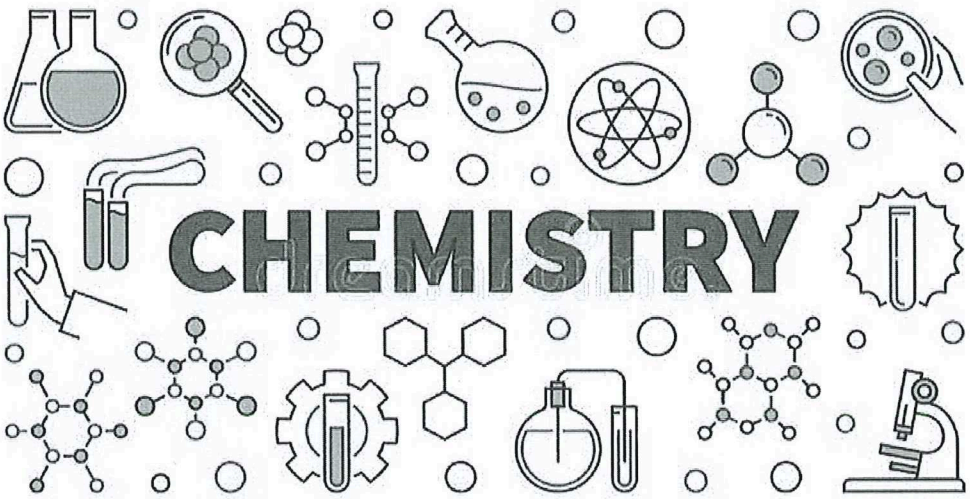


WJEC Chemistry 1

Option – Higher Tier

1.2 Mark Scheme

Common questions

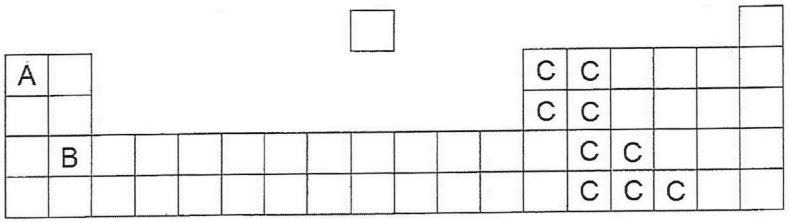
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8/1	(a)			award (1) for every correct answer **A** and **C** both needed, either order **C** **B** **A** **D**	1 1 1	1 1		5		
	(b)	(i)		**3**		1		1		
		(ii)		**4**		1		1		
	(c)			both have 7 protons (and 7 electrons) (1) nitrogen-14 has 7 neutrons and nitrogen-15 has 8 neutrons (1) award (1) for general description of isotopes e.g. same number of protons, different number of neutrons		2		2		
				Question 8/1 total	**3**	**6**	**0**	**9**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)			straight line from anywhere along the top of Li bar to anywhere along the top of Cs bar – *ruler must be used* (1) potassium value further from the line than the sodium value (1) *accept numerical values for each metal*			2	2	2	
	(b)	(i)		similarity: observation (1) ..... reason (1) both float ..... densities less than water / less than 1 both form bubbles / fizz ..... (hydrogen) gas formed both move (about)..... (hydrogen) gas formed do not accept: both melt / ball shape difference: observation (1) ..... reason (1) potassium burns, lithium doesn't..... more exothermic / more reactive potassium moves about more ..... more reactive potassium melts, lithium doesn't ..... lithium has higher melting point neutral answer: potassium reacts more violently	4			4		4
		(ii)		reactants: $Li + O_2$ (1) product: Li_2O (1) balancing: $\mathbf{4}Li + O_2 \rightarrow \mathbf{2}Li_2O$ (1) *only award balancing mark if the formulae of reactants and products are correct*		3		3	1	

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		any three of following for (1) each • potassium's outer shell electron furthest away from nucleus • least attraction / electron most easily lost • chlorine's outer shell closest to nucleus • greatest attraction / electron most easily gained allow (1) for 'reactivity increases down Group 1 and decreases down Group 7' if no other mark awarded	3			3		
				Question 6 total	**7**	**3**	**2**	**12**	**3**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		**A** lithium chloride / LiCl **B** sodium bromide / NaBr **C** potassium iodide / KI all correct for (2) any one correct for (1) if no compound correctly identified, award (1) for three correct metals or (1) for three correct halides ignore incorrect formulae if compound names given			2	2		2
		(ii)		$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$ reactants: $Ag^+ + Cl^-$ (1) product: AgCl (1) state symbols (1) *only award state symbols mark if the formulae of reactants and products are correct*	1	2		3		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)			**W** chlorine / Cl_2 **X** bromine / Br_2 **Y** iodine / I_2 **Z** fluorine / F_2 all correct for (2) any two correct for (1) award (1) if halide ions given instead of halogens		2		2		2
	(c)			reactants **and** products: $Fe + F_2$ **and** FeF_3 (1) balancing: 2 : 3 : 2 (1) *only award balancing mark if the formulae of reactants and products are correct*		2		2	1	
				Question 8 total	**1**	**6**	**2**	**9**	**1**	**4**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			 award (1) each accept **C** in any of positions shown	1	2		3		
	(b)	(i)		all points plotted correctly (2) tolerance ± ½ square award (1) for 3/4 correct points line of best fit through the points (1)		3		3	3	
		(ii)		increases as atomic number increases / going down the group		1		1	1	
	(c)			87 (2) if incorrect award (1) for indication that difference between values is 273			2	2	2	
	(d)			inert atmosphere inside light bulbs / inert atmosphere for welding (1) inert / unreactive because it has full outer shell (1)	2			2		
				Question 5 total	**3**	**6**	**2**	**11**	**6**	**0**

