

Question number	Answer	Marks	Guidance
1	<i>trend:</i> decreases	1	If trend is wrong you lose all the marks for this part. You could say weaker metallic bonding but this will only score one of the two explanation marks.
	increase in size of atom or more levels in the atom	1	
	weaker attraction by the nucleus for delocalised electrons	1	
2	hydroxides: solubility increases	1	You need to learn these trends. They are almost always asked for. You must state (aq). You cannot just have Ba ²⁺ ions. You could write an ionic equation for this reaction by leaving out the spectator ions Ba ²⁺ (aq) + SO ₄ ²⁻ (aq) → BaSO ₄ (s)
	sulfates: solubility decreases	1	
	add: BaCl ₂ (aq) (or Ba(NO ₃) ₂ (aq))	1	
	with Na ₂ SO ₄ , white precipitate is formed	1	
	NaNO ₃ , no change	1	
	BaCl ₂ + Na ₂ SO ₄ → BaSO ₄ + 2NaCl	1	
3 (a)	<i>hydroxides:</i> solubility increases from Mg to Ba	1	
	<i>sulfates:</i> solubility decreases from Mg to Ba	1	
3 (b)	add hydrochloric acid	1	HNO ₃ or CH ₃ COOH can be allowed but not H ₂ SO ₄ . (HCl gas not allowed.) Ba(NO ₃) ₂ will also be accepted even though it is not the recognised test. If you added the wrong reagent then you cannot get the observation marks. The ionic equation will be accepted too.
	<i>add:</i> BaCl ₂	1	
	MgCl ₂ : no change or no reaction	1	
	MgSO ₄ : white precipitate	1	
	MgSO ₄ + BaCl ₂ → BaSO ₄ + MgCl ₂	1	
3 (c)	reactivity increases down the group	1	
	Ba + 2H ₂ O → Ba(OH) ₂ + H ₂	1	
4 (a)	Antacid OR to neutralise acidity OR	1	Credit suitable reference to indigestion or to laxative or to relief of constipation

	eases indigestion		
4 (b)	<p>M1 Decrease in T decreases the energy of the particles / ions / H⁺ / molecules</p> <p>M2 (also scores M1) Decrease in the number of / less particles / ions / H⁺ / molecules with E ≥ E_{Act} or E ≥ minimum energy to react</p> <p>M3 Few(er) / Less effective / productive / successful collisions</p>	3	In M1 and M2, credit “atoms” but ignore “calcium carbonate”, ignore “calcium”, ignore any ion formula except H ⁺ QoL
4 (c) (i)	<p>Strontium has a higher melting point than barium, because</p> <p>Correct reference to size of cations/proximity of electrons</p> <p>M1 (For Sr) delocalised <u>electrons closer to cations / positive ions / atoms / nucleus</u></p> <p>OR</p> <p><u>cations / positive ions / atoms are smaller</u></p> <p>OR</p> <p><u>cation / positive ion / atom or it has fewer (electron) shells / levels</u></p> <p>Relative strength of metallic bonding</p> <p>M2 (Sr) has <u>stronger</u> attraction between the <u>cations / positive ions / atoms / nucleus and the delocalised electrons</u></p> <p>OR</p> <p><u>stronger metallic</u> bonding (assume argument refers to Sr but accept converse argument for Ba)</p>	2	<p>Ignore general Group 2 statements</p> <p>Penalise M1 if Sr or Ba is said to have <u>more or less</u> delocalised electrons</p> <p>Ignore reference to shielding</p> <p>CE = 0 for reference to molecules or intermolecular forces or covalent bonds</p> <p>Ignore “Van der Waals forces (between atoms)” but penalise if “between molecules”</p>
4 (c) (ii)	$\text{Sr} + 2\text{H}_2\text{O} \rightarrow \text{Sr}(\text{OH})_2 + \text{H}_2$	1	Or multiples
4 (d) (i)	$2\text{Mg} + \text{TiCl}_4 \rightarrow 2\text{MgCl}_2 + \text{Ti}$	1	Or multiples
4 (d) (ii)	It or MgSO ₄ is <u>soluble</u> OR forms a <u>solution</u> (and is washed away) OR <u>dissolves</u>	1	Credit reference to MgSO ₄ being the most soluble Group 2 sulfate. Ignore “disappears”
5 (a) (i)	Increases	1	
5 (a) (ii)	Decreases	1	
5 (a) (iii)	Increases	1	
5 (b)	<p>Calcium has a higher melting point than strontium, because</p> <p>Correct reference to size of cations/proximity of electrons</p>	2	<p>CE = 0 for reference to molecules or intermolecular forces or covalent bonds</p> <p>Ignore “Van der Waals forces (between atoms)” but penalise if between “molecules</p>

