

## 5.2 Ideal gas molecules

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

**Total: 21 marks**

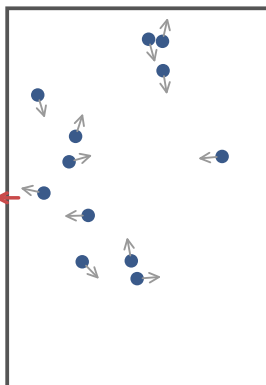
### Objective

Cover ideal gas molecules (5.15–5.22): molecular motion and pressure, absolute zero and the Kelvin scale, temperature and kinetic energy, and the two gas relationships. Original IGCSE-level practice.

### 1 Key knowledge and worked examples

#### ■ Molecules make pressure

force on the wall:  
pressure



molecules in random motion collide with the walls — each collision exerts a force; pressure is the total force per unit area

#### ■ Kelvin and the two laws

$K = ^\circ C + 273$ ; **absolute zero  $-273\text{ }^\circ C = 0\text{ K}$** . Kelvin temperature  $\propto$  average molecular kinetic energy.

$$p_1 V_1 = p_2 V_2 \text{ (constant } T) \quad \frac{p_1}{T_1} = \frac{p_2}{T_2} \text{ (constant } V)$$

**Worked check.**  $200\text{ cm}^3$  of gas at  $150\text{ kPa}$  and  $300\text{ K}$  is warmed to  $600\text{ K}$  in the same volume:  $p_2 = 150 \times 600/300 = 300\text{ kPa}$ ; then released to double the volume at that temperature:  $p = 300 \times 200/400 = 150\text{ kPa}$ .

### 2 Practice

**2.1** State the value of absolute zero in  $^\circ C$ . [1]

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**2.2** Convert  $50\text{ }^\circ C$  to kelvin and  $0\text{ K}$  to  $^\circ C$ . [2]

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**2.3** A gas at  $100\text{ kPa}$  in  $6\text{ dm}^3$  is compressed to  $2\text{ dm}^3$  at constant temperature. Calculate the new pressure. [2]

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**2.4** A fixed volume of gas at  $200\text{ kPa}$  and  $300\text{ K}$  is warmed to  $450\text{ K}$ . Calculate the new pressure. [2]

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**2.5** State what happens to gas molecules' average speed when temperature rises. [1]

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### 3 Exam-style questions

**3.1** Explain, in terms of molecules, why a sealed can's pressure rises when it is heated. [3]

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**3.2** A sealed cylinder of gas at  $180\text{ kPa}$  and  $300\text{ K}$  is cooled to  $200\text{ K}$  at constant volume. Calculate the new pressure, and state one assumption. [3]

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**3.3** Explain why pumping a bicycle tyre gets harder as it fills, using particle ideas. [3]

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**3.4** A balloon holds  $12 \text{ dm}^3$  of gas at  $300 \text{ kPa}$  at depth. It rises and expands to  $40 \text{ dm}^3$  at the same temperature. Calculate the gas pressure at the surface, stating one assumption. [4]

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