HSPTA MALAPPURAM

PHYSOL-*The Solution for Learning Physics*

Question Bank

CHAPTER 13- Kinetic Theory

Each question scores One

1	According to kinetic theory of ideal gas, size of the molecule is...... compared to distance between molecules. Ans: smaller in size.
2	According to kinetic theory of ideal gas, molecules of a gas behaves as....... spheres. (Elastic/inelastic) Ans:Elastic
3	The energy loss due to collision between 2 molecules of ideal gas is...... Ans:Zero
4	4. The distance between 2 successive collisions is called.... Ans: Free path.
5	Equation for pressure in terms of density of gas is..... Ans: $P= 1/3\ \rho v^2$
6	Average kinetic energy of gas molecules is directly proportional to...... Ans: $\sqrt{T}$
7	Equation for v_{rms}=...... Ans: $\sqrt{\frac{3RT}{M}}$
8	For a given gas v_{rms} is directly proportional to..... Ans: $\sqrt{T}$
9	If the molecular mass is higher, r.m.s speed of gas molecule will...... (Increase/decrease) Ans: decrease.
10	NK_B=........ Ans: R
11	What microscopic property of an ideal gas doubles when the absolute temperature is doubled Ans. Average kinetic energy of the molecules.
12	What macroscopic property of an ideal gas doubles when the absolute temperature is doubled while keeping the pressure constant? Ans: Volume

Each question scores Two

1	How does the average kinetic energy of each gas in a mixture compare? Ans. The average kinetic energies are equal because they are at the same temperature.
2	Given a sample of 1 cm^3 of hydrogen and 1 cm^3 of oxygen both at NTP.Which sample has a larger

	number of molecules? Ans. Both the samples contain the same number of molecules in accordance with Avogadro's Law.
3	Sometimes a cycle with well inflated tyre left in the Sun has its tube burst open. Why? Ans. In the Sun, the pressure of air inside the tyre increases due to rise in temperature.
4	Explain with the help of kinetic theory, why the pressure of a gas on its container walls rises when the volume is reduced. Ans. When the volume of gas is reduced, its pressure increases on account of the fact that: (i) the molecules have to travel a shorter distance between impacts on the container walls and (ii) these impacts are now distributed over a smaller area.
5	In terms of kinetic theory of gases, explain why the pressure of a gas in a closed container increases when the gas is heated. Ans. When the temperature of a gas is increased, its pressure increases due to the following two reasons. (i) With an increase in temperature, the velocity of the gas molecules increases and as such they strike the walls of the container more often than before. (ii) Due to an increased velocity, each impact is more powerful than before.
6	The volume of a gas sample is increased. Why does the pressure which is exerted by the gas decrease? Ans. When the volume of a gas is increased, its pressure decreases on account of the fact that: (i) the molecules have to travel a longer distance between impacts on the container walls and (ii) these impacts are now distributed over a large area.
7	What is the temperature when all molecular motion ceases? Ans. Since the mean square velocity $v^2 = vrms^2$ is directly proportional to the absolute temperature (T), i.e., v rms is proportional to T, v rms=0 when T=0, Thus, at absolute zero, the molecules of a gas stop moving.
8	Is 'temperature' less than absolute zero possible? If not, why? Ans. The temperature is on account of the translational molecular motion. At absolute zero, this molecular motion completely stops. Obviously, a temperature less than absolute zero is not possible.
9	What are the different ways of increasing the number of molecular collisions per unit time in a gas? Ans. By increasing the temperature, by increasing the number of molecules and by decreasing the volume.
10	Is it possible to increase the temperature of a gas without adding heat to it? If yes, explain how? Ans. The temperature of a gas can be increased by compressing it. The work done in compressing the gas is converted into its internal energy which results in an increase in its temperature.

Each question scores Three

1	How does the ideal gas model explain the rise in pressure of a gas as its temperature is raised without changing its volume?

	Ans. Raising the temperature of the gas increases the kinetic energies of its molecules and as a result of that their speeds increase. The increased speeds of the particles not only means that they have larger momenta, but they also hit the walls more frequently.
2	On the basis of kinetic theory, explain why evaporation causes cooling? Ans. The molecules of a liquid are moving with different velocities. Further, the temperature of a liquid is determined by the rms velocity of its molecules. Ordinarily, the molecules are prevented from leaving the liquid surface by the downward force of cohesion. But in evaporation, some of the molecules moving with large velocities manage to escape and as such the rms velocity of the remaining molecules decreases. This results in a decrease in temperature, i.e., cooling of the liquid.
3	Two vessels of the same size are at the same temperature. One of them holds 1 kg of H_2 gas and the other holds 1 kg of N_2 gas. (a) Which of the vessels contains more molecules? (b) Which of the vessels is under greater pressure and why? (c) In which vessel is the average molecular speed greater? How many times greater? Ans. (a) Hydrogen. As 2g of H_2 contains N_A molecules, 1 kg of H_2 contains $(N_A/2) \times 1000 = 500\ N_A$ molecules where N_A is the Avogadro's number. In case of N_2, 28g of N_2 contains N_A molecules, therefore, 1 kg of N_2 contains $(N_A/28)$ x 1000 =$36N_A$. (b) As $P = N\ k_BT$ and k_B, T are constants, P is proportional to N. Since the number (N) of the molecules per unit volume is more in case of hydrogen than in case of nitrogen, hydrogen exerts more pressure than nitrogen. (c) Hydrogen.

Each question scores Four

1	Give any four postulates of Kinetic theory of ideal gas. Ans: 1. Molecules of a gas are alike and different for different molecules. 2. Molecules of a gas are very small compared to distance between them. 3.Molecules of a gas behaves as perfectly elastic spheres. 4.Molecules of a gas are in random motion in all direction with all possible velocities.
2	Derive the expression for rms velocity of gas molecules.

Each question scores Five

1	Write any three postulates of kinetic theory of an ideal gas. Derive the expression for pressure exerted by an ideal gas.