

KINETIC THEORY

General Instructions: Answer all the questions. If you are unable to answer any question, go through the page number that is given against that particular question in the text book. You can find the answer.

Test Paper-II

MAX MARKS: 40

TIME: 2Hrs

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|---|--|------|---|
| 1 | Using kinetic theory of gases derive an expression for finding the pressure of an Ideal gas. | P323 | 3 |
| 2 | What is the kinetic interpretation of temperature? | P325 | 2 |
| 3 | Find the mean square speed of a molecule in nitrogen gas at a temperature 300K.
Given that mass of nitrogen molecule is 28 gms and Avogadro number is 6.02×10^{26} | P325 | 2 |
| 4 | A flask contains argon and chlorine in the ratio of 2:1 by mass. The temperature of the mixture is 27°C. Obtain the ratio of (i) average kinetic energy per molecule, and (ii) root mean square speed v_{rms} of the molecules of the two gases. Atomic mass of argon = 39.9 u; Molecular mass of chlorine = 70.9u | P325 | 3 |
| 5 | Uranium has two isotopes of masses 235 and 238 units. If both are present in Uranium hexafluoride gas which would have the larger average speed? If atomic mass of fluorine is 19 units, estimate the percentage difference in speeds at any temperature. | P326 | 3 |
| 6 | State the number of coordinates required to specify the location of a molecule in the following cases
1. A molecule free to move in space
2. A molecule constrained to move in a plane
3. A molecule constrained to move in a straight line | P327 | 2 |
| 7 | Give the translational degrees of freedom associated with the following.
a. A molecule free to move in space
b. A molecule constrained to move in a plane
c. A molecule constrained to move in a straight line | P327 | 2 |
| 8 | What is the average value of kinetic energy for a gas in thermal equilibrium? What are the energies associated with | P328 | 3 |

- a. Monoatomic gas molecule
- b. Diatomic gas molecule

9	What does the quadratic term occurring in the expression for energy indicates?	P328	1
10	State the law of equipartition of energy. Also calculate the value of ratio of specific heats (γ) for a Mono atomic gas.	P329	3
11	Calculate the value of ratio of specific heats (γ) for a (a) Diatomic gas and Poly atomic gas.	P329	3
12	A cylinder of fixed capacity 44.8 litres contains helium gas at standard temperature and pressure. What is the amount of heat needed to raise the temperature of the gas in the cylinder by 15°C ? ($R= 8.31 \text{ J mol}^{-1}\text{K}^{-1}$)	P330	3
13	Show that specific heat capacity of solids is $C= 3R$	P330	2
14	Calculate the specific heat capacity of water.	P330	2
15	What happens to the specific heats of all substances as $T \rightarrow 0$? Why?	P330	2
16	What is meant by mean free path? Derive an expression to find the mean free path of a gas molecule.	P331	3
17	Estimate the mean free path for a water molecule in water vapour at 373K. Given that at STP number of molecules per unit volume is $n=2.7 \times 10^{25} \text{ m}^{-3}$	P332	1