



GCSE MARKING SCHEME

SUMMER 2019

**GCSE (NEW)
SCIENCE (DOUBLE AWARD) - UNIT 5**

3430U50-1

3430UE0-1

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 5 – CHEMISTRY 2

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)			tightly electrons malleable	3			3		
	(b)	(i)		1-100nm accept any correct indication of the answer different	2			2		
		(ii)		anti-bacterial / anti-fungal / kills bacteria / anti-viral	1			1		
				Question 1 total	6	0	0	6	0	0

Question				Marking details	Marks available																																		
					AO1	AO2	AO3	Total	Maths	Prac																													
2	(a)	(i)		correction 1 – (should be) acid (1) correction 2 – (should be pH) 7 (1) correction 3 – (should be) Na ₂ CO ₃ (1) award credit for correct corrections in any order	1 1	1		3		3																													
		(ii)		<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Chemical Name</th> <th>Chemical formula</th> <th>Colour with Universal Indicator</th> <th>pH</th> <th>Acid, Alkali or Neutral</th> </tr> </thead> <tbody> <tr> <td>Sulfuric acid</td> <td>H₂SO₄</td> <td style="border: 2px solid black;">Green</td> <td>1</td> <td>Acid</td> </tr> <tr> <td>Ethanoic acid</td> <td>CH₃COOH</td> <td>Orange</td> <td>4</td> <td style="border: 1px solid red;">Alkali</td> </tr> <tr> <td>Calcium hydroxide</td> <td>Ca(OH)₂</td> <td>Purple</td> <td>14</td> <td>Alkali</td> </tr> <tr> <td>Water</td> <td>H₂O</td> <td>Green</td> <td style="border: 1px solid red;">5</td> <td>Neutral</td> </tr> <tr> <td>Sodium carbonate</td> <td style="border: 1px solid red;">NaCO₃</td> <td>Blue</td> <td>10</td> <td>Alkali</td> </tr> </tbody> </table> <p style="margin-left: 20px;">error 3</p> <p style="margin-left: 200px;">error 2</p> <p style="margin-left: 200px;">error 1</p> <p>'green' circled</p> <p>do not accept more than one circled</p>	Chemical Name	Chemical formula	Colour with Universal Indicator	pH	Acid, Alkali or Neutral	Sulfuric acid	H ₂ SO ₄	Green	1	Acid	Ethanoic acid	CH ₃ COOH	Orange	4	Alkali	Calcium hydroxide	Ca(OH) ₂	Purple	14	Alkali	Water	H ₂ O	Green	5	Neutral	Sodium carbonate	NaCO ₃	Blue	10	Alkali		1	1		1
Chemical Name	Chemical formula	Colour with Universal Indicator	pH	Acid, Alkali or Neutral																																			
Sulfuric acid	H ₂ SO ₄	Green	1	Acid																																			
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Water	H ₂ O	Green	5	Neutral																																			
Sodium carbonate	NaCO ₃	Blue	10	Alkali																																			
	(b)	(i)		carbon dioxide / CO ₂ (1) barium chloride / BaCl ₂ (1)	2			2		2																													
		(ii)		<u>limewater goes milky</u> accept alternative descriptions to milky e.g. turns white / cloudy	1			1		1																													

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)	(i)	I	C		1		1		
			II	33		1		1	1	
		(ii)		exothermic	1			1		
	(d)	(i)		magnesium sulfate		1		1		
		(ii)		<u>lit splint</u> goes <u>pop</u> accept burning splint do not accept glowing splint	1			1		1
		(iii)	I	Zn ²⁺ and Cl ⁻	1			1		
			II	ZnCl ₂ do not allow ECF from part I		1		1		
				Question 2 total	8	6	0	14	1	8

