5.2 TEST MS

1. (a) (i) *Equation* $Na_2O + H_2O \rightarrow 2NaOH$ **(1)**

pH 11–14 **(1)**

(ii) *Equation* $SO_2 + H_2O \rightarrow H_2SO_3$ **(1)**

pH 2–5 **(1)** 4

(b) Covalent oxides → acidic solutions **(1)**
ionic oxides → alkaline solutions **(1)** 2

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2.

(i) Macromolecular/giant covalent/giant molecular 1

(ii) Silicon/Si 1

(iii) e.g. $CaO + SiO_2 \rightarrow CaSiO_3$ Base 1

Balanced 1

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3. (a) (i) SO_2 1

+4 1

(ii) $4P + 5O_2 \rightarrow 2P_2O_5$ 1

or $P_4 + 5O_2 \rightarrow P_4O_{10}$

(b) (i) B 1

E 1

They have low melting points
or there are weak van der Waals forces between molecules 1

(ii) Add water or heat in a flame 1

Test pH check flame colour 1

13/14 yellow 1

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4. (a) (i) *can form a solution with pH less than 3*: P_4O_{10} or SO_3 **(1)**

(ii) *can form a solution with with a pH greater than 12*: Na_2O **(1)** 2

penalise any wrong answer to zero

(b) (i) $MgO + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$ or an ionic equation **(1)**

i.e. $MgO + 2H^+ \rightarrow Mg^{2+} + H_2O$

not $O^{2-} + 2H^+$ ì H_2O

(ii) $2NaOH + SiO_2 \rightarrow Na_2SiO_3 + H_2O$ or ionic equation **(1)**

i.e. $SiO_2 + 2OH^- \rightarrow 2Na^+ + H_2O$

(iii) $3Na_2O + 2H_3PO_4 \rightarrow 2Na_3PO_4 + 3H_2O$ etc or ionic equation **(1)** 3

i.e. $Na_2O + 2H^+$ ì $2Na^+ + H_2O$

5. (a) (i) NaOH may be shown as ions. Balanced using H_2 or ½ H_2

$2Na + 2H_2O \rightarrow 2NaOH + H_2$ 1

(ii) silicon forms a giant covalent / atomic lattice / has a macromolecular structure / has diamond structure **(1)**

contains many covalent bonds / forms 4 bonds per atom / lattice is strong / the bonding is strong / bonds are strong / silicon is non-polar **(1)** 2

condone 'bond is strong'

(b) (i) SiO_2 / P_2O_5 / P_4O_{10} / P_2O_3 / P_4O_6 / SO_2 / SO_3 / Cl_2O / ClO_2 / Cl_2O_6 / Cl_2O_7 1

(ii) Na_2O / Na_2O_2 / MgO 1

(iii) Al_2O_3 must give formulae 1

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6. (a) (i) Deductions:

Ionic **(1)**
Ions not free to move in the solid state **(1)**
Ions free to move when molten or in aqueous solution **(1)**
Identity of **P**: Na_2O or sodium oxide **(1)**
N.B. If a formula given this must be correct

Equation: $Na_2O + H_2O \rightarrow 2\ NaOH$ **(1)** 5

(ii) Deductions:

Covalent
Intermolecular forces are weak or van der Waals forces, or dipole-dipole
N.B. Any answer including a reference to hydrogen bonding is incorrect

Identity of **Q**: SO_2 or sulphur dioxide **(1)**

Equation: $SO_2 + H_2O \rightarrow H_2\ SO_3$**(1)**
NB Allow max one for SO_3 **4**

(b) (i) Amphoteric **(1)**

(ii) Equation with NaOH

$Al(OH)_3 + NaOH \rightarrow NaAl(OH)_4$

OR $Al(OH)_3(H_2O)_3 + OH^- \rightarrow [Al(OH)_4(H_2O)_2]^- + H_2O$

OR $Al(OH)_3 + OH^- \rightarrow [Al(OH)_4]^-$

R identified as $Al(OH)_3$ or $Al(OH)_3(H_2O)_3$ **(1)**
A balanced equation **(1)**
N.B. Allow equation with six co-ordinate Aluminium and up to six OH^- ligands
N.B. Allow equation mark if $M(OH)_3$ given in a balanced equation

Equation with H_2SO_4

$2Al(OH)_3 + 3H_2SO_4 \rightarrow Al_2(SO_4)_3 + 6H_2O$
OR $Al(OH)_3(H_2O)_3 + H^+ \rightarrow [Al(OH)_2(H_2O)_4]^+ + H_2O$
NB Allow equations with six co-ordinate Aluminium and up to six H_2O ligands
NB Allow equation mark if $H(OH)_3$ given in a balanced equation

Correct Al species as product **(1)**
A balanced equation **(1)**

(iii) Large lattice energy
or strong covalent bonds
or ΔH_{soln} is very positive
or ΔG is very positive
or sum of hydration energies less than covalent bond energies **(1)** 6

[15]

(c) P_4O_{10} is a molecular (structure) or simple covalent **(1)**
Weak <u>intermolecular forces or van der Waals</u> forces (between molecules) **(1)**
SiO_2 is a macromolecule / giant covalent / giant molecule **(1)**
Not giant lattice

(Strong) <u>covalent</u> bonds (between atoms) must be broken **(1)** 4

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