CLASS 11 PHYSICS EXTRA QUESTIONS

Class 11 Physics Chapter 12 Kinetic Theory – Extra Questions with Answers

Extra practice questions for Class 11 Physics Chapter 12 (Kinetic Theory), beyond the textbook. These Class 11 Physics Chapter 12 important questions are handy for last-minute exam practice.

Contents

Extra practice questions for Class 11 Physics Chapter 12 (Kinetic Theory), beyond the textbook. These Class 11 Physics Chapter 12 important questions are handy for last-minute exam practice.

Very Short Answer Questions (1 mark)

Q1. Write the ideal gas equation.
Ans: $PV=nRT$.

Q2. What is the value of the universal gas constant R?
Ans: 8.314 J/(mol·K).

Q3. How many degrees of freedom does a monatomic gas molecule have?
Ans: 3 (all translational).

Q4. State the law of equipartition of energy.
Ans: Energy is distributed equally among all degrees of freedom, each contributing $(1/2)k_BT$ per molecule.

Q5. Write the formula for pressure of an ideal gas from kinetic theory.
Ans: $P=(1/3)\rho v_{rms}^2$.

Short Answer Questions (2–3 marks)

Q6. Find the number of moles in 44 g of CO_2 (molar mass 44 g/mol).
Ans: n=mass/molar mass=44/44=1 mole.

Q7. Two moles of an ideal gas occupy 0.05 m^3 at 300 K. Find the pressure (R=8.314 J/mol·K).
Ans: $P=nRT/V=2(8.314)(300)/0.05=99768$ Pa $\approx 9.98\times10^4$ Pa.

Q8. Calculate the average kinetic energy per molecule of a gas at 300 K ($k_B=1.38\times10^{-23}$ J/K).
Ans: $KE=(3/2)k_BT=(3/2)(1.38\times10^{-23})(300)=6.21\times10^{-21}$ J.

Higher-Order Thinking / Application Questions

Q9. Explain, using the kinetic theory of gases, why the pressure of a gas increases when it is heated at constant volume, connecting this to molecular motion.
Ans: According to kinetic theory, temperature is a measure of the average kinetic energy of gas molecules: average $KE=(3/2)k_BT$. When a gas is heated, its temperature rises, so the average kinetic energy (and hence average speed) of the molecules increases. At constant volume, the molecules now collide with the container walls more frequently and with greater momentum change per collision (since they move faster). Since pressure is a result of the cumulative force from molecular collisions on the walls per unit area, this increase in collision frequency and force leads to a corresponding increase in pressure, consistent with $P=(1/3)\rho v_{rms}^2$ (v_{rms} increasing with T).

Q10. Compare the number of degrees of freedom, and hence specific heat capacities, of a monatomic gas (like helium) and a diatomic gas (like oxygen) at moderate temperatures, explaining why diatomic gases have higher molar specific heats.
Ans: A monatomic gas has only 3 translational degrees of freedom, so by the law of equipartition of energy, its internal energy per mole is (3/2)RT, giving molar specific heat at constant volume $C_v=(3/2)R$. A diatomic gas, at moderate temperatures, has 5 degrees of freedom (3 translational + 2 rotational, since a diatomic molecule can rotate about two axes perpendicular to the bond axis), giving internal energy per mole = (5/2)RT and $C_v=(5/2)R$. Because diatomic gas molecules have more ways (degrees of freedom) to store

thermal energy for the same rise in temperature, more heat is needed to raise their temperature by the same amount, giving them a higher molar specific heat than monatomic gases.

Class 11 Physics Chapter 12 – Solutions and Notes

For complete step-by-step answers and a quick summary, check the Class 11 Physics Chapter 12 Solutions and Class 11 Physics Chapter 12 Revision Notes.

See also: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5 | Chapter 6 | Chapter 7 | Chapter 8 | Chapter 9 | Chapter 10 | Chapter 11 | Chapter 12

Practice more: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5 | Chapter 6 | Chapter 7 | Chapter 8 | Chapter 9 | Chapter 10 | Chapter 11

Quick revision: Chapter 1 | Chapter 2 | Chapter 3 | Chapter 4 | Chapter 5 | Chapter 6 | Chapter 7 | Chapter 8 | Chapter 9 | Chapter 10 | Chapter 11