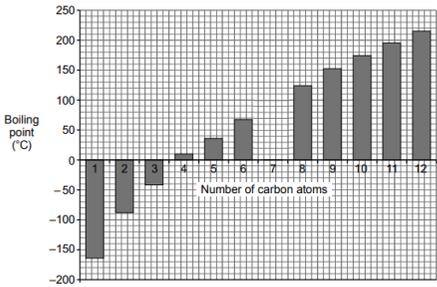
Question				Marking details	Marks available																					
					AO1	AO2	AO3	Total	Maths	Prac																
3	(a)	(i)	I	. Model 2: C-C bond horizontal, H atoms above and below, staggered. Box: <input checked="" type="checkbox"/> . Model 3: C-C bond horizontal, H atoms above and below, eclipsed. Box: <input type="checkbox"/> . Model 4: C-C bond vertical, H atoms to the left and right. Box: <input type="checkbox"/> ."/> <p>accept any correct indication of the answer</p>	1			1																		
			II	<p>covalent ionic giant covalent metallic</p> <p>accept any correct indication of the answer</p>	1			1																		
		(ii)	I	<table border="1"> <thead> <tr> <th>Substance</th> <th>Melting point / °C</th> <th>Electrical conductivity</th> <th>Type of structure</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>2072</td> <td>conducts only when molten</td> <td>(giant) ionic</td> </tr> <tr> <td>B</td> <td>-182</td> <td>does not conduct electricity</td> <td>(simple) molecular</td> </tr> <tr> <td>C</td> <td>1610</td> <td>does not conduct electricity</td> <td>(giant) covalent</td> </tr> </tbody> </table> <p>all three correct</p>	Substance	Melting point / °C	Electrical conductivity	Type of structure	A	2072	conducts only when molten	(giant) ionic	B	-182	does not conduct electricity	(simple) molecular	C	1610	does not conduct electricity	(giant) covalent						
Substance	Melting point / °C	Electrical conductivity	Type of structure																							
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B	-182	does not conduct electricity	(simple) molecular																							
C	1610	does not conduct electricity	(giant) covalent																							
			II	<p>substance B</p>		1		1																		
	(b)			<p>14.28 / 14.3 / 14 award (2) for correct answer</p> <p>award (1) for correct molecular mass of 56 if incorrect answer</p> <p>no ECF if incorrect M_r calculated in first step</p>			2	2	2																	
				Question 3 total	2	4	0	6	2	0																

Question				Marking details				Marks available					
								AO1	AO2	AO3	Total	Maths	Prac
4	(a)			0 1 2 3 4 5 6		1		1					
	(b)			0 – 25% 1 – 19% 19 – 25% 6 – 24%			1	1	1				
	(c)			The alloys all contain at least one metal <input type="checkbox"/> The alloys all contain at least two metals <input type="checkbox"/> The alloys all contain at least three metals <input checked="" type="checkbox"/> The alloys all contain at least four metals <input type="checkbox"/>		1		1					
	(d)			All of the alloys are used for decorative purposes <input type="checkbox"/> All of the gold alloys are used for decorative purposes <input checked="" type="checkbox"/> All of the silver alloys are used for decorative purposes <input type="checkbox"/> None of the silver alloys are used for decorative purposes <input type="checkbox"/>			1	1					
	(e)			0.00198 / 1.98 × 10 ⁻³ / 0.002 award (2) for correct answer award (1) for multiplication by 18 or 5:90 ratio if incorrect answer e.g. 18 × 0.00011 / 5:90 / 90 ÷ 5			2	2	2				
				Question 4 total	0	2	4	6	3	0			

