Chapter 11: Group 2

Homework marking scheme

1 a i As the group is descended the number of electron energy levels increases [1]
so each successive energy level is further from the nucleus. [1]

ii Metallic radius of radium is greater than 0.217 nm. [1]

iii Positive metal cations [1]
in a sea of delocalised electrons. [1]

iv They are good electrical conductors because the delocalised electrons are free to move and carry the current. [1]
If one layer of metal cations slides over another [1]
the resulting structure is identical (and no disruption occurs). [1]

v $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ [1]

vi $1s^2 2s^2 2p^6 3s^2 3p^6$ [1]

b i Both metals react by losing their outer two electrons. [1]
The outer two electrons of strontium are further from the attractive pull of the nucleus [1]
therefore, strontium loses its outer two electrons more easily and is therefore more reactive. [1]

ii $Sr + 2H_2O \rightarrow Sr(OH)_2 + H_2$ [1]

iii The aqueous $Sr(OH)_2$ is a strong alkali and gives OH^- ions in solution. [1]

iv The aqueous $Sr(OH)_2$ reacts with CO_2 to give a precipitate of $SrCO_3$. [1]
$Sr^{2+}(aq) + 2OH^-(aq) + CO_2(g) \rightarrow SrCO_3(s) + 2H_2O(l)$
or
$2OH^-(aq) + CO_2(g) \rightarrow CO_3^{2-}(s)$ [1]

v 0.44 g of Sr = $\frac{0.44}{87.6}$ = 0.005 02 mol [1]
$n(H_2) = n(Sr) = = 0.005\ 02$ mol [1]
volume of hydrogen = $n \times 24 = 0.005\ 02 \times 24\ dm^3 = 0.12\ dm^3 = 120\ cm^3$. [1]

2 a $2Mg(NO_3)_2 \rightarrow 2MgO + 4NO_2 + O_2$
or $Mg(NO_3)_2 \rightarrow MgO + 2NO_2 + ½O_2$
correct symbols [1]
balancing. [1]

b i 0.890 g magnesium nitrate = $\frac{0.890}{148.3}$ = 0.006 mol [1]
$n(O_2) = ½n(Mg(NO_3)_2) = ½ \times 0.006$ mol = 0.003 mol [1]
volume of oxygen = $0.003 \times 24\ dm^3 = 0.072\ dm^3$ (72 cm^3). [1]

ii volume of $NO_2 = 4 \times$ volume of oxygen [1]
= 0.288 dm^3 (288 cm^3). [1]

iii

	$Mg(NO_3)_2$	H_2O
	57.86%	42.14
No. of mol	$\frac{57.86}{148.3} = 0.39$	$\frac{42.14}{18} = 2.34$
Relative number	$\frac{0.39}{0.39} = 1$	$\frac{2.34}{0.39} = 6$

Formula is $Mg(NO_3)_2.6H_2O$ [3]

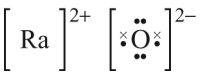
c It would be much harder to decompose. [1]
The nitrates are harder to decompose as the group is descended. [1]

d **i** No reaction would be seen. [1]
The solubility of the metal hydroxides increase as the group is descended. [1]

ii A white precipitate would form. [1]
The solubility of the Group 2 sulfates decrease as the group is descended.
($BaSO_4$ is very insoluble.) [1]

e **i** radium hydroxide [1]
$O^{2-}(g) + H_2O(aq) \rightarrow 2OH^-(aq)$ [1]

ii



radium ion with 2+ charge and with no electrons in outer shell [1]
oxide ion with 2– charge and with eight electrons in outer shell [1]
two of the eight oxide electrons being different to the other six. [1]