CHEMICAL THERMODYNAMICS

ENTHALPY(H)

CHEMICAL THERMODYNAMICS

- WHEN A THERMODYNAMIC PROCESS TAKES AT CONSTANT VOLUME AND CONSTANT TEMPERATURE,THE HEAT GAINED OR LOST(q)IS EQUAL TO CHANGE IN INTERNAL ENERGY(ΔE).ALL CHEMICAL PROCESSES CAN NOT BE CARRIED OUT IN THE ABOVE CONDITIONS. MANY REACTIONS ARE CONDUCTED IN LABORATORY AT CONSTANT PRESSURE THAT IS ATMOSPERIC PRESSURE .TO STUDY HEAT EXCHANGE ANOTHER THERMO DYNAMIC FUNCTION ENTHALLPY INTRODUCED.

ENTHALPY(H).

- DEFINITION:IT IS THE TOTAL HEAT CONTENT OF THE SYSTEM AT CONSTANT PRESSURE.IT IS GIVEN THE SUM OF INTNERNAL ENERGY AND PRESSURE-VOLUME ENEGY OF A SYSTEM UNDER PARTICULAT SET OF CONDITIONS.
- MATHEMATICALLY,
- H=E+PV
- CHANGE OF ENTHALPY OF A SYSTEM IS THE DIFFERENCE BETWEEN FINAL ENTHALPY AND INITIAL ENTHALPY.
- MATHEMATICALLY,$\Delta H=H_f-H_i$

ENTHALPY(H)

- FOR A CHEMICAL REACTION AT CONSTANT TEMPERATURE AND AT CONSTANT PRESSURE,$\Delta H = H_p - H_R$

  WHERE H_p=ENTHALPY OF PRODUCTS

  H_R=ENTHALPY OF REACTANTS

- $H = E + PV$……(1)

TAKING THE DIFFERENTIALS OF BOTH THE SIDES OF ABOVE,

$\Delta H = \Delta E + P\Delta V + V\Delta P$……..(2)

ENTHALPY(H)

- AT CONTANT PRESSURE,$\Delta P=0$
- FROM EQUATION(2),$\Delta H=\Delta E+P\Delta V$……(3)
- FROM 1ST LAW OF THERMODYNAMICS,

$Q=\Delta E+P\Delta V$ IMPLIES THAT $\Delta E=Q-P\Delta V$

PUTTING THE VALUE OF ΔE IN EQUATION (3)

$\Delta H=Q$, $\Delta H=Q_P$

IF THE THERMODYNAMIC PROCESS AT CONSTANT PRESSURE,THEOF CHANGE ENTHALPY IS EQUAL TO HEAT EVOLVED ABSORBED DURING THE SYSTEM

ENTHALPY(H)

- RELATION BETWEENΔH&ΔE FOR GASEOUS REACTANTS AND PRODUCTS:

LET US CONSIDER A GASEOUS CHEMICAL REACTION,

$$n_R\ V_R \rightarrow n_P\ V_P$$

WHERE

n_R AND V_R ARE NO OF MOLES AND VOLUME OF THE REACANTS.

n_P AND V_P ARE NO OF MOLES AND VOLUME OF THE PRODUCTS

ENTHALPY(H)

- APPLYING IDEAL GAS EQUATION TO BOTH REACTANTS AND PRODUCTS, $PV_R = n_R RT$

$PV_P = n_P RT$

BY SUBSTRACTING ,WE GET, $PV_P - PV_R = n_P RT - n_R RT$

$P(V_P - V_R) = (n_P - n_R)RT$

$P\Delta V = \Delta nRT$……(5)

FROM EQUATION(3) $\Delta H = \Delta E + P\Delta V$

ENTHALPY(H)

- USING EQUATION(5),$\Delta H=\Delta E+\Delta nRT$ ……(6)
- CASE I -IF $\Delta n=0$ OR $\Delta V=0$,THEN $\Delta H=\Delta E$
- CASE II=IF Δn OR ΔV IS NEGATIVE, $\Delta H<\Delta E$
- CASE III=IF Δn OR ΔV IS POSITIVE, $\Delta H>\Delta E$