GCSE MARKING SCHEME

SUMMER 2019

GCSE (NEW)
CHEMISTRY - UNIT 1

3410U10-1
3410UA0-1

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 CHEMISTRY UNIT 1: Chemical Substances, Reactions and Essential Resources

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 QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
1	*(a)*	(i)		**A** and **D** (1) **C** (1)		2		2		
		(ii)	I	2,8	1			1		
			II	10	1			1		
	(b)	(i)		electron (1) neutron (1)	1	1		2		
		(ii)		award (1) for either of following 7 particles in nucleus 3 protons and 4 neutrons (in the nucleus)		1		1		
				Question 1 total	**3**	**4**	**0**	**7**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
2	*(a)*	(i)		distillation	1			1		1
		(ii)		**C B A D**		1		1		1
		(iii)		the boiling point of ethanol is lower than the boiling point of water		1		1		1
	(b)	(i)		award (1) for either of following • contains two pigments / dyes • contains pigment **E** contains one unknown pigment (1)			2	2		2
		(ii)		0.84 (2) award (1) for $\frac{4.2}{5}$ ecf possible		2		2	2	2
				Question 2 total	**1**	**4**	**2**	**7**	**2**	**7**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*	(i)		**D** (1) contains only one **type** of atom (1)	2			2		
		(ii)		**A**		1		1		
		(iii)		C_2H_6		1		1		
	(b)	(i)		copper(II) sulfate + sodium hydroxide → copper(II) hydroxide + sodium sulfate		1		1		1
		(ii)		1		1		1	1	
		(iii)		5		1		1	1	
	(c)			$Fe(OH)_3$		1		1		
				Question 3 total	**2**	**6**	**0**	**8**	**2**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*			**A** constructive **B** destructive **C** conservative award (2) for all three correct award (1) for any one correct	2			2		
	(b)			magma rises / comes through gap (1) (magma / lava) <u>cools</u> to form new (igneous) rock / islands (1) award (1) for any reference to volcanoes if no other mark credited	2			2		
	(c)			earthquakes occur (1) due to plates <u>rubbing</u> together / (build-up of) <u>friction</u> (1)	2			2		
				Question 4 total	**6**	**0**	**0**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*	(i)		decreases			1	1	1	
		(ii)		tin / Sn		1		1	1	
	(b)	(i)		silicon / germanium / Si / Ge	1			1		
		(ii)		they are all found between metals and non-metals	1			1		
	(c)	(i)		carbon + oxygen → carbon dioxide		1		1		
		(ii)		award (1) for any of following • global warming • climate change • rising sea levels • habitat destruction • icecaps melting **quicker** • **more** freak weather conditions • **increased** flooding	1			1		
				Question 5 total	**3**	**2**	**1**	**6**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*	(i)		<table><tr><th></th><th>Mendeleev only</th><th>Today only</th><th>Both tables</th></tr><tr><td>the table is organised into groups</td><td></td><td></td><td>✓</td></tr><tr><td>copper and potassium are in the same group</td><td>✓</td><td></td><td></td></tr><tr><td>there are gaps in the table</td><td>✓</td><td></td><td></td></tr><tr><td>fluorine and chlorine are in the same group</td><td></td><td></td><td>✓</td></tr></table> award (2) for all four correct award (1) for any two or three correct			2	2		
		(ii)		germanium has exactly the same atomic mass as that predicted for ekasilicon ☐ germanium has a different colour to that predicted for ekasilicon ☐ germanium has a similar density to that predicted for ekasilicon ✓ germanium oxide has the same ratio of atoms as that predicted for ekasilicon oxide ✓ germanium oxide and germanium chloride have the same ratio of atoms ☐			1	1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		30.5% / 30.48 % (2) if incorrect award (1) for M_r of 105		2		2	2	
		(ii)		$GeO_2 + 4HCl \rightarrow GeCl_4 + 2H_2O$		1		1	1	
				Question 6 total	**0**	**3**	**3**	**6**	**3**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	*(a)*			**Indicative content** • sedimentation - allows large insoluble particles to settle at the bottom of the tank over a period of time • filtration - removes small insoluble particles by passing the water through beds of sand / filter beds • chlorination - addition of chlorine to kill germs / bacteria / viruses	6			6		

