(a) Basic Assumptions of Kinetic Theory of Gases

1.1 Postulates of Kinetic Theory of Gases

(a) Matter is made up of identical molecules.

(b) Thermal energy can be identified with molecular motion.

Methodology

Using laws of classical mechanics and statistical averaging one can find total energy of Ideal gases. We can use this theory to study viscosity, conduction, diffusion, effusion and Brownian motion.

1.1.1 Basic Assumption of Kinetic Theory

1. Any infinitely small volume of a gas contains a large number of molecules. The order of number of molecule is 10^{23}.

2. A gas is made up of identical molecules, which behaves as rigid, perfectly elastic, hard sphere but considered as point mass, since the distance between the masses is order of magnitude greater than the size as shown in figure 1.

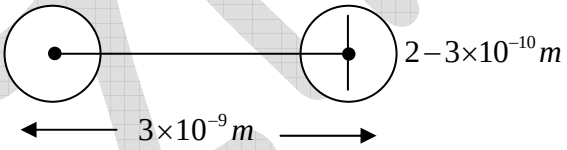

Figure 1

The diameter of molecule is order of $10^{-10}m$ at STP.

3. The molecules continuously move in random directions. All direction of motion are equally probable (Figure 2).

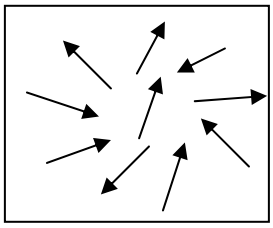

Figure 2

4. The size of the molecules is much less than the average distance between them. The average distance between them is order of $10^{-9}m$ and diameter is of order of $10^{-10}m$.

5. The molecule of a gas exerts no force on each other except when they collide. These forces are due to only exchange of momentum during collision.

6. The collision between molecules and with walls are perfectly elastic.

7. The molecular velocities are assumed to be uniformly distributed in all directions, which means velocity is isotropic symmetric and there is not any preferential direction.

8. The molecules move with all speeds ranging from 0 to ∞.

9. The time of collision is much less than the time between collisions.

Basic Statistical Formula to be used for Kinetic Theory:

If there is a sample random variable $X = \{x_1, x_2, x_3 ....., x_n\}$

And total number of variable is N, then some statistical phenomena is defined as

Mean Value: $X_{mean} = \frac{1}{N}\sum_{i=1}^{N} x_i$, where $N = \sum_i n_i$

If group of n_1 number of x_1

n_2 number of x_2

$\vdots$

n_n number of x_n

$$X_{mean} = \langle X \rangle = \frac{\sum_i n_i x_i}{\sum_i n_i}$$

Root mean square value $\langle X^2 \rangle = \frac{\sum_i n_i x_i^2}{\sum_i n_i} \Rightarrow X_{rms} = \sqrt{\langle X^2 \rangle}$

$\Delta X = \sqrt{\langle X^2 \rangle - \langle X \rangle^2}$ is identified as standard deviation