



GCSE MARKING SCHEME

SUMMER 2018

**GCSE (NEW)
CHEMISTRY - UNIT 1**

3410U10-1

3410UA0-1

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 1: Chemical Substances, Reactions and Essential Resources

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

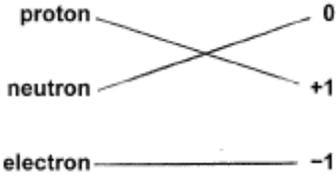
A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide 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.

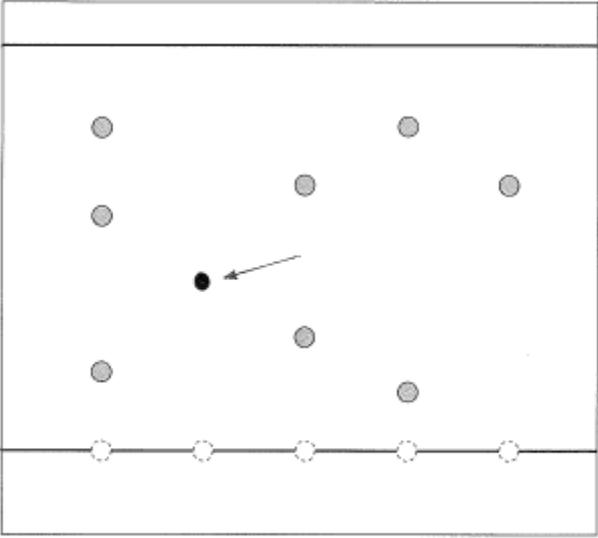
Marking abbreviations

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

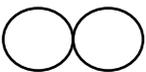
Foundation Tier only questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)			electrons (1) nucleus (1) protons and neutrons – both needed (1)	3			3		
	(b)			 <p>award (2) for all three correct award (1) for any one correct</p>	2			2		
	(c)	(i)		A and B – both needed		1		1		
		(ii)		B		1		1		
		(iii)		C		1		1		
		(iv)		B and D – both needed		1		1		
Question 1 total					5	4	0	9	0	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
2	(a)		chromatography	1			1		1
	(b)	(i)	award (2) for 3 / 3.0 / 3.00 / 2.996 if incorrect award (1) for correct distance moved by solvent front i.e. 7 cm		2		2	2	2
		(ii)	 <p>spot added 3 cm above start line ecf possible from part (i)</p>			1	1		

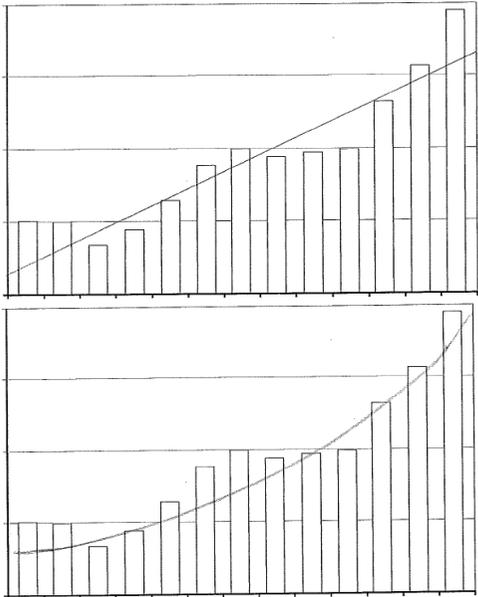
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			C (1) any of following for (1) <ul style="list-style-type: none"> • spot corresponds with that of banned substance • spot at 4.6 cm as it is for banned substance • dye has the same R_f value as the banned substance 			2	2		2
				Question 2 total	1	2	3	6	2	5

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)		method A / distillation (1)	2	1	3			3
				water boils / evaporates (1)						
				vapour condenses (1)						
				award evaporation mark if method C given						
		(ii)		8.6% (2)		2		2	2	
				if incorrect allow (1) for $43 \div 500 / 0.086$						
	(b)			cream / off white (1)	2			2		2
				yellow (1)						
				Question 3 total	4	3	0	7	2	5

