

Worksheet: Kinetic Theory

IB · Class 11 · Physics · 10 questions · 31 marks

Name: _____

Date: _____

Score: _____ / 31

Q1. 2 moles of an ideal gas are enclosed in a container of volume 0.05 m^3 at 300 K. Find the pressure ($R = 8.314 \text{ J/mol/K}$). [2 marks]

Q2. Find the rms speed of oxygen molecules at 300 K (molar mass 0.032 kg/mol , $R = 8.314 \text{ J/mol/K}$). [2 marks]

Q3. Using the law of equipartition of energy, estimate the molar specific heat of a solid element at room temperature. [2 marks]

Q4. A gas has number density $3 \times 10^{25} \text{ per m}^3$, molecular mass $4.65 \times 10^{-26} \text{ kg}$, and mean square speed $2.66 \times 10^5 \text{ m}^2/\text{s}^2$. Find its pressure. [3 marks]

Q5. Using the law of equipartition of energy, find C_v , C_p , and γ for a rigid diatomic gas. [3 marks]

Q6. Estimate the mean free path of a gas with number density 2.7×10^{25} per m^3 and molecular diameter 2×10^{-10} m. [3 marks]

Q7. A vessel contains a mixture of 2 mol of oxygen and 3 mol of nitrogen at a total pressure of 5×10^5 Pa. Find the partial pressure of each gas. [3 marks]

Q8. A gas at pressure 2×10^5 Pa, volume 4 L, and temperature 300 K is compressed to 2 L at 350 K. Find the new pressure. [3 marks]

Q9. A polyatomic gas molecule has 3 translational, 3 rotational, and 2 active vibrational modes. Find C_v , C_p , and γ . [5 marks]

Q10. Hydrogen ($M = 2$ u) and oxygen ($M = 32$ u) are at the same temperature. Find (a) the ratio of their rms speeds, and (b) the temperature at which oxygen's rms speed at that temperature equals hydrogen's rms speed at 300 K. [5 marks]