium carbonate + calcium sulfate → calcium carbonate + sodium sulfate • $Na_2CO_3 + CaSO_4 \rightarrow CaCO_3 + Na_2SO_4$	6			6		3

5-6 marks
Detailed description of how hard water is softened using both methods; one correct equation
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
Good description of how water is softened using both methods
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
Brief description of how water is softened using one of the methods
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**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	*(a)*	(i)		chlorine is more reactive than iodine (1) accept chlorine can gain an electron more easily than iodine award (1) for any of following • chlorine displaces iodide ion • chlorine takes electron from iodide ion • chlorine oxidises iodide ion	2			2		2
		(ii)		$Cl_2 + 2KI \rightarrow 2KCl + I_2$ award (1) for correct formulae for reactants and products award (1) for balancing **only** if correct formulae given		2		2		
	(b)			112 g of iron reacts with 213 g of chlorine (1) 1.32 g of iron reacts with $\frac{213}{112} \times 1.32$ g of chlorine (1) 2.51 g (1) ecf possible for incorrect relative mass values i.e. 112 or 213 alternative method moles Fe = $\frac{1.32}{56}$ = 0.0236 mol (1) moles Cl_2 = $\frac{3}{2} \times 0.0236$ = 0.0353 mol (1) mass Cl_2 = 0.0353 × 71 = 2.51 g (1) ecf possible for incorrect mole ratio				3	3	

Question				Marking details	Marks available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
	(c)	(i)		Cl_2 + **3**Br_2 → **2**$ClBr_3$		1		1		
		(ii)		77.46 / 77.5 / 77		1		1	1	
				Question 7 total	**2**	**7**	**0**	**9**	**4**	**2**

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Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)			type of oil used, towel material and volume of hydrogen peroxide ☐ type of oil used, towel material and temperature of stain remover ☐ type of oil used and towel material ✔ type of oil used, towel material and cost of stain remover ☐			1	1		1
	(b)			it is the cheapest stain remover ☐ it is heat resistant ☐ it has a low concentration of hydrogen peroxide ✔ it takes a long time to work ✔ **both** needed for (1) 0 if more than two boxes ticked			1	1		1
	(c)			award (1) for either of following • stain remover **D** may have a catalyst added • stain remover **D** may have an enzyme added			1	1		1

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Question				Marking details	Marks available					
					AO1	**AO2**	**AO3**	**Total**	**Maths**	**Prac**
	(d)	(i)		0.14 / 0.143　　(2) if answer incorrect award (1) for $\frac{0.4}{2.8}$ ecf possible for error in reading graph			2	2	2	
		(ii)		concentration **S** is **half** of concentration **T** (1) **half** the number of particles in the same volume (1) **half** the chance of successful collisions / **half** the number of successful collisions per second / **half** the frequency of successful collisions (1) award (2) if answered using 'lower' / 'fewer' rather than 'half' throughout	3			3		
				Question 8 total	**3**	**0**	**5**	**8**	**2**	**3**

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FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	2	3	0	5	0	2
2	0	6	2	8	3	0
3	1	3	2	6	2	5
4	6	1	0	7	2	0
5	0	2	4	6	1	1
6	6	0	0	6	0	0
7	0	3	4	7	3	5
8	3	5	0	8	0	3
9	6	1	0	7	1	0
TOTAL	24	24	12	60	12	10

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HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	3	5	0	8	0	3
2	6	1	0	7	1	0
3	0	5	3	8	3	3
4	1	4	4	9	3	6
5	3	2	0	5	2	3
6	6	0	0	6	0	3
7	2	7	0	9	4	2
8	3	0	5	8	2	3
TOTAL	24	24	12	60	15	23