GCSE MARKING SCHEME

SUMMER 2022

GCSE
SCIENCE (DOUBLE AWARD) - UNIT 2
3430U20-1 AND 3430UB0-1

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 SCIENCE (DOUBLE AWARD) UNIT 2 – CHEMISTRY 1

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.

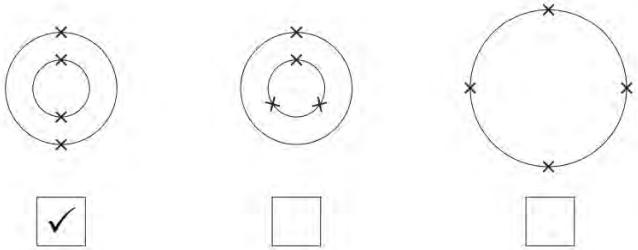
cao	=	correct answer only
ecf	=	error carried forward
bod	=	benefit of doubt

Foundation Tier only questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			(**C**) **A D B E** award (2) for all correct award (1) for 2 or 3 in correct positions			2	2		2
	(b)	(i)		award (1) for any of following • line drawn (on chromatography paper) using <u>pen</u> • line should be drawn using pencil • don't use a pen award (1) for any of following • water added <u>covers the sample</u> • water level should be below the line • don't cover the sample			2	2		2
		(ii)		0.7 (2) if answer incorrect award (1) for $\frac{7}{10}$ or 0.2		2		2	2	
				Question 1 total	**0**	**2**	**4**	**6**	**2**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)	(i)		award (1) for either of following copper … because there are no bubbles copper … because there is no rise in temperature (accept no change in temperature) neutral answer – no reaction		1		1		1
		(ii)		51		1		1	1	1
	(b)			exothermic	1			1		
	(c)	(i)		award (2) for all points plotted correctly – tolerance ±½ small square award (1) for 4 or 5 points plotted correctly award (1) for suitable curve from origin		3		3	3	
		(ii)		Graph stops at 60 s ☐ Graph is still rising at 60 s ✓ Graph reaches a maximum temperature of 56 °C ☐			1	1		

