



PHYSICS

BOOKS - VGS BRILLIANT PHYSICS (TELUGU ENGLISH)

KINETIC THEORY

Very Short Answer Questions

1. State the law of equipartition of energy.



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2. Define mean free path.



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3. How does kinetic theory justify Avogadro's hypothesis and show that Avogadro Number in different gases is same?



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4. What are the units and dimensions of a specific gas constant?



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5. When does a real gas behave like an ideal gas?



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6. State Boyle's law and Charles law.



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7. State Dalton's law of partial pressures.



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8. Define absorptive power of a body. What is the absorptive power of a perfect black body?



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9. Pressure of an ideal gas in container is independent of shape of the container explain.



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10. Explain the concept of degrees of freedom for molecules of a gas.



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11. What is the expression between the pressure and kinetic energy of a gas molecule ?



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12. The absolute temperature of a gas is increased 3 times. What will be the increase in rms velocity of the gas molecule?



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Short Answer Questions

1. Explain the kinetic interpretation of Temperature.



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2. How can specific heat capacity of monoatomic, diatomic and polyatomic gases be explained on the basis of Law of equipartition of Energy?



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3. Explain the concept of absolute zero of temperature on the basis of kinetic theory.



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4. Prove that the average kinetic energy of a molecule of an ideal gas is directly proportional to the absolute temperature of the gas.



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5. Two thermally insulated vessels 1 and 2 of volumes V_1 and V_2 are joined with a valve and filled with air at temperature (T_1, T_2) and pressure (P_1, P_2) respectively. If the valve joining the two vessels is opened, what will be the temperature inside the vessels at equilibrium.



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6. What is the ratio of r.m.s. speed of Oxygen and Hydrogen molecules at the same temperature?



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7. Four molecules of a gas have speeds 1,2,3 and $4km/s$. Find the rms speed of the gas molecule.



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8. If a gas has 'f' degrees of freedom, find the ratio of C_p and C_v .



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9. Calculate the molecular K.E of 1 gram of Helium (Molecular weight 4) at $127^\circ C$. Given $R = 8.31 J mol^{-1} K^{-1}$.



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10. When pressure increases by 2% , what is the percentage decrease in the volume of a gas, assuming Boyle's law is obeyed ?



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Long Answer Questions

1. Derive an expression for the pressure of an ideal gas in a container from Kinetic Theory

and hence give Kinetic Interpretation of Temperature.



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Additional Problems

1. Estimate the fraction of molecular volume to the actual volume occupied by oxygen gas at STP. Take the diameter of an oxygen molecule to be 3\AA .



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2. Molar volume is the volume occupied by 1 mole of any (ideal) gas at standard temperature and pressure (STP : 1 atmospheric pressure , $0^{\circ} C$) . Show that it is 22.4 litres.



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3. An air bubble of volume 1.0cm^3 rises from the bottom of a lake 40m deep at a temperature of $12^{\circ} C$. To what volume does it

grow when it reaches the surface, which is at a temperature of $35^{\circ}C$?



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4. At what temperature is the root mean square speed of an atom in an argon gas cylinder equal to the rms speed of a helium gas atom at $-20^{\circ}C$? (atomic mass of $Ar = 39.9u$, of $He = 4.0u$).



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5. From a certain apparatus, the diffusion rate of hydrogen has an average value of $28.7\text{cm}^3\text{s}^{-1}$. The diffusion of another gas under the same conditions is measured to have an average rate of $7.2\text{cm}^3\text{s}^{-1}$. Identify the gas. [Hint : Use Graham's law of diffusion: $R_1 / R_2 = (M_2 / M_1)^{1/2}$, where R_1, R_2 , are diffusion rates of gases 1 and 2, and M_1 and M_2 their respective molecular masses. The law is a simple consequence of kinetic theory.]



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