SMART EXAM RESOURCES
SUBJECT: CHEMISTRY
TOPIC:STOICHIOMETRY
SET-2-QP-MS

CALCULATE CONCENTRATION

1 In a titration, 25.0 cm^3 of 0.0800 mol/dm^3 aqueous potassium hydroxide, KOH(aq), is neutralised by 20.0 cm^3 of dilute sulfuric acid, $H_2SO_4(aq)$.

$$2KOH(aq) + H_2SO_4(aq) \rightarrow K_2SO_4(aq) + 2H_2O(l)$$

Calculate the concentration of H_2SO_4, in g/dm^3 using the following steps.

- Calculate the number of moles of KOH used.

..... mol

- Determine the number of moles of H_2SO_4 which react with the KOH.

..... mol

- Calculate the concentration of H_2SO_4 in mol/dm^3.

..... mol/dm^3

- Calculate the concentration of H_2SO_4 in g/dm^3.

..... g/dm^3
[5]

MARK SCHEME:

Question	Answer	Marks
	M1 mol KOH = $0.0800 \times 25 / 1000$ $= 0.002(00) / 2(00) \times 10^{-3}$ M2 mol H_2SO_4 = M1 / 2 = 0.002 / 2 $= 0.001(00) / 1(00 \times 10^{-3}$ M3 = M2 × 1000 / 20 = 0.001 × 1000 / 20 $= 0.05(00) / 5.(00) \times 10^{-2}$ M4 = 98 M5 = 98 × M3 = 98 × 0.05(00) = 4.9(0) (g / dm^3)	5

2 The equation for the reaction is shown.

$$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$$

Calculate the concentration of NaOH(aq) formed, in g / dm^3, when 0.345 g of sodium is added to 50.0 cm^3 of distilled water. Assume there is no change in volume.

Use the following steps.

- Calculate the number of moles of Na added.

= ..... mol

- Determine the number of moles of NaOH formed.

= ..... mol

- Calculate the concentration of NaOH in mol / dm^3.

concentration of NaOH = ... mol / dm^3

- Determine the M_r of NaOH and calculate the concentration of NaOH in g / dm^3.

concentration of NaOH = ... g / dm^3

MARK SCHEME:

M1 mol Na = 0.345 / 23 = 0.015(00) (1) **M2** mol NaOH = M1 = 0.015(00) (1) **M3** M2 × 1000 / 50 = 0.015(00) × 20 = 0.3(00) (1) **M4** M_r NaOH = 40(1) **M5** M4 × M3 = 40 x 0.3= 12.(0) (g / dm^3) (1)	**5**

3 **(ii)** A student found that 2.5 g of zinc carbonate required 20 cm^3 of dilute nitric acid to react completely.

Calculate the concentration of dilute nitric acid using the following steps:

- calculate the mass of 1 mole of $ZnCO_3$

..... g

- calculate the number of moles of $ZnCO_3$ reacting

..... moles

- determine the number of moles of HNO_3 reacting

..... moles

- calculate the concentration of HNO_3.

..... mol/dm^3

[4]

MARK SCHEME:

	M1 125 M2 2.5 / 125 = 0.02(00) M3 0.02(00) × 2 = 0.04(00) M4 0.04(00) × 1000 / 20 = 2(.00)	**4**

4 A 25.0 cm^3 sample of limewater is placed in a conical flask. The concentration of $Ca(OH)_2$ in the limewater is determined by titration with dilute hydrochloric acid, HCl.

The equation for the reaction is shown.

$$Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + 2H_2O$$

20.0 cm^3 of 0.0500 mol/dm^3 HCl reacts with the 25.0 cm^3 of $Ca(OH)_2$.

Determine the concentration of $Ca(OH)_2$ in g/dm^3. Use the following steps.

- Calculate the number of moles in 20.0 cm^3 of 0.0500 mol/dm^3 HCl.

..... mol

- Determine the number of moles of $Ca(OH)_2$ in 25.0 cm^3 of the limewater.

..... mol

- Calculate the concentration of $Ca(OH)_2$ in mol/dm^3.

..... mol/dm^3

- Determine the concentration of $Ca(OH)_2$ in g/dm^3.

..... g/dm^3
[5]

MARK SCHEME:

	M1 Mol HCl = 0.0500 × 20.0 / 1000 = 0.001(00) M2 Mol $Ca(OH)_2$ = M1 / 2 = 0.00100 / 2 = 0.0005(00) M3 M2 × 1000 / 25 = 0.0005(00) × 40 = 0.02(00) M4 M_r $Ca(OH)_2$ = 74 M5 M4 × M3 = 74 × 0.02 = 1.48 (g / dm^3)	**5**

5 **a** Manganese(IV) oxide is added to 20 cm^3 of aqueous hydrogen peroxide. The total volume of oxygen gas produced is 72 cm^3 at r.t.p.

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$

Calculate the concentration of the aqueous hydrogen peroxide in g / dm^3 using the following steps.

- Calculate the number of moles of oxygen gas produced.

..... mol

- Determine the number of moles of hydrogen peroxide which reacts.

..... mol

- Calculate the concentration of aqueous hydrogen peroxide in mol / dm^3.

..... mol / dm^3

- Calculate the concentration of aqueous hydrogen peroxide in g / dm^3.

..... g / dm^3
[5]

b Suggest the identity of one **other** metal oxide which also catalyses this reaction.

..... [1]

MARK SCHEME

a	**M1** mol $O_2 = 72 / 24000 = 0.003(00)$ (1) **M2** mol $H_2O_2 = M1 \times 2 = 0.002 \times 2 = 0.006(00)$ (1) **M3** conc $H_2O_2 = M2 \times 1000 / 20 = 0.006 \times 1000 / 20 = 0.3(00)$ (1) **M4** M_r $H_2O_2 = 34$ (1) **M5** $= M4 \times M3 = 34 \times 0.3 = 10.2\ (g / dm^3)$ (1)	**5**
b	any transition metal oxide	**1**

6 $20.0\,cm^3$ of H_2SO_4 reacts with $25.0\,cm^3$ of $0.200\,mol/dm^3$ NaOH.

The equation for the reaction is shown.

$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$$

Calculate the concentration of H_2SO_4 using the following steps.

- Calculate the number of moles in $25.0\,cm^3$ of $0.200\,mol/dm^3$ NaOH.

..... mol

- Determine the number of moles of H_2SO_4 that react with the NaOH.

..... mol

- Calculate the concentration of H_2SO_4.

..... mol/dm^3
[3]

MARK SCHEME

	0.005 / 5 × 10^{-3} (1) 0.0025 / 2.5 × 10^{-3} (1) 0.125 (1)	**3**