AP CHEMISTRY • EXERCISE SHEET

1.1 Moles and Molar Mass

Name: _____ Class: _____ Date: _____ **Total: 16 marks**

Objective

Build the skills to answer exam questions on **moles and molar mass**.

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 $n = \dfrac{m}{M}$, and moles to particles by multiplying by Avogadro's number
- find the molar mass of a compound by adding atomic masses

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

■ **Moles from mass**

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

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

■ **Molar mass of a compound**

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

■ **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.

2 Practice

Now apply the methods above.

2.1 How many moles are in 44 g of CO_2 ($M = 44$ g/mol)? [2]

2.2 Find the molar mass of water, H_2O (H = 1, O = 16). [2]

2.3 Find the mass of 3 mol of carbon atoms ($M = 12$ g/mol). [2]

2.4 State the number of particles in one mole. [1]

3 Exam-style questions

3.1 One mole of any substance contains [1]

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

3.2 The molar mass of CO_2 (C = 12, O = 16) is [1]

- **A** 28 g/mol
- **B** 44 g/mol
- **C** 12 g/mol
- **D** 60 g/mol

3.3 A sample contains 88 g of CO_2 ($M = 44$ g/mol).

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

(b) Find the number of molecules (use 6.022×10^{23}). [2]

3.4 A student needs 0.5 mol of NaCl ($M = 58.5$ g/mol).

(a) Find the mass required. [2]

(b) State the units of molar mass. [1]

4 Go further

You are ready for more on this subtopic:

- work through the interactive **1.1 Moles and Molar Mass** lesson on the **Learn** page;
- read the **Atomic Structure and Properties** section of the AP Chemistry handout on the **Know** page for the full explanation and worked diagrams.

Solutions

2.1 $n = m/M = 44/44 = 1$ mol.

2.2 $2(1) + 16 = 18$ g/mol.

2.3 $m = nM = 3 \times 12 = 36$ g.

2.4 6.022×10^{23}.

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

3.2 B —$12 + 2(16) = 44$ g/mol.

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

3.4 (a) $m = nM = 0.5 \times 58.5 = 29.25$ g. (b) g/mol (grams per mole).