	<p>M1 (For Ca) delocalised <u>electron(s) closer to cations / positive ions / nucleus</u> OR <u>cations / positive ions / atoms are smaller</u> OR <u>cation / positive ion / atom or it has fewer (electron) shells / levels</u></p> <p>Relative strength of metallic bonding M2 (For Ca) has <u>stronger attraction between the cations / positive ions / nucleus and the delocalised electron(s)</u> OR <u>stronger metallic bonding</u> (assume argument refers to Ca but accept converse argument for Sr)</p>		<p>Ignore general Group 2 statements Answers must be specific</p> <p>Penalise M1 if Ca or Sr is said to have more or less delocalised electrons</p> <p>Ignore reference to shielding</p>
5 (c) (i)	<p>Sulfuric acid / it contains sulfate ions / SO_4^{2-} OR Sulfuric acid would form a (white) precipitate</p>	1	<p>Do not penalise an additional but incorrect formula for sulfate ion. If only the formula of the sulfate ion is given, it must be correct</p>
5 (c) (ii)	<p>$\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4$ ONLY</p>	1	<p>Ignore state symbols No multiples</p>
6 (a)	<p>Cross between the Na cross and the Mg cross</p>	1	
6 (b)	<p>$\text{Al(g)} \rightarrow \text{Al}^+(\text{g}) + \text{e}^-$ $\text{Al(g)} \text{e}^- \rightarrow \text{Al}^+(\text{g})$ $\text{Al(g)} + \text{e}^- \rightarrow \text{Al}^+(\text{g}) + 2\text{e}^-$</p>	2	<p>One mark for state symbols consequential on getting equation correct. Electron does not have to have the – sign on it Ignore (g) if put as state symbol with e but penalise state symbol mark if other state symbols on e^-</p>
6 (c)	<p>2nd / second / 2 / II</p>	1	<p>Only</p>
6 (d)	<p>Paired electrons in (3)p orbital</p> <p>repel</p>	1 1	<p>Penalise wrong number</p> <p>If paired electrons repel allow M2</p>
6 (e)	<p>Neon/ Ne</p> <p>$1\text{s}^22\text{s}^22\text{p}^6$ / $[\text{He}]2\text{s}^22\text{p}^6$</p>	1 1	<p>No consequential marking from wrong element</p> <p>Allow capital s and p Allow subscript numbers</p>
6 (f)	<p>Decreases</p>	1	<p>CE if wrong</p>

	Atomic radius increases/ electron removed further from nucleus or nuclear charge/ electron in higher energy level/ Atoms get larger/ more shells As group is descended more shielding	1 1	Accept more repulsion between more electrons for M2 Mark is for distance from nucleus Must be comparative answers from M2 and M3 CE M2 and M3 if mention molecules Not more sub-shells
7 (a) (i)	$\text{Ba} + 2\text{H}_2\text{O} \rightarrow \text{Ba}(\text{OH})_2 + \text{H}_2$	1	Ignore state symbols Credit multiples and correct ionic equations
7 (a) (ii)	(Reactivity with water) increase(s) / increasing / increased (down the Group / from Mg to Ba)	1	Accept "greater" or "gets more" or similar words to that effect. Ignore reference to "increase in solubility / gets more soluble"
7 (b)	$\text{Mg}(\text{OH})_2$	1	Accept $\text{Mg}^{2+}(\text{OH})_2$ / $\text{Mg}(\text{HO})_2$ Insist on brackets and correct case
7 (c)	M1 Barium meal / barium swallow / barium enema or (internal) X-ray or to block X-rays M2 BaSO_4 / barium sulfate is insoluble (and therefore not toxic)	2	Accept a correct reference to M1 written in the explanation in M2 , unless contradictory For M2 NOT barium ions NOT barium NOT barium meal and NOT "It" Ignore radio-tracing