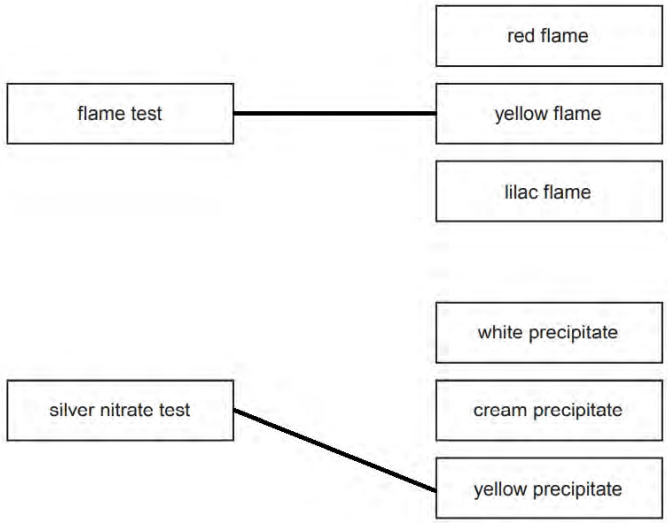
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		The particles collide with less energy so less chance of successful collisions ☐ The particles move slower so less chance of successful collisions ☐ The particles have less surface area so less chance of successful collisions ☐ The particles get used up so less chance of successful collisions ✓	1			1		
		(iv)		increase the temperature (of the acid) (1) increase the concentration (of the acid) (1) accept use stronger acid neutral answer – use a catalyst / any reference to magnesium	2			2		2
		(v)		$MgCl_2$		1		1		
				Question 2 total	**4**	**6**	**1**	**11**	**4**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			award (1) for each correct number Beryllium has 4 protons. The atomic number of beryllium is 4. The mass number of beryllium is 9. Beryllium has 5 neutrons.		4		4		
	(b)			 ✓		1		1		
	(c)			3		1		1		
				Question 3 total	**0**	**6**	**0**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			Water vapour evaporated to form clouds ☐ The Earth cooled so water vapour condensed ✓ Bacteria and algae turned the water vapour into liquid water ☐ There were no more volcanoes to produce water vapour ☐		1		1		
	(b)			carry out photosynthesis / use up carbon dioxide (1) produce oxygen (1)	2			2		
	(c)			argon / Ar	1			1		
	(d)			$2NaN_3 \longrightarrow 2Na + \boxed{3} N_2$		1		1	1	
				Question 4 total	**3**	**2**	**0**	**5**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			A ☐ B ☐ C ✓ D ☐			1	1		
	(b)			A ✓ B ☐ C ☐ D ☐			1	1		
	(c)			potassium fluoride and calcium sulfate ☐ ammonium sulfate and potassium nitrate ☐ calcium fluoride and ammonium nitrate ☐ ammonium sulfate and calcium fluoride ✓			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		136		1		1	1	
		(ii)		48.7 (2) accept 49 if answer incorrect award (1) for either of following 38 or (19 × 2) shown in working 24.4 (ecf – use of 19 instead of 38)		2		2	2	
				Question 5 total	**0**	**3**	**3**	**6**	**3**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			award (1) for each correct line  	2			2		2
	(b)	(i)		award (1) for each correct formula AgI $NaNO_3$		2		2		
		(ii)		filtration			1	1		1
				Question 6 total	**2**	**2**	**1**	**5**	**0**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7				**Indicative content** **Advantages** good for healthy bones and teeth (due to calcium ions) reduces risk of heart disease good for brewing beer better taste **Disadvantages** does not readily form lather with soap solution / forms scum more soap solution needed to produce lather for washing e.g. clothes, dishes boilers and hot water pipes become 'furred up' (due to calcium carbonate / limescale precipitating) boilers and kettles become less efficient and pipes and radiators can become completely blocked energy is wasted as a result	6			6		
				5-6 marks Detailed description of advantages and disadvantages of hard water; two examples of each with reference to consequences of disadvantages *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 advantages and disadvantages of hard water; one example of each with simple development of one point *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 one advantage and one 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 7 total	**6**	**0**	**0**	**6**	**0**	**0**

Common questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8/1	(a)	(i)		award (1) for any of following to prevent it from reacting with air / oxygen / water (vapour) (in the air) because it reacts with air / oxygen / water (vapour) (in the air) to prevent oxidation / tarnishing	1			1		
		(ii)		it gets duller / tarnishes / loses its shine / turns white / turns grey neutral answers – changes colour / changes appearance	1			1		1
		(iii)		Na_2O		1		1		
	(b)	(i)		chlorine is toxic / poisonous	1			1		
		(ii)		$2Na + Cl_2 \rightarrow 2NaCl$ award (2) for correct equation if incorrect award (1) for correct formula of product		2		2		2
	(c)	(i)		–25 °C ☐ 25 °C ☐ 100 °C ☐ 150 °C ☑			1	1	1	
		(ii)		award (1) for any of following astatine will react <u>very</u> slowly / more slowly than iodine astatine will not react with hot iron astatine is less reactive than iodine / the least reactive neutral answers – quite slow / takes a long time to react reactivity decreases down the group (1)			2	2		
				Question 8/1 total	**3**	**3**	**3**	**9**	**1**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/2	(a)	(i)		award (1) each for any of following • different continents fit together like a jigsaw puzzle • similar fossils found on different continents • similar rocks found on different continents neutral answers different <u>countries</u> fit together like a jigsaw puzzle different continents / countries have <u>similar</u> coastlines same animals / plants found on different continents	3			3		
		(ii)		he could not suggest <u>how/why</u> the continents moved (1) neutral answer – no evidence to support his theory award (1) for either of following • we now know that the continents are on <u>huge/tectonic plates</u> that can <u>move</u> • we now know that tectonic <u>plates are moved</u> by <u>convection currents in the mantle</u> below the Earth's crust (1) neutral answers plates were discovered plate boundaries were discovered	2			2		
	(b)			earthquake	1			1		
				Question 9/2 total	**6**	**0**	**0**	**6**	**0**	**0**

