

Question number	Answer	Notes	Marks
1 (a)	copper	ignore symbol reject copper(II) / copper(II) ions / Cu^{2+}	1
(b)	zinc cannot displace itself	Accept zinc cannot react with zinc ions/zinc nitrate Accept the two metals involved have the same reactivity	1
(c)	aluminium zinc M copper M1 – aluminium at top <u>and</u> copper at bottom M2 – zinc above M	award M2 irrespective of where zinc is placed in the list	2

<p>(d) (i)</p>	<p>oxidation <u>and</u> reduction occur OR electron loss <u>and</u> electron gain occur OR oxidation number increase <u>and</u> decrease</p>	<p>reject references to oxygen</p> <p>Accept electron transfer</p> <p>Ignore species involved</p>	<p>1</p>
<p>(ii)</p>	<p>M1 – Ag⁺/silver <u>ion</u>(s)</p> <p>M2 – it gains electron/is reduced OR it takes electrons from Mg/magnesium (atoms) OR its oxidation number decreases OR it causes the oxidation number of Mg to increase</p>	<p>M2 DEP on M1 or near miss, e.g. Ag</p>	<p>1</p> <p>1</p>

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2 (a)	<table border="1"> <thead> <tr> <th>Name of barium salt</th> <th>Formula of barium salt</th> <th>Solubility in water</th> <th>Poisonous</th> </tr> </thead> <tbody> <tr> <td>barium chloride</td> <td>BaCl₂</td> <td></td> <td></td> </tr> <tr> <td>barium nitrate</td> <td></td> <td></td> <td></td> </tr> <tr> <td>barium carbonate</td> <td>BaCO₃</td> <td></td> <td></td> </tr> <tr> <td>barium sulfate</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Name of barium salt	Formula of barium salt	Solubility in water	Poisonous	barium chloride	BaCl ₂			barium nitrate				barium carbonate	BaCO ₃			barium sulfate						1
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(b)	<p>M1 (it forms) barium chloride/BaCl₂/a soluble (barium) salt</p> <p>M2 by reaction/with hydrochloric acid/stomach acid</p>	<p>by neutralisation</p> <p>word or chemical equation for 2 marks (equation can be unbalanced)</p>	any suggestion that barium chloride is reacting	1																				
(c)	barium sulfate/BaSO ₄			1																				

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3 (d)	<p>M1 barium sulfate is formed</p> <p>M2 which is not poisonous/not toxic/harmless IGNORE references to magnesium hydroxide not poisonous</p> <p>M2 dep on M1</p> <p>M3 barium hydroxide + magnesium sulfate → barium sulfate + magnesium hydroxide</p> <p>OR</p> <p>barium ions + sulfate ions → barium sulfate</p>	<p>'products', provided shown correctly in word equation</p> <p>is insoluble</p> <p>$\text{Ba}(\text{OH})_2 + \text{MgSO}_4 \rightarrow \text{BaSO}_4 + \text{Mg}(\text{OH})_2$</p> <p>OR</p> <p>$\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4$</p>		<p>1</p> <p>1</p> <p>1</p>
(e) (i)	<p>M1 water – (reacts) <u>very/extremely</u> quickly/more quickly <u>than strontium</u>/quickest IGNORE rapidly/vigorously</p> <p>M2 air – (reacts) <u>very/extremely</u> quickly/more quickly <u>than strontium</u>/quickest (without heating) IGNORE rapidly/vigorously</p>	<p>explosively/violently</p> <p>explosively/violently</p>		<p>1</p> <p>1</p> <p>1</p>
(ii)	<p>in/under any one of the following: (paraffin/mineral) oil/petroleum (oil)/(liquid) paraffin</p>	<p>in a vacuum</p>		<p>1</p>
(iii)	<p>IGNORE in an air tight container</p> <p>reactivity <u>increases</u> as atomic number <u>increases</u></p>	<p>reactivity increases with atomic number/down the group OWTTE reverse argument</p>		<p>1</p>

		positive correlation		
			Total	12