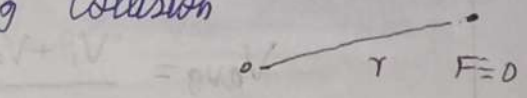
Thermodynamics

* 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

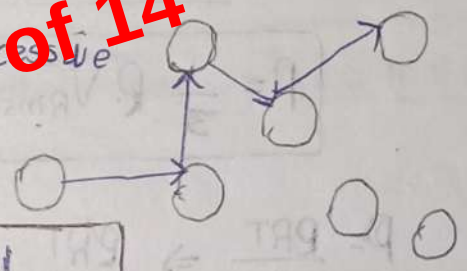
$F=0 \Rightarrow P.E=0$



* size of molecules is very small as compare to separation between molecules.
* All collisions are Elastic in nature.

Mean Free Path (λ mean)

* avg distance between two successive collisions



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

$V \rightarrow$ volume of container
$N \rightarrow$ No. of molecules
$d \rightarrow$ diameter of molecule
$n' \longrightarrow$ No. of molecules per unit volume

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

$$PV = nRT$$
$$PV = \frac{N}{N_A} RT$$
$$\left(\frac{P}{T}\right)\frac{N_A}{R} = \frac{N}{V} = n'$$
$$n' \propto \frac{P}{T}$$
$$\lambda_{mean} \propto \frac{T}{P}$$

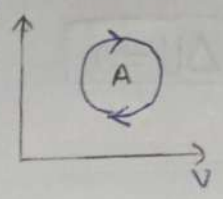
From ...

Positive work done

W = +ve

⇓

* clockwise direction



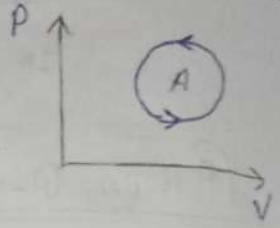
$W = A$

negative work done

W = -ve

⇓

* anti clockwise direction

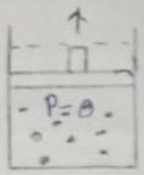


$W = -A$

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 Molar Heat (c)

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

* for poly tropic process C is constant

proof for C

$dQ = dU + dW$

$nC\,dT = nC_v dT + P\,dv$

$C = C_v + \frac{P\,dv}{n\,dT}$

from ①

$C = C_v + \frac{P\,dv}{\frac{P\,dv + V\,dp}{R}}$

$C = C_v + \frac{R}{\left(1 + \frac{V\,dp}{P\,dv}\right)}$

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

① $PV = nRT$

$P\,dv + V\,dp = nR\,dT$

$n\,dT = \frac{P\,dv + V\,dp}{R}$

② $PV^m = \text{constant}$

$dv\,mPV^{m-1} + V^m dP = 0$

$\frac{P\,dv\ m}{V} = -V^m dp$

$-m = \frac{V\,dp}{P\,dv}$