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		10	1			1		
		(ii)		salt petre / KNO ₃ / potassium			1	1	1	
	(b)	(i)		so the <u>ions</u> can <u>move</u> accept reference to the lead/Pb ²⁺ and chloride/Cl ⁻ ions	1			1		1
		(ii)		(because the chloride ions are) negatively charged (1) opposite charges attract (1)	1	1		2		2
		(iii)		(the lead ions) <u>gain electrons</u>		1		1		
		(iv)		$2\text{Cl}^- + 2\text{e}^- \rightarrow 2\text{Cl}$ <input type="checkbox"/> $\text{Cl}^- + \text{e}^- \rightarrow \text{Cl}^{2-}$ <input type="checkbox"/> $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ <input checked="" type="checkbox"/> $\text{Cl}^- + \text{e}^- \rightarrow \text{Cl}$ <input type="checkbox"/> $\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ <input type="checkbox"/> accept any correct indication of answer				1	1	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				<p>Indicative content</p> <ul style="list-style-type: none"> • near a dock / coast – to import the aluminium ore from overseas – because there is no aluminium ore in the UK • near a power station – to negotiate a cheap electricity supply – because of the large amounts used and the high costs • railway links – to be able to easily transport the aluminium • road links – to be able to transport the aluminium and for access for employees • housing area – available workforce nearby • distance from homes – reduce impact of noise pollution <p>AO1 – recalling factors important to location (3) AO2 – application to given example (3)</p> <p>5-6 marks Five or six of the factors are identified and correctly justified, including the need to be near the dock to import the aluminium ore from overseas and the power station to get sufficient electrical power; explanations are detailed and clearly justify why each factor is important for the location <i>There is a sustained line of reasoning which is coherent, relevant, substantiated and logically structured.</i></p> <p>3-4 marks Two or three of the factors are identified and some attempt at justifying their importance; explanations are reasonably detailed but might not justify why the factor is important to the process <i>There is a line of reasoning which is partially coherent, largely relevant, supported by some evidence and with some structure.</i></p> <p>1-2 marks One or two factors listed but little/no attempt at justifying their importance; there is little or no attempt at any explanation <i>There is a basic line of reasoning which is not coherent, largely irrelevant, supported by limited evidence and with very little structure.</i></p> <p>0 marks <i>No attempt made or answer worthy of any credit.</i></p>	3	3		6		
				Question 5 total	6	5	2	13	1	3

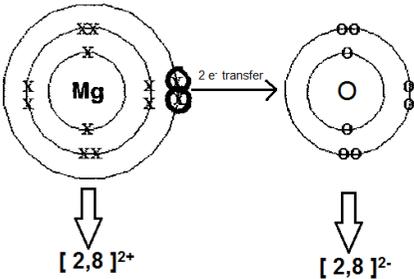
Common questions

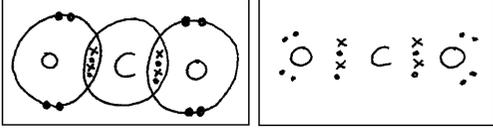
Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6/1	(a)		<p>the <u>larger the molecules / (as the size/fraction) gets bigger</u></p> <ul style="list-style-type: none"> the <u>smokier the flame</u> (1) the <u>more difficult</u> it becomes to <u>burn</u> (1) <p>accept the converse argument</p> <p>correct identification of both properties, without reference to increasing size (1)</p>			2	2		
	(b)	(i)	 <p>all 5 bars correctly plotted with $\pm\frac{1}{2}$ small square tolerance (2) 3 or 4 correct plots (1)</p> <p>accept charts where bars are touching – correct height of each bar to be credited</p>		2		2	2	

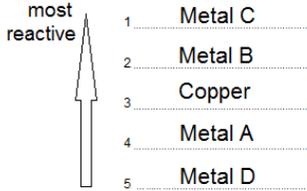
Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Prac	
		(ii)	<p>appropriate straight trend line drawn with ruler, spans across at least 6 bars (1)</p> <p>correct boiling point taken from the trend line (1)</p> <p>award no credit for a curved trend line (but allow ECF for a correct value read from an incorrect trend line)</p> <p>if no trend line drawn, award (1) for a value in the range 85-105</p>			2	2	2		
	(c)	(i)	<p>sand / foam / CO₂ / fire blanket because it removes oxygen</p> <p>both method and explanation needed</p>		1		1			
		(ii)	<p>5CO₂ + 6H₂O</p> <p>correct products (1)</p> <p>correctly balanced (1) – only if correct products given</p>		2		2	1		
		(iii)	<p>does not produce carbon dioxide / sulfur dioxide / only produces water (1)</p> <p>does not contribute to global warming / climate change / acid rain (1)</p>	1	1		2			