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		any two of following argon neon helium accept symbols		1		1		
		(ii)		any two of following nitrogen oxygen ozone hydrogen accept formulae		1		1		
		(iii)		ozone		1		1	1	
	(b)	(i)		methane (1) carbon dioxide (1)		2		2		
		(ii)					1	1		
	(c)	(i)		2	1			1	1	
		(ii)		5	1			1	1	
				Question 4 total	2	5	1	8	3	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
5	(a)		<p>O₂ on products side (1)</p> <p>2 in box (1)</p> <p>balancing mark only awarded if O₂ correct</p>		2		2	1	
	(b)	(i)	catalyst 1 is least effective because it has the lowest volume of gas collected after any given time / has the slowest reaction			1	1		1
		(ii)	<p>all points plotted correctly (2)</p> <p>4/5 points plotted correctly (1) tolerance $\pm \frac{1}{2}$ square</p> <p>curve through points from origin (1)</p> <p>ecf possible if plotting errors</p>		3		3	3	
		(iii)	<p>steeper curve (1)</p> <p>reaching final volume of 80 (1)</p>		2		2	1	2
		(iv)	<p>can replace bung / delivery tube before reaction starts (1)</p> <p>no loss of gas (1)</p>			2	2		2
			Question 5 total	0	7	3	10	5	5

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		16 (2) award (1) for mean of 19 calculated from all three results		2		2	2	
		(ii)	I	calcium carbonate zinc carbonate copper carbonate all three in correct order (1) more stable carbonates takes more time to decompose (1)			2	2		2
			II	the more reactive the metal, the more stable the carbonate			1			
		(iii)		CuO (1) CO ₂ (1)		2		2		
	(b)			123.5 (2) accept 124 award (1) for clear indication that formula includes one Cu, one C and three O atoms		2		2	2	
Question 6 total					0	6	3	9	4	2

Question			Marking details	Marks available						
				AO1	AO2	AO3	Total	Maths	Prac	
7	(a)		 <p>accept straight line or curve similar to examples above</p>			1	1	1		
	(b)		<p>burning <u>more</u> fossil fuels (1)</p> <p><u>more</u> cars / lorries / industry / factories (1)</p> <p>award 1 max for reference to deforestation if no other mark awarded</p>	2			2			

Question		Marking details		Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(c)		any sensible answer e.g. <ul style="list-style-type: none"> • electric / hybrid vehicles • low energy electrical appliances • renewable energy • carbon capture and storage (CCS) 	1			1		
	(d)		Most carbon dioxide is produced by electricity generation <input type="checkbox"/> Between 1900 and 2010 there was a massive increase in industry <input type="checkbox"/> The mean global temperature remained constant between 1950 and 1980 <input checked="" type="checkbox"/> The average number of cars per home has increased steadily since the 1980s. <input type="checkbox"/> The use of energy efficient appliances has increased since 2000 <input type="checkbox"/>			1	1		
Question 7 total				3	0	2	5	1	0

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
8	<p>Indicative content Interpretation of graph less tooth decay in areas that fluoridate their water supplies areas that have fluoridated for longer see more benefit more decay in areas that do not fluoridate decay has fallen in all areas between 2008 and 2012 all areas have less decay in 2012 than the fluoridated area had in 2008</p> <p>Supporting fluoridation decrease DMFT, less money spent on dental treatment</p> <p>Opposing fluoridation graph does not give strong evidence of benefit, fluoride is toxic in high concentrations, can cause fluorosis, other ways of taking fluoride, mass medication</p> <p>5-6 marks Uses the graph and knowledge in support of and in opposition to the fluoridation debate <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 Uses the graph to support fluoridation and some knowledge in support of or in opposition to the debate <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 Uses the graph or some knowledge in support of or in opposition to the fluoridation debate <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>	4		2	6		
	Question 8 total	4	0	2	6	2	0

Common questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/1	(a)	(i)		<p>C (1)</p> <p>all hardness is removed by boiling (1) accept after boiling it only needs the same amount of soap as soft water / water sample A</p> <p>explanation mark only to be awarded if correct sample chosen</p>			2	2		2
		(ii)		both types contain dissolved calcium ions / Ca^{2+} / magnesium ions / Mg^{2+}	1			1		
	(b)			<p>benefits – any of following for (1)</p> <ul style="list-style-type: none"> • stronger teeth • stronger bones • prevents heart disease <p>drawbacks – either of following for (1)</p> <ul style="list-style-type: none"> • causes limescale • forms scum with soap <p>award additional (1) for development of any point e.g. stronger bones linked to calcium ions; limescale linked to furring up / blocking of pipes or decreased efficiency of heating elements</p>	3			3		
				Question 9/1 total	4	0	2	6	0	2

