

Exercise walk-through

Solutions and Mixtures ■ 3.7

eXercise

You must be able to

- define **solute** 溶质, **solvent** 溶剂, and **solution** 溶液
- calculate **molarity** 摩尔浓度 $M = \frac{\text{mol solute}}{\text{L solution}}$
- find moles or mass from a molarity

Method — Solute, solvent, solution

A **solute** dissolves in a **solvent** to make a **solution**. In salt water, salt is the solute and water the solvent.

Method — Molarity

$$M = \frac{\text{moles of solute}}{\text{litres of solution}}.$$

Dissolving 0.5 mol in 2.0 L gives $\frac{0.5}{2.0} = 0.25$ M.

Method — Finding moles from molarity

Rearrange: $\text{mol} = M \times V(\text{L})$. In 0.50 L of 2.0 M solution there are $2.0 \times 0.50 = 1.0$ mol.

Method — From mass to molarity

Convert mass to moles first ($n = m/M_{\text{molar}}$), then divide by volume. 11.7 g of NaCl ($M_{\text{molar}} = 58.5$) is 0.20 mol; in 0.50 L that is 0.40 M.

Practice 2.1 ■ 2 marks

Find the molarity of 0.40 mol dissolved in 2.0 L.

Solution 2.1

Worked steps

$$M = \frac{0.40}{2.0} = 0.20 \text{ M} \quad \text{M1} \quad \text{A1}.$$

Practice 2.2 ■ 2 marks

How many moles are in 0.25 L of a 1.2 M solution?

Solution 2.2

Worked steps

$$\text{mol} = 1.2 \times 0.25 = 0.30 \text{ mol} \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 2 marks

Identify the solute and solvent in a copper sulfate solution.

Solution 2.3

Method: Solute, solvent, solution

Worked steps

Solute: copper sulfate; solvent: water **B1** **B1**.

Exam-style 3.1 ■ 1 mark

Molarity is defined as

- A** mol solute per kg solvent
- B** mol solute per L solution
- C** g solute per L solution
- D** L solution per mol solute

Solution 3.1

A mol solute per kg solvent

B mol solute per L solution 

C g solute per L solution

D L solution per mol solute

Worked steps

B — mol solute per litre of solution.

Exam-style 3.2 ■ 3 marks

A solution is made by dissolving 0.50 mol of KCl in enough water to make 250 mL.

- (a) Find the molarity.
- (b) How many moles are in 50 mL of this solution?

Solution 3.2

Method: Molarity

Worked steps

(a) $250 \text{ mL} = 0.250 \text{ L}$; $M = \frac{0.50}{0.250} = 2.0 \text{ M}$ **M1 M1 A1**. (b) $\text{mol} = 2.0 \times 0.050 = 0.10 \text{ mol}$ **M1 A1**.

Exam-style 3.3 ■ 3 marks

What mass of NaOH ($M_{\text{molar}} = 40.0 \text{ g/mol}$) is needed to make 500 mL of a 0.20 M solution?

Solution 3.3

Method: From mass to molarity

Worked steps

$\text{mol} = 0.20 \times 0.500 = 0.10 \text{ mol}$ **M1**; $\text{mass} = 0.10 \times 40.0 = 4.0 \text{ g}$ **M1** **A1**.