

Mark Scheme

Question	Answer	Marks	Guidance
1	B	1	

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2	(a)	$\text{Ba(OH)}_2 + 2\text{HCl} \rightarrow \text{BaCl}_2 + 2\text{H}_2\text{O} \checkmark$	1	ALLOW multiples IGNORE state symbols (even if wrong)
	(b)	<p><i>Increasing size:</i> Atomic radius increases OR more shells OR more (electron) shielding \checkmark</p> <p><i>Attraction</i> Nuclear attraction decreases OR (outer) electron(s) experience less attraction \checkmark</p> <p><i>Ionisation energy</i> Ionisation energy decreases OR less energy needed to remove electron(s) \checkmark</p>	3	<p>FULL ANNOTATIONS WITH TICKS, CROSSES, CON, etc MUST BE USED</p> <p>IGNORE more orbitals OR more sub-shells <i>Alternative must refer to shells</i></p> <p>ALLOW Energy levels for shells</p> <p>ALLOW more electron repulsion between shells IGNORE just 'shielding' (<i>more/greater needed</i>) IGNORE 'nuclear shielding'</p> <p>IGNORE 'pull' for attraction IGNORE 'electrons less tightly held' IGNORE 'nuclear charge' for 'nuclear attraction'</p> <p>IGNORE 'easier to remove electron' <i>Energy is required</i></p> <p>ALLOW less energy to oxidise</p>

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(c)	(i)	<p><i>Disproportionation:</i> oxidation and reduction of the same element ✓</p> <p><i>Redox:</i> Cl is oxidised from +5 (in KClO_3) to +7 (in KClO_4) ✓</p> <p>Cl is reduced from +5 (in KClO_3) to -1 (in KCl) ✓</p>	3	<p>ALLOW 'chlorine' OR 'Cl' for same element IGNORE 'species' for 'element'</p> <p>ALLOW after number, e.g. 5+ IGNORE ionic charges, e.g. Cl^{5+}</p> <p>IGNORE '5' (signs required)</p> <p>IGNORE any reference to electron loss/gain (even if wrong)</p> <p>ALLOW one redox mark if oxidation numbers are correct but reduction/oxidation is incorrectly assigned</p>
	(ii)	potassium chlorate(VII) ✓	1	Brackets required
(d)	(i)	<p><i>Equation</i> $\text{Ba}(\text{NO}_3)_2(\text{aq}) + \text{Na}_2\text{SO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{NaNO}_3(\text{aq})$ ✓</p> <p><i>Entropy change and explanation</i> entropy decreases OR entropy change negative AND (BaSO_4) solid/ppt has less disorder/ more order/ fewer ways of arranging energy/ less freedom/ less random particles/dispersal of energy ✓</p>	2	<p>ALLOW multiples</p> <p>M2 is dependent on $\text{BaSO}_4(\text{s})$ (even if formula is incorrect – eg $\text{Ba}(\text{SO}_4)_2(\text{s})$ seen as a product in the attempted equation as long as reactants are not solid. BaSO_4 solid/ppt may be assumed from $\text{BaSO}_4(\text{s})$ seen in the attempted equation.</p>

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Question		Answer	Marks	Guidance
	(ii)	<p><i>Equation</i> $\frac{1}{2}\text{I}_2(\text{s}) \rightarrow \text{I}(\text{g}) \checkmark$ <i>state symbols required</i></p> <p><i>Entropy change and explanation</i> entropy increases OR entropy change positive AND gas has more disorder/ less order/ more ways of arranging energy/ more freedom/ more random particles / more dispersal of energy \checkmark</p>	2	<p>DO NOT ALLOW $\text{I}_2(\text{s}) \rightarrow 2\text{I}(\text{g})$</p> <p>DEPENDENT on $\frac{1}{2}\text{I}_2(\text{s}) \rightarrow \text{I}(\text{g})$ OR $\text{I}_2(\text{s}) \rightarrow 2\text{I}(\text{g})$</p>
		Total	12	

Mark Schemes

Question	Answer	Marks	AO element	Guidance
3	B	1	AO2.6	
4	B	1	AO1.1	
5	D	1	AO1.2	ALLOW 1 in the answer box