Q1 Chemical reactions and stoichiometry   **[3 + 3 = 6 marks]**

a)   For the following balanced equations write a **net ionic equation**.
   Make sure that you include **states**.

[3 × 1 = 3 marks]

$$2\ Fe(NO_3)_3(aq) + 3\ Na_2CO_3(aq) \rightarrow Fe_2(CO_3)_3(s) + 6\ NaNO_3(aq)$$

$$2\ FeCl_3(aq) + SnCl_2(aq) \rightarrow 2\ FeCl_2(aq) + SnCl_4(aq)$$

$$2\ KI(aq) + Cl_2(l) \rightarrow 2\ KCl(aq) + I_2(g)$$
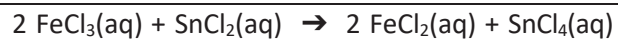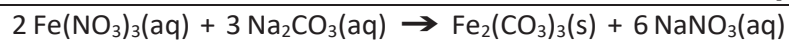
b)   Calculate the volume of 0.300 M $FeCl_3(aq)$ solution needed to react completely with
       20.0 mL of 0.0450 M $AgNO_3(aq)$ solution to give a precipitate of AgCl.
       The net ionic equation is:

$$Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$$

[3 marks]

c)   Sodium hydroxide, NaOH reacts with phosphoric acid, H_3PO_4 to form sodium phosphate, Na_3PO_4, used in food processing, and water.

$$3\ NaOH(aq)\ +\ H_3PO_4(aq)\ \rightarrow\ Na_3PO_4(aq)\ +\ 3\ H_2O(l)$$
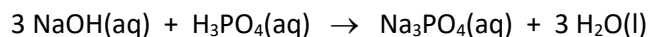
Data: $M_r\ Na_3PO_4$ = 163.94 g mol^{-1} $M_r\ H_3PO_4$ = 97.994 g mol^{-1}
$M_r\ NaOH$ = 39.997 g mol^{-1} $M_r\ H_2O$ = 18.015 g mol^{-1}

i)   Determine the limiting reagent if 35.60 g of NaOH is reacted with 30.80 g of H_3PO_4.

[3 marks]

ii)   Calculate the theoretical yield in grams of Na_3PO_4 when 35.60 g of NaOH is reacted with 30.80 g of H_3PO_4.

[2 marks]

iii)   Calculate the percentage yield of Na_3PO_4 if only 28.50 g Na_3PO_4 is obtained from the reaction.

[1 mark]