

5.2 questions ms

1. (i) $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ (1)
 (ii) $\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$ (1)

[2]

2. *Phosphorus (V) oxide* $\text{P}_4\text{O}_{10} + 6\text{H}_2\text{O} \rightarrow 4\text{H}_3\text{PO}_4$ (1)
Approximate pH 0 (1)
 allow -1 to 0.5
Sulphur dioxide $\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3$ (1)
Approximate pH 3 (1)
 allow 1 to 4

[4]

3. (i) $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$ (1) 1
 (ii) aluminium is protected by an **oxide** layer (1) 1

(iii)

	Sodium oxide	Silicon dioxide	Phosphorus(V) oxide	Sulphur dioxide
Physical state at room temperature	solid	solid	solid	gas

allow abbreviations (s) and (g)

Type of bonding present	ionic	covalent	covalent	covalent
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must give ionic/covalent but ignore additional information about structure

if 8 correct, give 4 marks

if 6 or 7, give 3

if 4 or 5, give 2

if 2 or 3, give 1

4

- (iv) $\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$ (1)
 accept ionic charges (if correct) for Na compounds 1
- (v) $\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3$ (1)
 do **not** accept SH_2O_3
 accept ions on RHS 1
- (vi) silicon dioxide 7 (1)
 phosphorus(v) oxide 0 – 3 (1)
 (must give values) 2

[10]

4.	(a)	ionic (1)		
		O ²⁻ ion reacts with water (1)		
		forming OH ⁻ (or NaOH) (1)		3
	(b)	<i>General type</i>	covalent (1) (or non-metal or molecular)	
		<i>Formula</i>	SO ₂ (1) etc	2
[5]				
5.	(a)	Mg + 2HCl → MgCl ₂ + H ₂		1
		MgO + 2HCl → MgCl ₂ + H ₂ O		1
		<i>Allow ionic equations</i>		
	(b)	Hydrogen collection		1
		Using a gas syringe or measuring cylinder/ graduated vessel over water		
		<i>Allow if shown in a diagram</i>		
		Measurements	(i) P	1
			(ii) T	1
			(iii) V	1
		Use ideal gas equation to calculate mol hydrogen or mass/Mr		1
		Mol H ₂ = mol Mg (Mark consequentially to equation)		1
	(c)	MgCl ₂ + 2NaOH → Mg(OH) ₂ + 2NaCl	Species	1
			Balanced	1
		<i>Allow an ionic equation</i>		
		Mg(OH) ₂ → MgO + H ₂ O		1

(d) *Allow 2 significant figures in these calculations and ignore additional figures*

EITHER

$$\text{Mol MgO obtained stage 2} = \text{mass MgO} / M_r \text{MgO} \quad 1$$

$$= 6.41 / 40.(3) = 0.159 \text{ Allow } 0.16 \quad 1$$

Allow method mark if formula of magnesium oxide or M_r incorrect

Moles of Mg = moles of H_2 hence

$$\text{Mol original MgO} = \text{mol MgO from stage 2} - \text{mol H}_2 \quad 1$$

$$= 0.159 - 0.0528 = 0.106 \text{ Allow } 0.11 \quad 1$$

Mark consequentially to moles of magnesium oxide determined above

OR

$$\text{Mass MgO formed from Mg} = 0.0528 \times M_r \text{MgO} \{ \text{or } 40.(3) \} \quad (1)$$

$$= 2.13 \text{ g} \quad \text{Allow } 2.1 \quad (1)$$

Allow method mark if formula of magnesium oxide or M_r incorrect

$$\text{Mass original MgO} = \text{total mass MgO} - \text{mass formed from Mg} \quad (1)$$

$$= 6.41 - 2.13 = 4.28 \text{ g} \quad \text{Allow } 4.3 \quad (1)$$

Mark consequentially mass of magnesium oxide determined above

[15]

6.

the trend is a decrease in pH (or from alkaline to acid) (1)(can be implied from separate values)

$\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$ product (1) equation (1)

(allow Na^+ OH^- , ignore state symbols)

Na_2O is ionic lattice (1)

(if lattice is not mentioned lose mark only once ie allow ionic for MgO , Al_2O_3)

$\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg}(\text{OH})_2$ product (1) equation (1)

(allow $\text{Mg}^{2+} + 2\text{OH}^-$)

MgO is ionic lattice (1)

MgO sparingly soluble (1)

Al_2O_3 is ionic lattice or covalent macromolecular (1)(if covalent not mentioned lose mark only once)

insoluble in water or no reaction (1)(if formula wrong lose one mark)

SiO_2 is covalent macromolecular (1)(if covalent not mentioned lose mark only once) insoluble in water or no reaction (1)(formula wrong lose 1 mark)

$\text{P}_4\text{O}_{10} + 6\text{H}_2\text{O} \rightarrow 4\text{H}_3\text{PO}_4$ product (1) equation (1)(allow P_2O_5 , P_4O_6 , P_2O_3)

H_3PO_4 is a strong acid or very acidic (1)

P_4O_{10} is covalent molecular (1)(if covalent or molecular not mentioned lose mark once only)

$\text{SO}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_3$ Product (1) equation (1) or $\text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4$

Product (1) equation (1)

H_2SO_3 is a weak acid (1) H_2SO_4 is a strong acid or very acidic (1)

SO_2 is covalent molecular (1) SO_3 is covalent molecular (1)

(Choose the best of the above two answers if both given)

max 19

[19]