5-6 marks
Complete account of the purpose of all three stages
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 account of two stages
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
Reference to one or two stages
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				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			award (1) for any of following • reduces risk of tooth decay • prevents tooth decay • strengthens tooth enamel award (1) for any of following • toxic in large amounts • fluorosis • stomach cancer • mass medication • removes choice of individual • other sensible answers	2			2		
	(c)			52.5 % / 53% (2) if incorrect award (1) for 84 litres saved		2		2	2	
				Question 7 total	**8**	**2**	**0**	**10**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	*(a)*	(i)		2_{NaCl}		1		1		
		(ii)		an insoluble solid formed during a reaction		1		1		1
		(iii)		all points plotted correctly (2) any four or five points plotted correctly (1) tolerance ±½ small square appropriate smooth curve drawn through points (1)		3		3	3	3
		(iv)		as concentration increases, **time** decreases			1	1	1	
		(v)		as concentration increases, **rate** increases			1	1	1	
	(b)	(i)		as temperature increases, reaction rate increases (1) accept 'as temperature increases, reaction time decreases' curve is steeper at higher temperatures (1) accept 'curve becomes horizontal more quickly at higher temperatures'			2	2	1	2
		(ii)		dirty tube / tube not washed out properly			1	1		1
				Question 8 total	**0**	**5**	**5**	**10**	**6**	**7**

COMMON QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/1	*(a)*	(i)		increases ignore references to sodium/potassium anomaly			1	1	1	
		(ii)		reactivity increases (1) award (1) for either of following • the outer electron gets further from nucleus so it is easier to lose it • there are more shells so it is easier to lose the outer electron	2			2		
	(b)	(i)		award (1) for either of following • small piece of sodium • use tweezers to handle sodium use in fume cupboard (1)	2			2		2
		(ii)		award (2) for correct balanced equation $2Na + Cl_2 \rightarrow 2NaCl$ if incorrect award (1) for NaCl		2		2		
				Question 9/1 total	**4**	**2**	**1**	**7**	**1**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10/2	*(a)*			(thermal) decomposition	1			1		1
	(b)	(i)		it glows	1			1		1
		(ii)		$CaCO_3 \rightarrow CaO + CO_2$ award (1) for $CaCO_3$ award (1) for CaO and CO_2		2		2		
	(c)	(i)		award (1) for any of following • steam released • hissing • expands • crumbles	1			1		1
		(ii)		$CaO + H_2O \rightarrow Ca(OH)_2$ award (1) for CaO and H_2O award (1) for $Ca(OH)_2$		2		2		
				Question 10/2 total	**3**	**4**	**0**	**7**	**0**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
11	*(a)*			award (1) each for up to **two** of following • speeds up a chemical reaction • lowers activation energy • not used up during the reaction doesn't take part in the reaction - neutral answer	2			2		
	(b)	(i)		award (1) for any <u>comparison</u> of active ranges • **A** works in pH range of 0.5-4.5 <u>and</u> **B** works in pH range 3-8 • **A** works at a lower pH range / **B** works at a higher pH range • **A** works over a narrower pH range / **B** works over a wider pH range award (1) for <u>comparison</u> of optimum pH e.g. • **A** works best at pH 2 <u>and</u> **B** works best at pH 5.5 • **A** works best at a lower pH / **B** works best at a higher pH award (1) for <u>comparison</u> of activity at given points • both have the same activity at their optimum pH • both have the same activity at pH 3.75 up to maximum (2)			2	2		
		(ii)		curve drawn rising from pH 5 then falling to pH 9 (1) peak at pH 7 (1)			2	2		
				Question 11 total	**2**	**0**	**4**	**6**	**0**	**0**