Higher Tier only questions

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>3</td><td>(a)</td><td></td><td></td><td>F (1)

it has six electrons in the outer shell and has three (electron) shells (1)</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>A and E (1)

both have a full outer shell (of electrons) (1)</td><td></td><td>2</td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td><table><tr><th>Isotope</th><th>Atomic number</th><th>Mass number</th></tr><tr><td>1</td><td>17</td><td>35</td></tr><tr><td>2</td><td>17</td><td>37</td></tr></table>award (1) for each correct row

if neither row is correct award (1) for any two correct numbers</td><td></td><td>2</td><td></td><td>2</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 3 total</td><td>0</td><td>6</td><td>0</td><td>6</td><td>1</td><td>0</td></tr>
</table>

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td></td><td>
<table>
<tr><th>Concentration of sodium thiosulfate (g/dm^3)</th><th>Time 1 (s)</th><th>Time 2 (s)</th><th>Time 3 (s)</th><th>Mean time (s)</th></tr>
<tr><td>0.2</td><td>114</td><td>113</td><td>112</td><td>113</td></tr>
<tr><td>0.4</td><td>74</td><td>70</td><td>72</td><td>72</td></tr>
<tr><td>0.6</td><td>40</td><td>38</td><td>57</td><td>39</td></tr>
<tr><td>0.8</td><td>21</td><td>23</td><td>22</td><td>22</td></tr>
<tr><td>1.0</td><td>14</td><td>16</td><td>15</td><td>15</td></tr>
</table>
</td><td></td><td></td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td></td><td>award (2) for all points plotted correctly – tolerance ±½ small square
award (1) for 3 or 4 points plotted correctly

award (1) for suitable curve</td><td></td><td>3</td><td></td><td>3</td><td>2</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td></td><td>the higher the concentration the higher the rate (1)

because there are more particles in the same volume (1)

therefore more chance of (successful) collisions / more (successful) collisions per second / greater frequency of collisions (1)

or reverse argument

the lower the concentration the lower the rate (1)

because there are fewer particles in the same volume (1)

therefore less chance of (successful) collisions / fewer (successful) collisions per second / lower frequency of collisions (1)</td><td>3</td><td></td><td></td><td>3</td><td></td><td></td></tr>
</table>