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
10/2	(a)	(i)	51 ±1		1		1	1	1
		(ii)	award (3) for 424 if incorrect answer award (1) for readings of 240 and 28 award (1) for 212 × 2 ecf possible		3		3	3	
		(iii)	water would not be liquid / would be a gas above 100 °C			1	1		
	(b)	(i)	Na ⁺ and K ⁺	1			1		
		(ii)	electron loss (1) one electron from outer shell (1)	2			2		
	(c)		3 KNO ₃ + Al(OH) ₃ → Al(NO ₃) ₃ + 3 KOH		1		1	1	
Question 10/2 total				3	5	1	9	5	1

Question		Marking details		Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
11/3	(a)		<p>award (1) for any of following</p> <ul style="list-style-type: none"> • plates move towards each other • more dense plate forced downwards • more dense plate subducted • mountain ranges form • volcanoes form <p>award (2) for any two linked points e.g. more dense plate subducted causing mountain ranges to form</p>	2			2		
	(b)		<p>cross on any of following boundaries for (1)</p> <ul style="list-style-type: none"> • South American and African • North American and Eurasian • Pacific and Nazca • North American and African <p>gap forms and magma rises to fill the gap / volcano forms / new igneous rock forms (1)</p>	2			2		
	(c)		earthquake	1			1		
Question 11/3 total				5	0	0	5	0	0

Higher Tier only questions

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	(a)	(i)		Na ₂ S ₂ O ₃ accept atoms in any order		1		1	1	
		(ii)		solution in water / dissolved in water	1			1		
		(iii)		sulfur forms as a solid / sulfur is insoluble / sulfur is precipitated (1) solid blocks view of cross (1)	1	1		2		2
	(b)	(i)		the mean of the results collected at 45°C / 24.3 (1) either of following for (1) <ul style="list-style-type: none"> the middle value is very different to the other two / is an anomaly the middle value should not have been used in calculating the mean 			2	2		
		(ii)		the higher temperature the faster the reaction / higher the rate (1) particles have more energy / move faster (1) any of following for (1) <ul style="list-style-type: none"> frequency of collisions increases more collisions per unit time more collisions have minimum required energy more collisions achieve activation energy more collisions are successful 	2		1	3	1	
				Question 4 total	4	2	3	9	2	2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			<p>award (1) each accept C in any of positions shown</p>	1	2		3		
	(b)	(i)		<p>all points plotted correctly (2) tolerance $\pm \frac{1}{2}$ square award (1) for 3/4 correct points</p> <p>line of best fit through the points (1)</p>		3		3	3	
		(ii)		increases as atomic number increases / going down the group		1		1	1	
	(c)			<p>87 (2)</p> <p>if incorrect award (1) for indication that difference between values is 273</p>			2	2	2	
	(d)			<p>inert atmosphere inside light bulbs / inert atmosphere for welding (1)</p> <p>inert / unreactive because it has full outer shell (1)</p>	2			2		
				Question 5 total	3	6	2	11	6	0

Question	Marking details	Marks available					
		AO1	AO2	AO3	Total	Maths	Prac
6	<p>Indicative content limestone / calcium carbonate is heated <u>strongly</u> to convert into quicklime / calcium oxide glows orange / becomes softer left to cool and <u>small</u> amount of water is added to quicklime to produce slaked lime / calcium hydroxide fizzing / hissing / exothermic reaction solid crumbles</p> <p>calcium carbonate → calcium oxide + carbon dioxide $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$</p> <p>calcium oxide + water → calcium hydroxide $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$</p> <p>5-6 marks Gives methods and observations, balanced symbol equations <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 Some details of methods and observations, attempt at symbol equations <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 Some details of method or observations, attempt at word equations <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 No attempt made or no response worthy of credit.</p>	6			6		3
Question 6 total		6	0	0	6	0	3