HIGHER TIER ONLY QUESTIONS

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
3	*(a)*			award (1) each for up to **two** of following • speeds up a chemical reaction • lowers activation energy • not used up during the reaction doesn't take part in the reaction - neutral answer	2			2		
	(b)	(i)		award (1) for any <u>comparison</u> of active ranges • **A** works in pH range of 0.5-4.5 <u>and</u> **B** works in pH range 3-8 • **A** works at a lower pH range / **B** works at a higher pH range • **A** works over a narrower pH range / **B** works over a wider pH range award (1) for <u>comparison</u> of optimum pH e.g. • **A** works best at pH 2 <u>and</u> **B** works best at pH 5.5 • **A** works best at a lower pH / **B** works best at a higher pH award (1) for <u>comparison</u> of activity at given points • both have the same activity at their optimum pH • both have the same activity at pH 3.75 up to maximum (2)			2	2		
		(ii)		curve drawn rising from pH 5 then falling to pH 9 (1) peak at pH 7 (1)			2	2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			activity increases up to optimum temperature (1) decreases after optimum temperature (1) rate of decrease is more rapid than rate of increase (1) reference to denaturing / lock and key - neutral answers			3	3		
				Question 3 total	**2**	**0**	**7**	**9**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
4	*(a)*			award (1) each for up to **two** of following • similar fossil patterns on different continents • similar rock patterns on different continents • coastlines of continents fit together like a jigsaw he was <u>unable</u> to explain how continents <u>moved</u> / suggested <u>no mechanism for movement</u> (1)	3			3		
	(b)	(i)		plates are moving apart **and** magma rising to fill the gap (1) magma <u>cools</u> to form new igneous rock / ocean floor / ridge / islands (1)	2			2		
		(ii)		rock furthest away from ridge identified as oldest - either left-hand side or right-hand side			1	1		
				Question 4 total	**5**	**0**	**1**	**6**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	*(a)*			suitable scale for y-axis (1) all points plotted correctly (2) any five or six points plotted correctly (1) tolerance ±½ small square appropriate curve through points (1)		4		4	4	4
	(b)			graph extrapolated to enable reading at 65 °C (1) increase in solubility 25.2 – 9.0 = 16.2 g (1) 81 g of crystals formed (1) ecf possible		2	1	3	3	3
				Question 5 total	**0**	**6**	**1**	**7**	**7**	**7**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	*(a)*			hydrogen is a highly reactive gas ☐ only 0.5 ppm of hydrogen is present ☐ hydrogen does not become liquid on cooling to −200 °C ✓ hydrogen has a higher boiling point than helium ☐			1	1		
	(b)			carbon dioxide has a boiling point above −200 °C ☐ carbon dioxide has a melting point above −200 °C ✓ carbon dioxide has a melting point below −200 °C ☐ carbon dioxide has a boiling point below −200 °C ☐			1	1		
	(c)			they have different boiling points (1) nitrogen has lowest boiling point and evaporates first / oxygen has highest boiling point and evaporates last (1) gases collected (at different places on column) in order of boiling points (1)	1	2		3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)			7.53×10^7 (2) if incorrect award (1) for either of following 75 268 817 $\frac{700000}{0.0093}$			2	2	2	
				Question 6 total	**1**	**2**	**4**	**7**	**2**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	*(a)*	(i)		award (1) for any of following • all have 19 protons but 20, 21 and 22 neutrons • all have 19 protons but different numbers of neutrons • all have same number of protons but 20, 21 and 22 neutrons all have same number of protons but different numbers of neutrons - neutral answer ignore references to electrons		1		1		
		(ii)		39.1 (3) 39.13468 (2) award (1) for correct substitution (39 × 93.1) + (40 × 0.0122) + (41 × 6.88)	1	2		3	3	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		award (1) for any **two** similarities • both float • both move • both bubble on surface • both produce hydrogen / gas • both form hydroxides / alkaline solutions award (1) for any **two** differences • potassium melts into ball (but lithium doesn't) • potassium ignites / burns (but lithium doesn't) • potassium bubbles / moves more rapidly (than lithium) • potassium is more reactive (than lithium)	2			2		2
		(ii)		$2K + 2H_2O \rightarrow 2KOH + H_2$ reactants (1) products (1) balancing (1) - reactants and products must be correct for balancing mark to be awarded		3		3		
				Question 7 total	**3**	**6**	**0**	**9**	**3**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	*(a)*			faster reaction / higher rate at higher temperature (1) particles have more energy / move faster at higher temperature (1) award (1) for any of following • more collisions per given time • more frequent collisions • greater chance of collisions • more collisions have energy above activation energy • more successful collisions	3			3		1
	(b)			rate decreases over time (1) due to reactant particles being used up / fewer reactant particles (1)	2			2		1