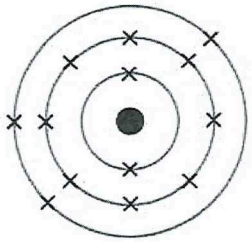
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
7	(a)	(i)		all have 7 electrons in outer shell so need to gain 1 electron (1) reactivity decreases down the group because outer shell becomes further from nucleus / has more shielding (1) therefore becomes more difficult to attract an electron (1)	3			3		
		(ii)		$4\ HF + SiO_2 \rightarrow SiF_4 + 2\ H_2O$		1		1	1	
		(iii)		$CaF_2 + H_2SO_4 \rightarrow 2HF + CaSO_4$ 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
9	(a)			award (1) each for any two correct statements e.g. • 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)			$2Ca(NO_3)_2 \rightarrow 2CaO + O_2 + 4NO_2$ 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**

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
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**

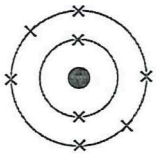
Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)			 accept electrons shown as dots accept diagram with nucleus missing		1		1		
	(b)	(i)		**B** and **D** (1) must be correct to access second mark award (1) for either of following they have same number of protons but different number of neutrons they have same atomic number but different mass number ignore reference to electrons	1	1		2		
		(ii)		**A** and **F** (1) must be correct to access second mark award (1) for any of following they have different numbers of protons and electrons **A** has more electrons than protons and **F** has more protons than electrons neutral answer - they are $\mathbf{A}^-$ and $\mathbf{F}^+$ do not award the mark if there is any suggestion that the number of neutrons is relevant	1	1		2		
				Question 5 total	**2**	**3**	**0**	**5**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
6	(a)	(i)		<table><tr><th>Compound</th><th>Flame test colour</th><th>Symbol of ion</th><th>Observation on adding silver nitrate solution</th><th>Symbol of ion</th></tr><tr><td>S</td><td>brick red</td><td>Ca^{2+}</td><td>yellow precipitate</td><td>I^-</td></tr><tr><td>T</td><td>apple green</td><td>Ba^{2+}</td><td>white precipitate</td><td>Cl^-</td></tr></table> award (1) mark for each correct answer do not accept ions with missing (or incorrect) charges but penalise once only e.g. award (2) if all three ions identified but no charges given award (1) if two ions identified but no charges given	4			4		4
		(ii)		award (1) for any of following the yellow would hide the white precipitate it would look (pale) yellow (like iodide) / cream (like bromide) there would be a mixture of two precipitates it would not be possible to distinguish between the colours			1	1		1
	(b)			$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$ award (1) for ions award (1) for product formula award (1) for state symbols – can only be awarded if ions and product are correct		3		3		
				Question 6 total	**4**	**3**	**1**	**8**	**0**	**5**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)			**Indicative content** • lithium fizzes and moves around the surface of the water • sodium moves faster on the surface, fizzes more and melts into a ball • potassium reacts more vigorously again, melts into a ball and ignites producing a lilac flame • reactions more vigorous on moving down the group • outer electron is lost during the reaction • lost more easily on moving down the group because it is further away from the nucleus / attraction between the nucleus and the outer electron decreases	6			6		3
				5-6 marks Detailed description of reactions; explanation of relative ease of loss of outer electron *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 reactions; reference to loss of outer electron *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** Basic description of some reactions *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)	(i)		18.8 g (3) if answer incorrect credit each correct step in one of two possible methods (ecf possible throughout) method 1 n(K) = $\frac{15.6}{39}$ = 0.4 mol (1) n(K_2O) = $\frac{0.4}{2}$ = 0.2 mol (1) mass K_2O = 0.2 × 94 = 18.8 g (1) method 2 M_r(K_2O) = 94 / mass of 156 (for K)(1) (156 g K produces) 188 g K_2O (1) 15.6 g K produces 18.8 g K_2O (1)		3		3	3	
		(ii)		3.0×10^{22} (2) accept 3×10^{22} if answer incorrect award 1 mark for 0.30×10^{23}		2		2	2	
				Question 9 total	**6**	**5**	**0**	**11**	**5**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10	(a)	(i)		**C** (1) reactivity of halogens decreases down the table / chlorine is the most reactive/ iodine is the least reactive (1) award (1) for any of following chlorine displaces bromine and iodine iodine does not displace bromine or chlorine chlorine reacts with sodium bromide and sodium iodide iodine does not react with sodium bromide or sodium iodide	2		1	3		3
		(ii)		$Cl_2 + 2NaI \rightarrow 2NaCl + I_2$ award (1) for reactants award (1) for products award (1) for balancing - can only be awarded if reactants and products are correct ignore state symbols accept ionic equation $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$				3		
	(b)			$n(Fe) = \frac{7}{56} = 0.125$ (1) $n(Br) = \frac{30}{80} = 0.375$ (1) ratio 1:3 therefore $FeBr_3$ (1) **working must be shown**		3		3	2	
				Question 10 total	**2**	**6**	**1**	**9**	**2**	**3**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9/1	(a)			**A** (1) **B** (1) **F** (1) **D** (1)	1 1	1 1		4		
	(b)					1		1		
	(c)	(i)		number of protons 15 number of neutrons 20 number of electrons 19	3			3		
		(ii)		isotopes	1			1		
				Question 9/1 total	**6**	**3**	**0**	**9**	**0**	**0**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
10/2	(a)	(i)		award (1) for any of following • they have same number of electrons in their outer shell • they have 1 electron in their outer shell • they lose 1 electron when reacting	1			1		
		(ii)		density			1	1		
	(b)	(i)		stored in oil / liquid paraffin do not accept paraffin	1			1		1
		(ii)		sodium hydroxide / NaOH (1) hydrogen / H_2 (1)	2			2		
		(iii)		lithium / Li	1			1		
		(iv)		NaF		1		1		
	(c)	(i)		61 (2) if incorrect award (1) for any of following figures in method or as final answer 114 0.61 / 0.606 10.1 / 10		2		2	2	
		(ii)		mass medication / medical treatment without permission / no choice neutral answers any health problem not needed because it's in toothpaste	1			1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
		(iii)		toothpaste accept mouthwash neutral answers dental products fluoride supplements	1			1		
				Question 10/2 total	**7**	**3**	**1**	**11**	**2**	**1**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
8	(a)	(i)		increases			1	1		
		(ii)		outer shell gets further away (from the nucleus) / there are more shells (1) there is lower attraction for an (incoming) electron / it is harder to gain an electron (1)	2			2		
	(b)			Cl_2 + 2NaBr → Br_2 + 2NaCl award (1) each for formulae Cl_2 NaCl award (1) for balancing only if both formulae are correct		3		3		
	(c)	(i)		3.20		1		1	1	
		(ii)		$\frac{1.27}{63.5}$ $\frac{3.20}{80}$ (1) 0.02 : 0.04 ⇨ 1: 2 ⇨ $CuBr_2$ (1) working **must** be shown ecf possible alternative method percentage composition of **both** elements		2		2	2	2

