

N5

Combined Gas Equation

By combining the above three relationships, the following relationship for the pressure, volume and temperature of a fixed mass of gas is true for all gases.

$$\frac{p \times V}{T} = \text{constant}$$

$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

Example

A balloon contains 1.5 m³ of helium at a pressure of 100 kPa and at a temperature of 27 °C. If the pressure is increased to 250 kPa at a temperature of 127 °C, calculate the new volume of the balloon.

$$p_1 = 100 \text{ kPa}$$

$$V_1 = 1.5 \text{ m}^3$$

$$T_1 = 27 \text{ °C} = 300 \text{ K}$$

$$p_2 = 250 \text{ kPa}$$

$$V_2 = ?$$

$$T_2 = 127 \text{ °C} = 400 \text{ K}$$

$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

$$\frac{100 \times 1.5}{300} = \frac{250 \times V_2}{400}$$

$$V_2 = \underline{0.8 \text{ m}^3}$$