THERMODYNAMICS

TL;DRs

An OS Creation of Shazin

Relations Among Temperature Scales:

$$\frac{C}{5}=\frac{F-32}{9}=\frac{K-273}{5}$$

First Law of Thermodynamics:

"When work is completely converted to heat or heat is completely converted to work then work and heat becomes proportional to each others"

Mathematical Implementation : If a system consumes **dQ** heat, so the internal energy of the system changes by **du** and work done by heat is **dW** then,

$$\boxed{dQ=du+dW}$$

Conditions:

1. **dQ** is positive(+ve) if the system consumes heat , **dQ** is negative(-ve) if system loses heat
2. **du** positive if the internal energy of the system is increased and **du** negative if the internal energy decreases.
3. **dW** is positive if the work is done by the system, **dW** is negative if the work is done to the system.

Application of first Law in Isothermal(সমোষ্ণ) Process:

"A system where Temperature remains constant but heat and volume changes"

In isothermal process as the temperature remains constant so the internal energy is also constant it means **du = 0** .

$$dQ=dW$$

$$\boxed{W = Q = nRTln\left(\frac{V_2}{V_1}\right)}$$

W = Work done by heat

Q = Heat

n = number of moles in gas

R = Universal gas constant

T = temperature

V_1 = Initial Volume

V_2 = Final Volume

Relation between Pressure and Volume in Adiabatic Process: $\boxed{P_1 V_1^{\gamma} = P_2 V_2^{\gamma}}$

Relation between Volume and Temperature in Adiabatic Process:

$$\boxed{T_1 V_1^{\gamma-1} = T_2 V_2^{\gamma-1}}$$

Relation between Pressure and Temperature in Adiabatic Process (in case of an ideal gas): $\boxed{T_1 P_1^{\frac{1-\gamma}{\gamma}} = T21\, P_2^{\frac{1-\gamma}{\gamma}}}$

Application of first Law in Adiabatic(রুদ্ধতাপীয়) Process:

"A system where Heat remains constant but Pressure and Volume Changes"

dW = -du

****Facts:**

1. In adiabatic process the work is done by the system's heat or energy. So if the volume of the system increases the internal energy or the Temperature decreases
2. In the same condition the Temperature increase if the system's volume is reduced

Mathematical Implementation: $\boxed{W = \frac{R}{\gamma-1}[T_1 - T_2]}$

Work in Isobaric(সমচাপ) System:

Mathematical Implementation: $\boxed{dW = PdV}$

Molar Specific Heat(আপেক্ষিক তাপ):

"Molar specific heat is actually the Heat required to increase the Temperature of 1 Mole of a gas by 1 unit"

Mathematical Implementation: $\boxed{C=\frac{\Delta Q}{n\Delta T}}$

C = Molar specific heat
ΔQ = Heat
n = Number of moles in gas
ΔT = Temperature

C_p and C_v :

C_p : C_p is essentially the Molar specific Heat in a Constant Pressure $\boxed{C_p=\frac{\Delta Q}{n\Delta T}}$

C_v : C_v is essentially the Molar specific Heat in a Constant Volume $\boxed{C_v=\frac{\Delta Q}{n\Delta T}}$

***Remember:* $C_p > C_v$**

Relation between C_p and C_v : $\boxed{C_p-C_v=R}$ where R = gas constant.

What The Fuck is γ

γ (gamma) in Thermodynamics is actually the ratio of **C_p and C_v** .

$$\boxed{\gamma=\frac{C_p}{C_v}}$$

*** $\frac{C_p}{C_v}-1=\frac{R}{C_v}$

*** $C_v = \frac{R}{\gamma - 1}$

Value of γ in Different Gases

Scenario	Example	Value
Mono-atomic Gas	He, Ne, Ar	1.67
Di-atomic Gas	H_3, O_2 , N_2 , Cl_3	1.40
Tri-atomic Gas	CO_2, C_2O_6 , NH_3	1.33