

Thermodynamics

* The Branch Physics which deals with conversion of Heat into other forms of Energy

KTG (Kinetic theory of Gases)

* Gases are made up of large no of molecules.

* molecules do not exert forces on each other except their during collision

$$F=0 \Rightarrow P.E=0$$



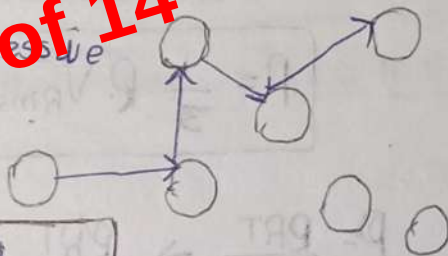
* size of molecules is very small as compare to separation between molecules.

* All collisions are Elastic in nature.

Mean Free Path

* avg distance between two successive collisions

$$\lambda_{\text{mean}} = \frac{V}{\sqrt{2} \pi n' d^2} = \frac{1}{\sqrt{2} \pi n' d^2}$$



$V \rightarrow$ volume of container

$N \rightarrow$ No. of molecules

$d \rightarrow$ diameter of molecule

$n' \rightarrow$ No. of molecules per unit volume

$$n' = \frac{N}{V}$$

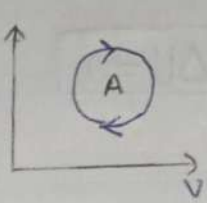
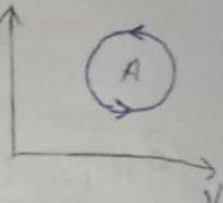
$$PV = nRT$$

$$PV = \frac{N}{N_A} RT$$

$$\left(\frac{P}{T}\right) \frac{N_A}{R} = \frac{N}{V} = n'$$

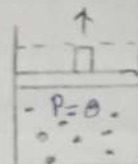
$$n' \propto \frac{P}{T}$$

$$\lambda_{\text{mean}} \propto \frac{T}{P}$$

Positive work done	Negative work done
$W = +ve$ $\Downarrow$ * clockwise direction  $W = A$	$W = -ve$ $\Downarrow$ * anti clockwise direction  $W = -A$

Free Expansion

In free expansion $W = 0$
 due to pressure by the gas $P = 0$



Poly tropic process

* this is not adiabatic process

$$PV^m = \text{constant}$$

Formula for

$$C = C_v + \frac{R}{1-m}$$

* for poly tropic process C is constant

proof for C

$$dq = du + dw$$

$$ncdT = nc_vdT + PdV$$

$$C = C_v + \frac{PdV}{ndT}$$

from ①

$$C = C_v + \frac{PdV}{\frac{PdV + VdP}{R}}$$

$$C = C_v + \frac{R}{\left(1 + \frac{VdP}{PdV}\right)}$$

$$C = C_v + \frac{R}{1-m}$$

$$\textcircled{1} \quad PV = nRT$$

$$PdV + VdP = nRdT$$

$$ndT = \frac{PdV + VdP}{R}$$

$$\textcircled{2} \quad PV^m = \text{constant}$$

$$dV^m PV^{m-1} + V^m dP = 0$$

$$\frac{V^m PdV}{V} = -V^m dP$$

$$-m = \frac{VdP}{PdV}$$