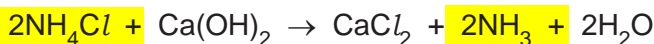


**GCSE Chemistry A (Gateway Science)**  
**J248/04** Chemistry A C4-C6 and C7 (Higher Tier)

**Question Set 10**

- 1 (a) In an experiment, a mixture of ammonium chloride and calcium hydroxide is heated.

Ammonia gas,  $\text{NH}_3$ , is made.



A student adds 5.00 g of ammonium chloride to an excess of calcium hydroxide.

Calculate the maximum volume of ammonia gas that could be made at room temperature and pressure.

One mole of a gas occupies  $24 \text{ dm}^3$  at room temperature and pressure.

$$\text{Mr of } \text{NH}_4\text{Cl} = 14 + 4 + 35.5 = 53.5$$

$$\text{mass} = \text{Mr} \times \text{mol} \quad \text{mol } \text{NH}_4\text{Cl} = \frac{\text{mass}}{\text{Mr}} = \frac{5}{53.5} = 0.093 \text{ mol}$$

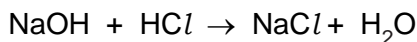
$$\text{molar ratio} = 2:2 \quad \therefore 0.093 \text{ mol ammonia}$$

$$1 \text{ mol} = 24 \text{ dm}^3$$

$$0.093 = 2.24 \text{ dm}^3$$

$$\text{Volume of ammonia gas} = \dots\dots\dots 2.24 \dots\dots\dots \text{ dm}^3 \quad [2]$$

- (b) In another experiment a student reacts sodium hydroxide solution with dilute hydrochloric acid.



- (i)  $35.0 \text{ cm}^3$  of  $0.075 \text{ mol/dm}^3$  hydrochloric acid,  $\text{HCl}$ , are added to  $25.0 \text{ cm}^3$  of  $0.100 \text{ mol/dm}^3$  sodium hydroxide solution,  $\text{NaOH}$ .

(see end of paper)

Use the information to determine which reactant is in excess. [3]

- (ii) To find the exact amount of dilute hydrochloric acid that reacts with  $25.0 \text{ cm}^3$  of the sodium hydroxide solution, the student does a titration.

Look at the student's results. The rough titration is **not** shown.

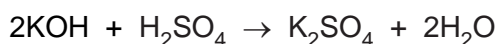
	Titration 1	Titration 2	Titration 3	Titration 4
Final burette reading ( $\text{cm}^3$ )	36.30	38.60	39.25	38.30
Initial burette reading ( $\text{cm}^3$ )	0.00	2.80	4.05	2.10
Volume of acid used ( $\text{cm}^3$ )	36.30	35.80	35.20	36.20

Use the student's concordant results to calculate the mean volume of hydrochloric acid required.

$$\frac{36.3 + 36.2}{2} = 36.25$$

$$\text{Mean volume} = \dots\dots\dots 36.25 \dots\dots\dots \text{ cm}^3 \quad [2]$$

- (c) In another titration  $25.0 \text{ cm}^3$  of potassium hydroxide solution, KOH, are titrated with  $0.200 \text{ mol/dm}^3$  sulfuric acid,  $\text{H}_2\text{SO}_4$ .



$$C = m/V$$

$24.80 \text{ cm}^3$  of sulfuric acid are needed to neutralise  $25.0 \text{ cm}^3$  of the potassium hydroxide solution.

- Calculate the concentration of the potassium hydroxide solution in  $\text{mol/dm}^3$ .

	$2\text{KOH}$	+	$\text{H}_2\text{SO}_4$	
C	$= 0.00992 \div \frac{25}{1000}$ $= 0.3968$ (3)		$0.2 \text{ m}$	*note molar ratios
m	$0.00496$ $\times 2$ (2)		$= 0.2 \times \frac{24.8}{1000} = 0.00496$ (1)	
V	$\frac{25}{1000}$		$\frac{24.8}{1000}$	

Concentration = .....  $0.3968$  .....  $\text{mol/dm}^3$  [4]

### Total Marks for Question Set 10: 11

bi)  $C = m/V \therefore m = CV$

$$\text{mol of HCl} = 0.075 \times \frac{35}{1000} = 0.002625$$

$$\text{mol of NaOH} = 0.1 \times \frac{25}{1000} = 0.0025$$

molar ratio is 1:1

so, HCl is in excess as  $0.002625 > 0.0025$



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