

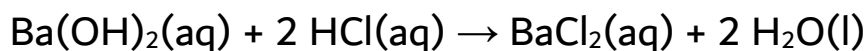
MARK SCHEME

GCSE

CHEMISTRY

Titration - 1

1. 25.0 cm³ of 0.200 mol/dm³ barium hydroxide solution reacted with 22.8 cm³ of hydrochloric acid. Calculate the concentration of the hydrochloric acid in mol/dm³. Give your answer to 3 significant figures.



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

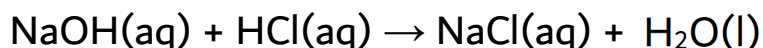
$$\text{moles HCl} = 2 \times \text{moles of Ba(OH)}_2 = 2 \times 0.00500 = 0.0100 \text{ mol}$$

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

$$= 0.439 \text{ mol/dm}^3$$

Answer: 0.439 mol/dm³

2. 22.5 cm³ of sodium hydroxide solution reacted with 25.0 cm³ of 0.100 mol/dm³ hydrochloric acid.



- a) Calculate the concentration of the sodium hydroxide solution in mol/dm³. Give your answer to 3 significant figures.

$$\text{moles HCl} = \text{conc} \times \text{vol (dm}^3) = 0.100 \times 25.0/1000 = 0.00250 \text{ mol}$$

$$\text{moles NaOH} = \text{moles of HCl} = 0.00250 \text{ mol}$$

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

$$= 0.111 \text{ mol/dm}^3$$

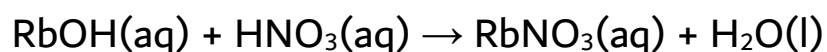
Answer: 0.111 mol/dm³

b) Calculate the concentration of the sodium hydroxide solution in g/dm³. Give your answer to 3 significant figures.

$$\text{conc NaOH} = 40 \times 0.111 = 4.44 \text{ g/dm}^3$$

Answer: 4.44 g/dm³

3. What volume of 0.150 mol/dm³ rubidium hydroxide reacts with 25.0 cm³ of 0.240 mol/dm³ nitric acid? Give your answer to 3 significant figures.



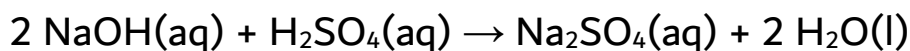
$$\text{moles HNO}_3 = \text{conc} \times \text{vol (dm}^3) = 0.240 \times 25.0/1000 = 0.00600 \text{ mol}$$

$$\text{moles RbOH} = \text{moles HNO}_3 = 0.00600 \text{ mol}$$

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

Answer: 0.0400 dm³

4. 25.0 cm³ of 0.200 mol/dm³ sodium hydroxide solution reacted with 28.7 cm³ sulfuric acid. Calculate the concentration of the sulfuric acid in mol/dm³. Give your answer to 3 significant figures.



$$\text{moles NaOH} = \text{conc} \times \text{vol (dm}^3\text{)} = 0.200 \times 25.0/1000 = 0.00500 \text{ mol}$$

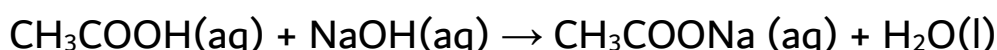
$$\text{moles H}_2\text{SO}_4 = 1/2 \times \text{moles of NaOH} = 1/2 \times 0.00500 = 0.00250 \text{ mol}$$

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

$$= 0.0871 \text{ mol/dm}^3$$

Answer: 0.0871 mol/dm³

5. 25.0 cm³ of 0.150 mol/dm³ sodium hydroxide reacted with 30.3 cm³ of a solution of ethanoic acid.



- a) Calculate the concentration of the ethanoic acid in mol/dm³. Give your answer to 3 significant figures.

$$\text{moles NaOH} = \text{conc} \times \text{vol (dm}^3\text{)} = 0.150 \times 25.0/1000 = 0.00375 \text{ mol}$$

$$\text{moles CH}_3\text{COOH} = \text{moles NaOH} = 0.00375 \text{ mol}$$

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

$$= 0.124 \text{ mol/dm}^3$$

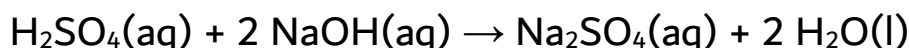
Answer: 0.124 mol/dm³

b) Calculate the concentration of the ethanoic acid in g/dm³. Give your answer to 3 significant figures.

$$\text{conc CH}_3\text{COOH} = 60 \times 0.124 = 7.43 \text{ g/dm}^3$$

Answer: 7.43 g/dm³

6. 25.0 cm³ of a solution of sodium hydroxide solution required 21.5 cm³ of 0.100 mol/dm³ sulfuric acid for neutralisation.



a) Find the concentration of the sodium hydroxide solution in mol/dm³. Give your answer to 3 significant figures.

$$\text{moles H}_2\text{SO}_4 = \text{conc} \times \text{vol (dm}^3) = 0.100 \times 21.5/1000 = 0.00215 \text{ mol}$$

$$\text{moles NaOH} = 2 \times \text{moles of H}_2\text{SO}_4 = 2 \times 0.00215 = 0.00430 \text{ mol}$$

$$\text{conc NaOH} = \text{moles/volume(dm}^3) = 0.00430/25.0/1000$$

$$= 0.172 \text{ mol/dm}^3$$

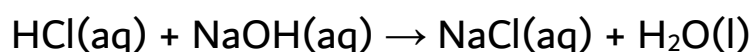
Answer: 0.172 mol/dm³

b) Find the concentration of the sodium hydroxide solution in g/dm³. Give your answer to 3 significant figures.

$$\text{conc NaOH} = 40 \times 0.172 = 6.88 \text{ g/dm}^3$$

Answer: 6.88 g/dm³

7. Find the volume of 1.20 mol/dm³ hydrochloric acid that reacts with 25.0 cm³ of 1.50 mol/dm³ sodium hydroxide. Give



$$\text{moles NaOH} = \text{conc} \times \text{vol (dm}^3) = 1.50 \times 25.0/1000 = 0.0375 \text{ mol}$$

$$\text{moles HCl} = \text{moles of NaOH} = 0.0375 \text{ mol}$$

$$\text{volume HCl} = \text{moles/conc} = 0.0375/0.120 = 0.0313 \text{ dm}^3$$

Answer: 0.0313 dm³