Class 11 Physics · Chapter 12: Kinetic Theory

Worksheet · 20 marks · about 40 minutes · based on NCERT

Name _____ Class and section _____ Date _____

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1. A vacuum chamber at 300 K holds 2.5×10^{16} gas molecules per cubic metre. The pressure in the chamber is about ($k_B = 1.38 \times 10^{-23}$ J K^{-1}) [1]

(a) 3.5×10^{-7} Pa (b) 1.0×10^{-4} Pa
(c) 6.2×10^{19} Pa (d) 9.3×10^{-6} Pa

2. The pressure of a gas is doubled while its temperature is kept constant. The mean free path of its molecules [1]

(a) doubles (b) stays the same
(c) becomes four times (d) becomes half

3. A sample of a real gas follows $PV = \mu RT$ most closely when it is kept at [1]

(a) high pressure and low temperature (b) low pressure and high temperature
(c) high pressure and high temperature (d) low pressure and low temperature

4. For a monatomic ideal gas, the ratio $\gamma = C_p/C_v$ is [1]

(a) $\frac{5}{3}$ (b) $\frac{7}{5}$
(c) $\frac{4}{3}$ (d) $\frac{9}{7}$

5. In a vessel at a fixed temperature, the rms speed of hydrogen molecules (molar mass 2 g mol^{-1}) is four times the rms speed of the molecules of a gas X in the same vessel. The molar mass of X is [1]

(a) 8 g mol^{-1} (b) 16 g mol^{-1}
(c) 32 g mol^{-1} (d) 64 g mol^{-1}

6. Molecules of a gas at room temperature move at a few hundred metres per second, yet the smell of a perfume opened at one end of a classroom takes minutes to reach the other end. Explain. [2]

7. State the law of equipartition of energy. A CO molecule at moderate temperature has one mode of vibration. Find its average energy at temperature T. [2]

8. Three molecules have speeds 2, 4 and 6 m s^{-1}. Calculate $\langle v^2 \rangle$ and $(\langle v \rangle)^2$, and state what the result shows. [2]

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9. A gas at 300 K and 1.0×10^5 Pa has density 1.28 kg m^{-3}. (a) Find its molar mass and suggest which common gas it could be. (b) What would its density be at 600 K and the same pressure? ($R = 8.31$ J mol^{-1} K^{-1}) [3]

10. The mean free path of the molecules of a gas at 300 K and 1.0 atm is 1.0×10^{-7} m. Find the mean free path (a) at 300 K and 0.50 atm, (b) at 600 K and 1.0 atm, (c) after the gas, sealed in a rigid vessel at 300 K and 1.0 atm, is heated to 600 K. [3]

11. At what temperature will the rms speed of oxygen molecules be double its value at 27 °C? What is the average kinetic energy of an oxygen molecule at that temperature? ($k_B = 1.38 \times 10^{-23}$ J K^{-1}) [3]

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