3 Rearranging equations and calculating concentrations

3.1 Rearranging equations

In chemistry, you sometimes need to rearrange an equation to find the desired values.

For example, you may know the amount of a substance (*n*) and the mass of it you have (*m*), and need to find its molar mass (*M*).

The amount of substance (*n*) is equal to the mass you have (*m*) divided by the molar mass (*M*):

$$n = \frac{m}{M}$$

You need to rearrange the equation to make the molar mass (*M*) the subject.

Multiply both sides by the molar mass (*M*):

$$M \times n = m$$

Then divide both sides by the amount of substance (*n*):

$$m = \frac{m}{N}$$

Practice questions

1 Rearrange the equation $c = \frac{n}{V}$ to make:

a *n* the subject of the equation

b *V* the subject of the equation.

2 Rearrange the equation $PV = nRT$ to make:

a *n* the subject of the equation

b *T* the subject of the equation.

3.2 Calculating concentration

The concentration of a solution (a solute dissolved in a solvent) is a way of saying how much solute, in moles, is dissolved in 1 dm^3 or 1 litre of solution.

Concentration is usually measured using units of mol dm^{-3}. (It can also be measured in g dm^3.)

The concentration of the amount of substance dissolved in a given volume of a solution is given by the equation:

$$c = \frac{n}{V}$$

where *n* is the amount of substance in moles, *c* is the concentration, and *V* is the volume in dm^3.

The equation can be rearranged to calculate:

- the amount of substance *n*, in moles, from a known volume and concentration of solution
- the volume *V* of a solution from a known amount of substance, in moles, and the concentration of the solution.

Practice questions

3 Calculate the concentration, in mol dm^{-3}, of a solution formed when 0.2 moles of a solute is dissolved in 50 cm^3 of solution.

4 Calculate the concentration, in mol dm^{-3}, of a solution formed when 0.05 moles of a solute is dissolved in 2.0 dm^3 of solution.

5 Calculate the number of moles of NaOH in an aqueous solution of 36 cm^3 of 0.1 mol dm^{-3}.