

Exercise walk-through

Moles and Molar Mass ■ 1.1

eXercise

You must be able to

- use the **mole** 摩尔 as a fixed count, 6.022×10^{23} particles (**Avogadro's number** 阿伏伽德罗常数)
- use the **molar mass** 摩尔质量 (g/mol) to convert between grams and moles
- convert with $n = \frac{m}{M}$, and moles to particles by multiplying by Avogadro's number
- find the molar mass of a compound by adding atomic masses

Method — Moles from mass

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

36 g of water ($M = 18 \text{ g/mol}$) is $n = 36/18 = 2 \text{ mol}$.

Method — Molar mass of a compound

Add the atomic masses. For H_2O : $2(1) + 16 = 18 \text{ g/mol}$. For CO_2 :
 $12 + 2(16) = 44 \text{ g/mol}$.

Method — Moles to particles

Multiply by Avogadro's number: 2 mol is $2 \times 6.022 \times 10^{23} \approx 1.2 \times 10^{24}$ molecules.

Practice 2.1 ■ 2 marks

How many moles are in 44 g of CO_2 ($M = 44 \text{ g/mol}$)?

Solution 2.1

Worked steps

$$n = m/M = 44/44 = 1 \text{ mol} \quad \text{M1} \quad \text{A1}.$$

Practice 2.2 ■ 2 marks

Find the molar mass of water, H_2O ($\text{H} = 1$, $\text{O} = 16$).

Solution 2.2

Worked steps

$$2(1) + 16 = 18 \text{ g/mol} \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 2 marks

Find the mass of 3 mol of carbon atoms ($M = 12 \text{ g/mol}$).

Solution 2.3

Worked steps

$$m = nM = 3 \times 12 = 36 \text{ g} \quad \text{M1} \quad \text{A1}.$$

Practice 2.4 ■ 1 mark

State the number of particles in one mole.

Solution 2.4

Method: Moles to particles

Worked steps

$$6.022 \times 10^{23} \text{ (B1) .}$$

Exam-style 3.1 ■ 1 mark

One mole of any substance contains

- A** 1000 particles
- B** 6.022×10^{23} particles
- C** 6.022×10^{-23} particles
- D** 12 particles

Solution 3.1

A 1000 particles

B 6.022×10^{23} particles



C 6.022×10^{-23} particles

D 12 particles

Worked steps

B — a mole is Avogadro's number of particles.

Exam-style 3.2 ■ 1 mark

The molar mass of CO_2 ($\text{C} = 12$, $\text{O} = 16$) is

A 28 g/mol

B 44 g/mol

C 12 g/mol

D 60 g/mol

Solution 3.2

Method: Molar mass of a compound

A 28 g/mol

B 44 g/mol



C 12 g/mol

D 60 g/mol

Worked steps

B — $12 + 2(16) = 44$ g/mol.

Exam-style 3.3 ■ 2 marks

A sample contains 88 g of CO_2 ($M = 44 \text{ g/mol}$).

(a) Find the number of moles.

(b) Find the number of molecules (use 6.022×10^{23}).

Solution 3.3

Method: Moles to particles

Worked steps

(a) $n = 88/44 = 2 \text{ mol}$ **M1** **A1**. (b) $2 \times 6.022 \times 10^{23} = 1.2 \times 10^{24} \text{ molecules}$
M1 **A1**.

Exam-style 3.4 ■ 2 marks

A student needs 0.5 mol of NaCl ($M = 58.5 \text{ g/mol}$).

- (a) Find the mass required.
- (b) State the units of molar mass.

Solution 3.4

Method: Molar mass of a compound

Worked steps

(a) $m = nM = 0.5 \times 58.5 = 29.25 \text{ g}$ **M1** **A1**. (b) g/mol (grams per mole) **B1**.