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
				$\frac{1.27}{4.47} \times 100 = 28\%$ $\frac{3.20}{4.47} \times 100 = 72\%$ (1) for 100 g of compound $\frac{28}{63.5}$ $\frac{72}{80}$ 0.44 : 0.90 ⇨ 1:2 ⇨ $CuBr_2$ (1) ecf possible						
				Question 8 total	**2**	**6**	**1**	**9**	**3**	**2**

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
9	(a)	(i)		potassium / K^+ bromide / Br^- do not accept bromine calcium / Ca^{2+} iodide / I^- do not accept iodine award (3) for all four ions correct award (2) for any two correct award (1) for any one correct			3	3		3
		(ii)		$BaCl_2$		1		1		
	(b)			$Na^+(aq) + NO_3^-(aq) \longrightarrow AgCl(s)$ ☐ $Ag^+(aq) + NO_3^-(aq) + Na^+(aq) + Cl^-(aq) \longrightarrow NaNO_3(s) + AgCl(s)$ ☐ $Ag^+(aq) + NO_3^-(aq) \longrightarrow AgNO_3(s)$ ☐ $Ag^+(aq) + Cl^-(aq) \longrightarrow AgCl(s)$ ✓ $Ag^+(aq) + Cl^-(aq) \longrightarrow NaNO_3(s)$ ☐		1		1		

Question				Marking details	Marks available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			from the equation 552 g of Ag_2CO_3 gives 432 g of Ag (1) 1 g of Ag_2CO_3 gives $\frac{432}{552}$ g of Ag (1) 13.8 g of Ag_2CO_3 $\frac{432}{552} \times 13.8$ g of Ag = 10.8 g (1) ecf possible alternative method moles of Ag_2CO_3 = $\frac{13.8}{276}$ = 0.05 mol (1) 2 mol of of Ag_2CO_3 gives 4 mol of Ag therefore 0.10 mol of Ag produced (1) mass of Ag = n × M_r = 0.10 × 108 = 10.8 g (1) ecf possible second alternative method (applying conservation of mass) percentage of Ag in Ag_2CO_3 = $\frac{216}{276} \times 100 = 78.3\%$ (1) mass of Ag on left-hand side = $\frac{78.3}{100} \times 13.8 = 10.8$ g (1) so 10.8 g of Ag formed (1) ecf possible		3		3	3	
				Question 9 total	**0**	**5**	**3**	**8**	**3**	**3**