

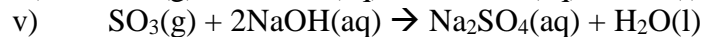
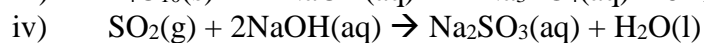
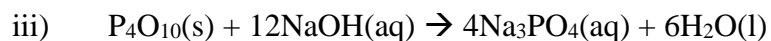
5.2 ANSWERS TO EXERCISES

5.2 Exercise 1

1.
 - a) $2\text{Na(s)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH} + \text{H}_2\text{(g)}$
 - b) $\text{Mg(s)} + \text{H}_2\text{O(g)} \rightarrow \text{MgO(s)} + \text{H}_2\text{(g)}$
2.
 - a) $4\text{Na(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{Na}_2\text{O(s)}$
 - b) $2\text{Mg(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{MgO(s)}$
 - c) $4\text{Al(s)} + 3\text{O}_2\text{(g)} \rightarrow 2\text{Al}_2\text{O}_3\text{(s)}$
 - d) $\text{Si(s)} + \text{O}_2\text{(g)} \rightarrow \text{SiO}_2\text{(s)}$
 - e) $4\text{P(s)} + 5\text{O}_2\text{(g)} \rightarrow \text{P}_4\text{O}_{10}\text{(s)}$
 - f) $\text{S(s)} + \text{O}_2\text{(g)} \rightarrow \text{SO}_2\text{(g)}$

5.2 Exercise 2

1.
 - a) the charges on Mg^{2+} and Al^{3+} are larger than the charge on Na^+
and Mg^{2+} and Al^{3+} are smaller in size than Na^+
so the attraction between Mg^{2+} and O^{2-} , and between Al^{3+} and O^{2-} is
greater than the attraction between Na^+ and O^{2-}
so more energy is needed to separate the ions
 - b) SiO_2 is giant covalent
and much energy is required
to break the covalent bonds between Si and O atoms
 - c) P_4O_{10} and SO_2 are simple molecular
 SiO_2 is giant covalent
Less energy is required to break intermolecular forces between P_4O_{10} or
 SO_2 molecules
Than is required to break covalent bonds between Si and O atoms
 - d) The P_4O_{10} molecules are larger than SO_2 molecules
so the intermolecular forces between P_4O_{10} molecules
are larger than the intermolecular forces between SO_2 molecules
so more energy is required to separate P_4O_{10} molecules than SO_2
molecules
2.
 - a)
 - i) $\text{Na}_2\text{O(s)} + \text{H}_2\text{O(l)} \rightarrow 2\text{NaOH(aq)}$ pH 12 - 14
 - ii) $\text{MgO(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Mg(OH)}_2\text{(s)}$ pH 8 - 9
 - iii) $\text{P}_4\text{O}_{10}\text{(s)} + 6\text{H}_2\text{O(l)} \rightarrow 4\text{H}_3\text{PO}_4\text{(aq)}$ pH 2 - 4
 - iv) $\text{SO}_2\text{(g)} + \text{H}_2\text{O(l)} \rightarrow \text{H}_2\text{SO}_3\text{(aq)}$ pH 2 - 4
 - v) $\text{SO}_3\text{(g)} + \text{H}_2\text{O(l)} \rightarrow \text{H}_2\text{SO}_4\text{(aq)}$ pH 1 - 3
 - b)
 - i) $\text{Na}_2\text{O(s)} + 2\text{HCl(aq)} \rightarrow 2\text{NaCl(aq)} + \text{H}_2\text{O(l)}$
 - ii) $\text{MgO(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{O(l)}$
 - iii) $\text{Al}_2\text{O}_3\text{(s)} + 6\text{HCl(aq)} \rightarrow 2\text{AlCl}_3\text{(aq)} + 3\text{H}_2\text{O(l)}$
 - c)
 - i) $\text{Al}_2\text{O}_3\text{(s)} + 2\text{NaOH(aq)} + 3\text{H}_2\text{O(l)} \rightarrow 2\text{NaAl(OH)}_4\text{(aq)}$
 - ii) $\text{SiO}_2\text{(s)} + 2\text{NaOH(aq)} \rightarrow \text{Na}_2\text{SiO}_3\text{(aq)} + \text{H}_2\text{O(l)}$



d) Na_2O and MgO are basic

they react with water to give solutions with pH greater than 7
and they react with acids.

These oxides are basic because the bonding is ionic.

Al_2O_3 is amphoteric

It reacts with acids and with alkalis

Al_2O_3 is amphoteric because the bonding is intermediate between ionic
and covalent

SiO_2 , P_4O_{10} , SO_2 and SO_3 are acidic

They react with water to give solutions with pH less than 7

And they react with alkalis

These oxides are acidic because the bonding is covalent.