IGCSE CHEMISTRY • EXERCISE SHEET

3.3 The mole and the Avogadro constant

Name: _____ Class: _____ Date: _____ **Total: 13 marks**

Objective

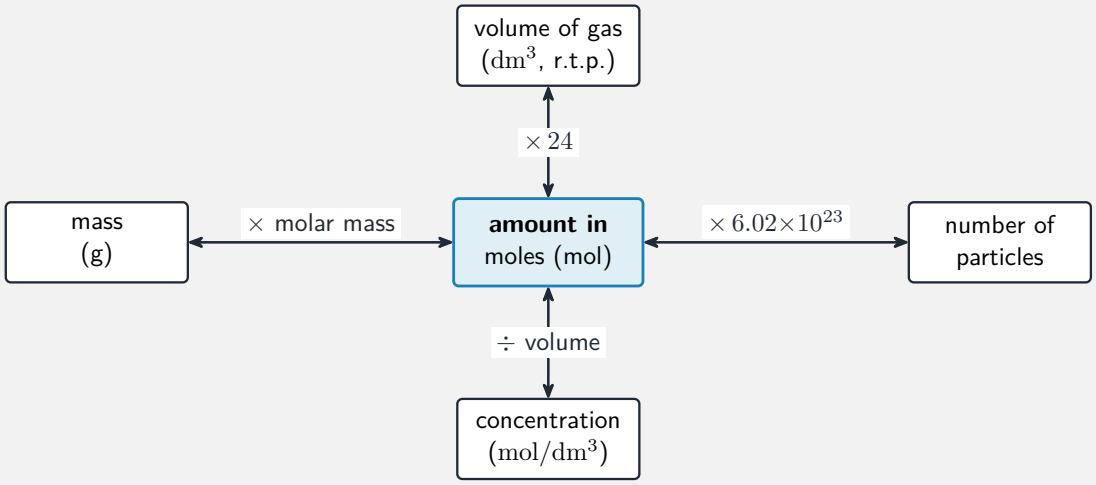
Build the skills to answer exam questions on **the mole** 摩尔—$n = \dfrac{\text{mass}}{M_r}$, gas volumes, **concentration** 浓度, reaction calculations, and the **limiting reactant** 限量反应物.

You must be able to:

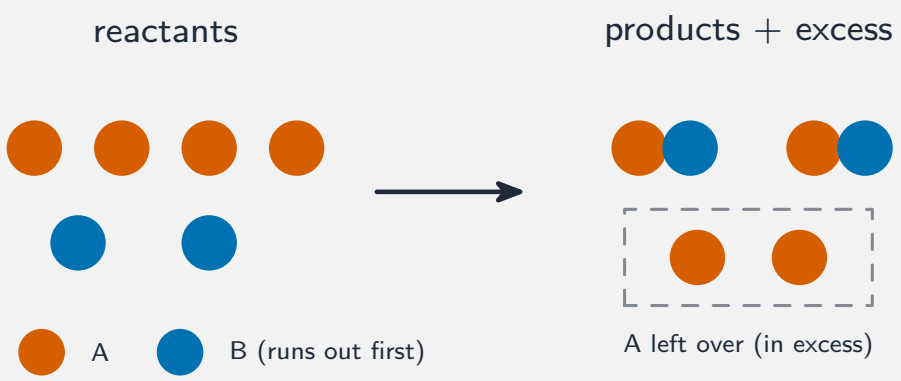
- use $n = \dfrac{\text{mass}}{M_r}$ and the molar gas volume (24 dm^3)
- use $c = \dfrac{n}{V}$ and do reacting-mass / titration calculations
- find the limiting reactant and an empirical formula

1 Worked examples

■ Mole calculations



$$n = \frac{mass}{M_r};\ volume\ of\ gas = n \times 24\ dm^3;\ c = \frac{n}{V}$$



The limiting reactant runs out first and sets how much product forms

36 **g water:** $n = \dfrac{36}{18} = 2$ mol.

2 Practice

2.1 Find the amount (in mol) in 8.0 g of NaOH ($M_r = 40$). [2]

2.2 Find the volume of 0.50 mol of a gas at r.t.p. [2]

3 Exam-style questions

3.1 The number of moles in 22 g of CO_2 ($M_r = 44$) is: [1]

- **A** 0.25
- **B** 0.50
- **C** 1.0
- **D** 2.0

3.2 Magnesium burns: $2Mg + O_2 \rightarrow 2MgO$ (A_r: Mg = 24, O = 16).

(a) Find the moles in 12 g of magnesium. [1]

(b) Find the mass of magnesium oxide formed. [3]

3.3 25.0 cm^3 of sodium hydroxide is neutralised by 20.0 cm^3 of 0.10 mol/dm^3 HCl. $NaOH + HCl \rightarrow NaCl + H_2O$.

(a) Find the moles of HCl. [2]

(b) Find the concentration of the sodium hydroxide. [2]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **3.3 The mole and the Avogadro constant** past-paper sheet in the Library, or try these in **Practice mode**:

- 0620/21 N25 —Q10 (mole calculation)
- 0620/21 N25 —Q11 (reacting masses)

Solutions

2.1 $n = \dfrac{8.0}{40} = 0.20$ mol.

2.2 $V = 0.50 \times 24 = 12$ dm^3.

3.1 B. $n = \dfrac{22}{44} = 0.50$ mol.

3.2 (a) $n = \dfrac{12}{24} = 0.50$ mol.
(b) ratio Mg : MgO is 1 : 1, so 0.50 mol MgO; $M_r(\text{MgO}) = 40$; mass $= 0.50 \times 40 = 20$ g.

3.3 (a) $n = 0.10 \times \dfrac{20.0}{1000} = 0.0020$ mol.
(b) ratio 1 : 1, so 0.0020 mol NaOH in 25.0 cm^3; $c = \dfrac{0.0020}{25.0/1000} = 0.080$ mol/dm^3.