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			award (1) for improvement and (1) for linked explanation e.g. ensure that the concentration of acid / mass of magnesium is kept the same (1) so that any change in results can only be as a result of changing temperature (1) use gas syringe (1) more precise / easier to read accurately (1) use of balance (1) record loss of mass more accurately than volume of gas (using this apparatus) (1) make repeat measurements (1) calculate mean values which are more accurate (1) accept other sensible answers			2	2		2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(d)	(i)		0.0185 mol of magnesium (1) 1:1 ratio / moles hydrogen produced also 0.0185 mol of hydrogen (1) 0.037 g of hydrogen (1) accept greater number of sig figs ecf possible		3		3	3	
		(ii)		0.0185 × 24 (1) 0.444 dm^3 (1) accept greater number of sig figs ecf possible from *(d)*(i)		2		2	2	
				Question 8 total	**5**	**5**	**2**	**12**	**5**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9				**Indicative content** Observations • sodium iodide turns brown with both chlorine and bromine • sodium bromide turns orange with chlorine • no reaction when iodine is added to sodium chloride or sodium bromide or when bromine is added to sodium chloride Conclusions • chlorine displaces both bromine and iodine from bromide/iodide solutions • chlorine is therefore most reactive • bromine displaces iodine from iodide solution and is therefore more reactive than iodine • more reactive halogens displace less reactive halogens from solution trend in reactivity - chlorine > bromine > iodine Equations • $Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$ • $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$ • $Br_2 + 2NaI \rightarrow 2NaBr + I_2$	4	2		6		4
				5-6 marks Accurate observations and conclusions; good attempt at two equations *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** Two observations and partial conclusion; attempt at one equation *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** One observation and attempt at conclusion *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 9 total	**4**	**2**	**0**	**6**	**0**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	*(a)*	(i)		respiration and combustion use oxygen and produce carbon dioxide whereas photosynthesis uses carbon dioxide and produces oxygen (1) burning more fossil fuels - increase in combustion deforestation - decrease in photosynthesis (1) <u>more</u> heat energy trapped in the atmosphere results in global warming (1)	3			3		
		(ii)		carbon dioxide (produced by power stations / factories) is trapped (1) award (1) for any of following • stored underground e.g. in old oil fields • turned into liquid or solid • reacted with another chemical accept other sensible answers	2			2		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		$\frac{30.4}{14}$ and $\frac{69.6}{16}$ (1) 2.17:4.35 simplest ratio 1:2 (1) NO_2 (1) award max (1) if no working shown no ecf possible		3		3	3	
		(ii)		N_2O_4 (2) if incorrect award (1) for $\frac{92}{46}$ no ecf possible from *(b)*(i)		2		2	2	
				Question 10 total	**5**	**5**	**0**	**10**	**5**	**0**

FOUNDATION TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	3	4	0	7	0	0
2	1	4	2	7	2	7
3	2	6	0	8	2	1
4	6	0	0	6	0	0
5	3	2	1	6	2	0
6	0	3	3	6	3	0
7	8	2	0	10	2	0
8	0	5	5	10	6	7
9	4	2	1	7	1	2
10	3	4	0	7	0	3
11	2	0	4	6	0	0
TOTAL	32	32	16	80	18	20

HIGHER TIER

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	4	2	1	7	1	2
2	3	4	0	7	0	3
3	2	0	7	9	0	0
4	5	0	1	6	0	0
5	0	6	1	7	7	7
6	1	2	4	7	2	0
7	3	6	0	9	3	2
8	5	5	2	12	5	4
9	4	2	0	6	0	4
10	5	5	0	10	5	0
TOTAL	32	32	16	80	23	22