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)	<p>temperature (of water) before and after burning (1) mass of fuel and burner before and after burning (1)</p> <p>initial \equiv before \equiv at start final \equiv after \equiv at end</p> <p>temperature rise and change in mass – neutral answers</p> <p>award (1) only for reference to measuring both temperature throughout and mass throughout</p> <p>award (1) for answers that refer to measuring both the temperature and mass either before or after burning only</p>			2	2		2
		(ii)	<p>distance between burner and flame / material or thickness or size of beaker / same size wick / same beaker</p> <p>reference to mass of fuel and mass of water – neutral</p>	1			1		1
		(iii)			1		1	1	
Question 6/1 total				2	7	6	15	6	3

Higher Tier only questions

Question		Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	Prac
2	(a)	 <p>both outer shell electrons of the magnesium shown going to the outer shell of the oxygen (1)</p> <p>electron configuration and charge of magnesium ion (1)</p> <p>electron configuration and charge of oxide ion (1)</p> <p>award (1) for charges of both the magnesium and oxide ions without electron configurations / both configurations of the magnesium and oxide ions without charges</p> <p>accept outer shell electron diagrams only</p>	1	2		3		
	(b)	<p>the <u>charges</u> of the ions in <u>magnesium oxide</u> are <u>greater</u> (than the charges of the ions in sodium chloride) (1)</p> <p>this results in <u>greater attraction / stronger bonds</u> needing <u>more energy</u> to break down the structure (1)</p>	2			2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			 <p>diagram with two shared pairs of electrons in each overlap and complete octets (2)</p> <p>award (1) for overlapping both oxygen outer shells with carbon outer shell with one shared pair in each overlap</p>		2		2		
				Question 2 total	3	4	0	7	0	0

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)			 <p>award (2) for all four correct award (1) if C and B are above copper and A and D are below copper but the order is wrong</p>			2	2		2
	(b)	(i)		(metal) Z → (metal) W		1		1		1
		(ii)		0.1			1	1		1
	(c)			<p>the <u>copper ions</u> / Cu^{2+} ions <u>gain (2) electrons</u> \equiv <u>reduction</u> (1)</p> <p>the <u>zinc atoms</u> / Zn <u>loses (2) electrons</u> \equiv <u>oxidation</u> (1)</p> <p>award (1) for general explanation of both oxidation and reduction without reference to the equation</p> <p>reference to gaining oxygen – neutral</p>		2		2		2
				Question 3 total	0	3	3	6	0	6

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)			0.05 mol (2) award (1) for $\frac{5.23}{106}$ or 0.049 if incorrect answer		2		2	2	2
	(b)	(i)	I	to find out the approximate volume (of acid) needed / to get a rough result so as to save time when carrying out accurate titration	1			1		1
			II	sodium carbonate because less volume of it needed both needed			1	1		1
		(ii)		<u>repeat</u> (the titration) <u>without the indicator</u> (1) 25 cm ³ of Na ₂ CO ₃ (1) 27.65 cm ³ of H ₂ SO ₄ (1) [award (1) for same volume of sodium carbonate <u>and</u> mean volume of sulfuric acid] evaporate the water / leave to evaporate / allow to crystallise (1)	4			4		4
	(c)	(i)		$\text{CuSO}_4 + 2\text{NaOH} \rightarrow \text{Cu(OH)}_2 + \text{Na}_2\text{SO}_4$ <p style="text-align: center;"> 1 mark 1 mark </p> <p>correct reactants (1) correct products (1) correct balancing (1) – only if reactants and products correct ignore state symbols</p>		3		3		