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			curve drawn below / to the left of plotted curve [must cover range of at least 0.5 g / dm^3 e.g. from 0.3 to 0.8]			1	1		
	(e)			award (2) for either of following 0.0063 6.3×10^{-3} award (1) for correct answer not given to 2 significant figures if answer incorrect award (1) for M_r 158 ecf possible from incorrect M_r e.g. 71		2		2	2	
				Question 4 total	**3**	**5**	**2**	**10**	**5**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5				**Indicative content** temporary hard water contains hydrogencarbonate (HCO_3^-) ions whilst permanent hard water contains sulfate (SO_4^{2-})/other ions add soap solution to each sample shake each sample neither will produce a lather boil both samples the sample that now gives a lather on the addition of soap solution is temporary hard water / the sample that does not give a lather is permanent hard water method works due to hydrogencarbonate ions forming calcium carbonate/limescale on heating whilst sulfate/other ions are unaffected by heating	5	1		6		6
				5-6 marks Good description of different composition and how to differentiate between the samples; clear understanding of the method *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 composition of either temporary or permanent hard water and how to differentiate between the samples; reference to 'furring' or precipitation of calcium carbonate *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 description of how to differentiate between the water samples *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	**5**	**1**	**0**	**6**	**0**	**6**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			respiration/combustion uses up oxygen and produces carbon dioxide (1) photosynthesis uses up carbon dioxide and produces oxygen (1) if neither mark credited – award (1) for naming process from both balance is maintained when both oxygen and carbon dioxide are used up at the same rate as they are produced (1)	3			3		
	(b)			**must** be reference to **both** countries for any marks any indication that USA and India both increase (up to 2005 / to begin with) (1) e.g. describing the increase using numbers 'USA doubles but India increases by 18 times' after 2005 / in 2015 / at the end USA decreases but India rises dramatically (1) must reference 'time' in some way and 'very large' rise for India neutral answers reference to USA being larger than India to begin with reference to India being larger than USA at the end e.g. India 550 more than USA in 2015			2	2		
	(c)			$C_3H_8 + \boxed{5} O_2 \longrightarrow \boxed{3} CO_2 + \boxed{4} H_2O$		1		1	1	
				Question 6 total	**3**	**1**	**2**	**6**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)			Si (1) award (1) for answer that identifies one property as metallic and another as non-metallic e.g. it has a high melting point but is brittle neutral answers it is a semiconductor it has metal and non-metal properties		2		2		
	(b)			The density of metals and non-metals increases ☐ The boiling point of metals increases but the boiling point of non-metals shows no trend ✓ The density of metals shows no trend but the density of non-metals decreases ☐ The boiling point of metals and non-metals shows no trend ☐ The density of metals increases but the density of non-metals shows no trend ✓ The boiling point of metals shows no trend but the boiling point of non-metals decreases ☐ The density of metals decreases but the density of non-metals shows no trend ☐			2	2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			there is no trend in the melting points of the non-metals / the elements preceding chlorine accept description e.g. there is a decrease in melting point from Si to P, then an increase from P to S and then another decrease from S to Cl neutral answer – melting point is unpredictable			1	1		
	(d)	(i)		liquid (1) award (1) for any of following only if first mark is awarded • 60 °C is <u>between</u> its melting point and boiling point • melting point is below 60 °C and boiling point is above 60 °C • 60 °C is <u>between</u> 44 °C and 281 °C • phosphorus has already melted at 60 °C but has not reached its boiling point neutral answer – its melting point is 44 °C and its boiling point is 281 °C			2	2		
		(ii)				1		1	1	
				Question 7 total	**0**	**3**	**5**	**8**	**1**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		(metals in Group 1) get more reactive (down the group) (1) award (1) for any of following due to a decrease in attraction between the nucleus and the outer shell electron easier to remove outer electron because there are more shells easier to remove outer electron because it is further from the nucleus	2			2		1
		(ii)		Group 1 metals are more reactive than Group 2 metals (1) award (1) for either of following • because Group 1 metals only need to lose 1 electron (from the outer shell) whereas Group 2 metals need to lose 2 electrons • because it is easier to lose 1 electron than 2 electrons	2			2		
	(b)			257.6 / 258 (3) if answer incorrect credit each correct step in one of two possible methods (ecf possible throughout) method 1 $n(H_2) = \frac{11.2}{2} = 5.6$ (1) n(Na) = 5.6 × 2 = 11.2 (1) mass Na = 11.2 × 23 = 257.6 (1) method 2 1 mol H_2 produced by 2 mol Na / 2 g H_2 produced by 46 g Na (1) 1 g H_2 produced by 23 g Na (1) 11.2 g H_2 produced by 23 × 11.2 = 257.6 g Na (1)		3		3	3	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ award (2) for correct equation award (1) if $Ca(OH)_2$ formula is correct		2		2		1
				Question 8 total	**4**	**5**	**0**	**9**	**3**	**2**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	0	2	4	6	2	4
2	4	6	1	11	4	4
3	0	6	0	6	0	0
4	3	2	0	5	1	0
5	0	3	3	6	3	0
6	2	2	1	5	0	3
7	6	0	0	6	0	0
8	3	3	3	9	1	3
9	6	0	0	6	0	0
TOTAL	24	24	12	60	11	14

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

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