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		all have 7 electrons in outer shell so need to gain 1 electron (1) reactivity decreases down the group because outer shell becomes further from nucleus / has more shielding (1) therefore becomes more difficult to attract an electron (1)	3			3		
		(ii)		$4 \text{ HF} + \text{SiO}_2 \rightarrow \text{SiF}_4 + 2 \text{ H}_2\text{O}$		1		1	1	
		(iii)		$\text{CaF}_2 + \text{H}_2\text{SO}_4 \rightarrow 2\text{HF} + \text{CaSO}_4$ reactants (1) products (1) balancing (1) award only when reactants are products are correct		3		3	1	
	(b)			mass chlorine = 21.25g (1) $\frac{21.25}{35.5}$ and $\frac{5.45}{27}$ (1) 0.599 : 0.202 ratio 1 : 3 therefore formula AlCl_3 (1) must show working		3		3	3	
				Question 7 total	3	7	0	10	5	0

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)	<p>maximum possible mass = 47.2 (3)</p> <p>if incorrect credit following steps in reacting masses calculation 117 of NaCl gives 46 of Na (1) 120 of NaCl gives $\frac{46}{117} \times 120$ of Na (1)</p> <p>ecf possible</p> <p>accept alternative method using moles $n(\text{NaCl}) = 2051$ (1) $n(\text{Na}) = 2051$ (1)</p> <p>$m = 2051 \times 23 = 47173$ $m = 47.2$ (1)</p> <p>percentage yield = 80.6 / 81 / 80.65 (1)</p> <p>ecf possible</p>						
		(ii)	<p>accept any of following for (1)</p> <ul style="list-style-type: none"> sodium chloride used was impure not all the sodium chloride had reacted side reactions taking place loss of product 	1			1		1
		(iii)	sodium would react with any water present		1		1		1

Question			Marking details	Marks available					
				AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)	<p>6.92 (3) award (2) for value given to any other number of sig figs</p> <p>$(6 \times 7.59) + (7 \times 92.41)$ (1)</p> <p>6.9241 (1)</p> <p>ecf possible following minor slip</p>	1	2		3	3	
		(ii)	the nucleus of lithium-7 contains four neutrons and that of lithium-6 contains three neutrons		1		1		
			Question 8 total	2	8	0	10	7	2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)			award (1) each for any two correct statements e.g. <ul style="list-style-type: none"> both carbonates and nitrates become more stable down the group nitrates are more stable than carbonates range of stabilities is less for carbonates than nitrates magnesium nitrate is far more unstable than the other nitrates 			3	3		
	(b)			heat in boiling tube with delivery tube (1) bubble gas through limewater / limewater turns milky (1) credit appropriate labelled diagram	1	1		2		2
	(c)			$2\text{Ca}(\text{NO}_3)_2 \rightarrow 2\text{CaO} + \text{O}_2 + 4\text{NO}_2$ reactants (1) products (1) balancing (1) award only when reactants are products are correct		3		3	1	
				Question 9 total	1	4	3	8	1	2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)			award (1) each for any three of following <ul style="list-style-type: none"> at low fluoride concentrations decay is high (8 DMFT) but fluorosis is very mild decay decreases rapidly (from 8 to 3 DMFT) as concentration is increased to 1ppm fluorosis is very mild at concentrations below 1ppm but above that increases rapidly at concentrations above 1 the DMFT does not fall much further 			3	3		
	(b)			4 th box studies showed that areas with no fluoridation did not have higher levels of decay than areas that did fluoridate			1	1		
	(c)			3 rd box more than one factor affects levels of decay			1	1		
	(d)			medication given to everyone regardless of whether they need it or not	1			1		
				Question 10 total	1	0	5	6	0	0

FOUNDATION TIER**SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES**

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	5	4	0	9	0	0
2	1	2	3	6	2	5
3	4	3	0	7	2	5
4	2	5	1	8	3	0
5	0	7	3	10	5	5
6	0	6	3	9	4	2
7	3	0	2	5	1	0
8	4	0	2	6	2	0
9	4	0	2	6	0	2
10	3	5	1	9	5	1
11	5	0	0	5	0	0
TOTAL	31	32	17	80	24	20

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	0	2	6	0	2
2	3	5	1	9	5	1
3	5	0	0	5	0	0
4	4	2	3	9	2	2
5	3	6	2	11	6	0
6	6	0	0	6	0	3
7	3	7	0	10	5	0
8	2	8	0	10	7	2
9	1	4	3	8	1	2
10	1	0	5	6	0	0
TOTAL	32	32	16	80	26	12