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

(d)	(i)	oxidation <u>and</u> reduction occur **OR** electron loss <u>and</u> electron gain occur **OR** oxidation number increase <u>and</u> decrease	reject references to oxygen Accept electron transfer Ignore species involved	1
	(ii)	**M1** – Ag^+/silver <u>ion</u>(s)		1
		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	**M2** DEP on **M1** or near miss, e.g. Ag	1

<table>
<tr><th>Question number</th><th>Answer</th><th>Accept</th><th>Reject</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td>
<table>
<tr><th>Name of barium salt</th><th>Formula of barium salt</th><th>Solubility in water</th><th>Poisonous</th></tr>
<tr><td>barium chloride</td><td>$BaCl_2$</td><td></td><td></td></tr>
<tr><td>barium nitrate</td><td></td><td></td><td></td></tr>
<tr><td>barium carbonate</td><td>$BaCO_3$</td><td></td><td></td></tr>
<tr><td>barium sulfate</td><td></td><td></td><td></td></tr>
</table>
</td><td></td><td></td><td>1

1</td></tr>
<tr><td>(b)</td><td>M1 (it forms) barium chloride/$BaCl_2$/a soluble (barium) salt

M2 by reaction/with hydrochloric acid/stomach acid</td><td>by neutralisation

word or chemical equation for 2 marks (equation can be unbalanced)</td><td>any suggestion that barium chloride is reacting</td><td>1

1</td></tr>
<tr><td>(c)</td><td>barium sulfate/$BaSO_4$</td><td></td><td></td><td>1</td></tr>
</table>

Question number	Answer	Accept	Reject	Marks
3 (d)	M1 barium sulfate is formed	'products', provided shown correctly in word equation		1
	M2 which is not poisonous/not toxic/harmless IGNORE references to magnesium hydroxide not poisonous	is insoluble		1
	M2 dep on M1			
	M3 barium hydroxide + magnesium sulfate → barium sulfate + magnesium hydroxide OR barium ions + sulfate ions → barium sulfate	$Ba(OH)_2 + MgSO_4 \rightarrow BaSO_4 + Mg(OH)_2$ OR $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$		1
(e) (i)	M1 water – (reacts) <u>very/extremely</u> quickly/more quickly <u>than strontium</u>/quickest IGNORE rapidly/vigorously	explosively/violently		1
	M2 air – (reacts) <u>very/extremely</u> quickly/more quickly <u>than strontium</u>/quickest (without heating) IGNORE rapidly/vigorously	explosively/violently		1
(ii)	in/under any one of the following: (paraffin/mineral) oil/petroleum (oil)/(liquid) paraffin IGNORE in an air tight container	in a vacuum		1
(iii)	reactivity <u>increases</u> as atomic number <u>increases</u>	reactivity increases with atomic number/down the group OWTTE reverse argument		1

		positive correlation		
			Total	**12**