KINETIC THEORY OF GASES

[1] State the number of degree of freedom possessed by a monoatomic molecule in Space
[a]2 [b.]3 [c]6
[b]

[2] State the number of degree of freedom possessed by a diatomic molecule in Space
[a]4 [b.]5 [c]6
[b]

[3] Perfect gas equation is
[a.] $PV = \mu RT$ [b] $P/V = \mu RT$ [c] $P = \mu RT$ v
[a]

Define the following:
[4] Mean free path
It is the average distance travelled by a molecule between two successive collision

[5]What is an ideal gas
A gas that satisfies the equation, $PV = \mu RT$ at all temps& pressures are said to be an ideal gas

[6]State any two characteristics of an ideal gas

1. The size of the gas molecules is negligibly small.
2. There is no force of attraction amongst the molecules of the gas.

[7]Define Molar specific heat capacity at constant pressure [C_P]

[8]Define Molar specific heat capacity at constant volume [C_v]

[9]Write any 3 postulates of kinetic theory of an ideal gas

[10]C_P is greater than C_V .Why?

   Extra amount of heat is taken by the gas to perform work.

[11] State law of equipartition of energy:

   For a dynamic system in thermal equilibrium, the total energy of the system
   gets equally divided amongst its various degrees of freedom and the energy
   associated with each degree of freedom per molecule is $\frac{1}{2}K_B T$

Long type questions

[12] Obtain the ratio of specific heat capacity of a monoatomic Gas, $\gamma = \frac{C_P}{C_V}$

[13] Obtain the ratio of specific heat capacity of a diatomicatomic Gas, $\gamma = \frac{C_P}{C_V}$

[14] Two cylinders A and B of equal capacity are connected to each other
via a stopcock. A contains a gas at standard temperature and pressure. B is
completely evacuated. The entire system is thermally insulated. The
stopcock is suddenly opened. Answer the following:
(a) What is the final pressure of the gas in A and B ?
(b) What is the change in internal energy of the gas?
(c) What is the change in the temperature of the gas?

Answer: (a) Since the final temperature and initial temperature remain the same,

$$\therefore \qquad P_2 V_2 = P_1 V_1$$

But $\qquad P_1 = 1 \text{ atm}, \quad V_1 = V, \quad V_2 = 2V \quad \text{and} \quad P_2 = ?$

$$\therefore \qquad P_2 = \frac{P_1 V_1}{V_2} = \frac{1 \times V}{2V} = 0.5 \text{ atm}$$

(b) Since the temperature of the system remains unchanged, change in internal energy is zero.

(c) The system being thermally insulated, there is no change in temperature (because of free expansion)