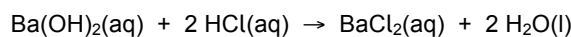1 25.0 cm^3 of 0.200 mol/dm^3 barium hydroxide solution reacted with 22.8 cm^3 of hydrochloric acid. Calculate the concentration of the hydrochloric acid in mol/dm^3. Give your answer to 3 significant figures.
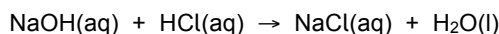
$$Ba(OH)_2(aq) + 2\,HCl(aq) \rightarrow BaCl_2(aq) + 2\,H_2O(l)$$

moles Ba(OH)$_2$ = conc x vol (dm^3) = 0.200 x $\frac{25.0}{1000}$ = 0.00500 mol

moles HCl = 2 x moles of Ba(OH)$_2$ = 2 x 0.00500 = 0.0100 mol

conc HCl = $\dfrac{\text{moles}}{\text{volume (dm}^3)}$ = $\dfrac{0.0100}{\frac{22.8}{1000}}$ = 0.439 mol/dm^3

2 22.5 cm^3 of sodium hydroxide solution reacted with 25.0 cm^3 of 0.100 mol/dm^3 hydrochloric acid.

$$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$$

a) Calculate the concentration of the sodium hydroxide solution in mol/dm^3. Give your answer to 3 significant figures.

moles HCl = conc x vol (dm^3) = 0.100 x $\frac{25.0}{1000}$ = 0.00250 mol

moles NaOH = moles of HCl = 0.00250 mol

conc NaOH = $\dfrac{\text{moles}}{\text{volume (dm}^3)}$ = $\dfrac{0.00250}{\frac{22.5}{1000}}$ = 0.111 mol/dm^3

b) Calculate the concentration of the sodium hydroxide solution in g/dm^3. Give your answer to 3 significant figures.

conc NaOH = 40 x 0.111 = 4.44 g/dm^3

3 What volume of 0.150 mol/dm^3 rubidium hydroxide reacts with 25.0 cm^3 of 0.240 mol/dm^3 nitric acid? Give your answer to 3 significant figures.

$$RbOH(aq) + HNO_3(aq) \rightarrow RbNO_3(aq) + H_2O(l)$$
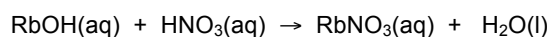
moles HNO$_3$ = conc x vol (dm^3) = 0.240 x $\frac{25.0}{1000}$ = 0.00600 mol

moles RbOH = moles HNO$_3$ = 0.00600 mol

volume RbOH = $\dfrac{\text{moles}}{\text{conc}}$ = $\dfrac{0.00600}{0.150}$ = 0.0400 dm^3

4 25.0 cm^3 of 0.200 mol/dm^3 sodium hydroxide solution reacted with 28.7 cm^3 sulfuric acid. Calculate the concentration of the sulfuric acid in mol/dm^3. Give your answer to 3 significant figures.
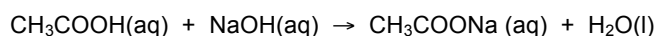
$$2\,NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2\,H_2O(l)$$
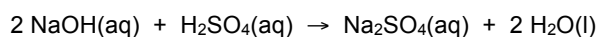
moles NaOH = conc x vol (dm^3) = 0.200 x $\frac{25.0}{1000}$ = 0.00500 mol

moles H$_2$SO$_4$ = $\frac{1}{2}$ x moles of NaOH = $\frac{1}{2}$ x 0.00500 = 0.00250 mol

conc H$_2$SO$_4$ = $\dfrac{\text{moles}}{\text{volume (dm}^3)}$ = $\dfrac{0.00250}{\frac{28.7}{1000}}$ = 0.0871 mol/dm^3

5   25.0 cm^3 of 0.150 mol/dm^3 sodium hydroxide reacted with 30.3 cm^3 of a solution of ethanoic acid.

$$CH_3COOH(aq) + NaOH(aq) \rightarrow CH_3COONa\ (aq) + H_2O(l)$$

a)   Calculate the concentration of the ethanoic acid in mol/dm^3. Give your answer to 3 significant figures.

moles NaOH = conc x vol (dm^3) = 0.150 x $\frac{25.0}{1000}$ = 0.00375 mol

moles CH$_3$COOH = moles NaOH = 0.00375 mol

conc CH$_3$COOH = $\frac{\textbf{moles}}{\textbf{volume (dm}^3)}$ = $\frac{0.00375}{\frac{30.3}{1000}}$ = 0.124 mol/dm^3

b)   Calculate the concentration of the ethanoic acid in g/dm^3. Give your answer to 3 significant figures.

conc CH$_3$COOH =   60 x 0.124 = 7.43 g/dm^3

Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Uses equation for other reactant moles			Does not round too much		
Shows suitable working			Can find concentration of other reagent			Can use sig figs		
Can work out moles from conc & vol			Can convert mol/dm^3 to g/dm^3			Gives units		