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
		(ii)	sulfate – add <u>barium chloride (solution)</u> and <u>white precipitate</u> (1) sodium – <u>flame test</u> and <u>yellow/orange flame</u> (1) assume ions are implied if correct tests and observations given	2			2		
	(d)		$\text{Mg}^{2+} + \text{CO}_3^{2-} \rightarrow \text{MgCO}_3$ <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="text-align: center;"> $\underbrace{\hspace{10em}}_{1 \text{ mark}}$ </div> <div style="text-align: center;"> $\underbrace{\hspace{5em}}_{1 \text{ mark}}$ </div> </div> correct reactants (1) correct products (1) ignore state symbols and attempt at balancing		2		2		
Question 4 total				7	7	1	15	2	8

Question			Marking details				Marks available					
							AO1	AO2	AO3	Total	Maths	Prac
5	(a)		<p>Its structure contains 32 faces <input checked="" type="checkbox"/></p> <p>Has a relative molecular mass of 60 <input type="checkbox"/></p> <p>Is an allotrope of carbon <input checked="" type="checkbox"/></p> <p>Has a giant ionic structure <input type="checkbox"/></p> <p>is a hydrocarbon compound <input type="checkbox"/></p> <p>It is a smart material <input type="checkbox"/></p> <p>Is 1×10^{25} time smaller than a football <input checked="" type="checkbox"/></p> <p>award (2) for all 3 correct award (1) for any 2 correct</p> <p>award (1) for 3 correct and 1 incorrect if four boxes ticked award (0) for 2 correct and 2 incorrect if four boxes ticked</p>									
	(b)	(i)	<p>90 (2)</p> <p>award (1) for 180 or for the total number of sides on all pentagons or all hexagons i.e. $(12 \times 5) / 60 / (20 \times 6) / 120$</p> <p>no ECF if incorrect number of sides calculated in first step</p>	1	1		2	2				
		(ii)	<p>6.97×10^{-28} (3)</p> <p>award (2) for correct calculation of 0.697 / 0.69655 if incorrect answer award (1) for correct identification of radius as 0.55 if final calculation is totally incorrect award (2) for correct answers using the diameter instead of radius (5.57×10^{-27}) award (1) for answer not given in standard form (5.57) accept correct answers using π value from the calculator</p>	1	2		3	3				

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			large surface area	1			1		
	(d)			do not know the long term effects (of nano-particles)	1			1		
	(e)			<p>good conductor it is similar to graphite / has delocalised electrons / only bonded to three other carbon atoms (1)</p> <p>not good conductor it is (simple) molecular / exists as discrete molecules / delocalised electrons trapped within the ball structure (1)</p> <p>award (1) if both reasons given but not linked to good / not good conductor</p>			2	2		
				Question 5 total	6	3	2	11	5	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
6			<p>Indicative content:</p> <ul style="list-style-type: none"> definition of isomers – having the same molecular formula but different structural formulae C₄H₁₀ represents isomerism in alkanes – dependent on chain length C₄H₈ represents isomerism in alkenes – dependent on position of double bond isomers of C₄H₁₀ naming butane and methylpropane isomers of C₄H₈ naming but-1-ene and but-2-ene <p>5-6 marks Correct definition of an isomer given; clearly explains isomerism in both alkanes and alkenes using the examples given; some isomers named <i>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.</i></p> <p>3-4 marks Attempt at definition of an isomer given; explains isomerism in either an alkane or alkene using one of the examples given <i>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.</i></p> <p>1-2 marks Definition of an isomer given or an example of isomerism shown <i>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.</i></p> <p>0 marks <i>No attempt made or no response worthy of credit.</i></p>	6			6		
			Question 6 total	6	0	0	6	0	0

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	6	0	0	6	0	0
2	8	6	0	14	1	8
3	2	4	0	6	2	0
4	0	2	4	6	3	0
5	6	5	2	13	1	3
6	2	7	6	15	6	3
TOTAL	24	24	12	60	15	14

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	2	7	6	15	6	3
2	3	4	0	7	0	0
3	0	3	3	6	0	6
4	7	7	1	15	2	8
5	6	3	2	11	5	0
6	6	0	0	6	0	0
TOTAL	24	24	12	60	13	17