

3.4 The Ideal Gas Law

Name: _____ Class: _____ Date: _____

Total: 14 marks

KEY WORDS kelvin 开尔文 • solution 溶液

Objective

Build the skills to answer exam questions on the **ideal gas law** $PV = nRT$.

You must be able to:

- use $PV = nRT$ with $R = 0.08206 \text{ L atm mol}^{-1}\text{K}^{-1}$
- convert temperature to **kelvin** 开尔文 and match units
- combine states with $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

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.

■ The ideal gas law

$$PV = nRT.$$

Use consistent units: P in atm, V in L, n in mol, T in **kelvin** ($T_K = T_C + 273$), with $R = 0.08206 \text{ L atm mol}^{-1}\text{K}^{-1}$.

■ A worked calculation

Find the volume of 2.0 mol of gas at 1.0 atm and 300 K:

$$V = \frac{nRT}{P} = \frac{(2.0)(0.08206)(300)}{1.0} = 49.2 \text{ L}.$$

■ Always convert to kelvin

A temperature in °C must become K first. $25^\circ\text{C} = 298 \text{ K}$. Forgetting this is a common lost mark.

■ The combined gas law

When n is fixed and conditions change,

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}.$$

Solve for the unknown, keeping temperatures in kelvin.

2 Practice

Now apply the methods above.

2.1 Convert 27°C to kelvin. [1]

2.2 Find n for a gas with $P = 2.0\text{ atm}$, $V = 10.0\text{ L}$, $T = 300\text{ K}$. [3]

2.3 A gas at 1.0 atm and 2.0 L is compressed to 0.5 L at constant T . Find the new pressure. [2]

3 Exam-style questions

3.1 In $PV = nRT$, the temperature must be in [1]

A	B
C	D

A $^{\circ}\text{C}$

B kelvin

C $^{\circ}\text{F}$

D any unit

3.2 A 5.0 L container holds 0.25 mol of gas at 350 K .

(a) Find the pressure in atm. [3]

(b) State what happens to the pressure if the temperature is doubled at constant volume. [1]

3.3 A balloon has volume 2.0 L at 300 K. Find its volume at 360 K if the pressure is unchanged. [3]