



QUESTION WORKBOOK

Ideal gases and the gas laws

Thermal physics · Year 13

AQA 3.6.2.2 · CIE 14.2, 15.1, 15.2 · OCR A 5.1.4

10 questions · 30 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

A1 State Boyle's law for a fixed mass of gas. [2]

A2 A gas has 2.0 mol in a volume of 0.05 m^3 at 300 K. Calculate its pressure using $pV = nRT$ ($R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$). [2]

A3 Explain how extrapolating a graph of pressure against temperature leads to the idea of absolute zero. [2]

SECTION B · Standard

B1 A gas at $1.0 \times 10^5 \text{ Pa}$ occupies 0.020 m^3 . It is compressed at constant temperature to 0.005 m^3 . Calculate its new pressure. [3]

- B2** Calculate the volume occupied by 0.50 mol of an ideal gas at a pressure of 2.0×10^5 Pa and a temperature of 300 K. [4]

- B3** A container of volume 0.010 m^3 holds 3.0×10^{23} gas molecules at 290 K. Calculate the pressure using $pV = NkT$ ($k = 1.38 \times 10^{-23} \text{ J K}^{-1}$). [3]

- B4** A gas of volume 0.010 m^3 at 300 K is heated at constant pressure to 400 K. Calculate its new volume. [3]

SECTION C · Stretch

- C1** A gas expands from 0.010 m^3 to 0.015 m^3 at a constant pressure of $2.0 \times 10^5 \text{ Pa}$. Calculate the work done by the gas. [4]

- C2** A gas occupies 0.024 m^3 at a pressure of $1.0 \times 10^5 \text{ Pa}$ and a temperature of 300 K . Calculate the number of molecules present. [4]

- C3** State the conditions under which a real gas behaves most like an ideal gas. [3]