Spontaneous Change :-

Those changes which takes place by it's own or by the help of simple initiation is called spontaneous changes.

[A] Examples for by it's own —

i) Falling of water.
ii) Rusting on iron or corrosion on metals.
iii) Movement of heat from higher level to lower level.
iv) Melting of ice.
v) Evaporation of water
vi) Diffusion of gases.
vii) Dissolving of common salt or sucrose in H_2O.

[B] By simple initiations :

i) Burning of L.P.G, a kerosene oil or Deesel
ii) Heat of $CaCO_3$ to form CaO & CO_2.

Above mentioned, all examples of 'A' are natural changes which takes place by it's own, so natural changes are called spontaneous changes also. spontaneous changes depends on three factors i-e

i) Change in enthalpy (ΔH)
ii) Change in entropy (ΔS)
iii) Change in Gibb's free energy (ΔG).

Any one factor alone is unable to predict spontaneity but by the help of all three any spontaneous changes can be predicted easily.

1. Change in enthalpy (ΔH):

(a) When the sign of ΔH is -ve, then Q = +ve, means heat is released by the system, means energy decreases & stability increases so it is favourable condition for spontaneous changes.

b) If the sign of ΔH is +ve then it favours to non-spontaneous change.

c) If the value of ΔH = 0, it shows to equilibrium.

Exceptions:- (i) Melting of ice, ΔH = +ve, Q = -ve

ii) Evaporation of water. ΔH = +ve Q = -ve.

In some cases ΔH = 0, still that show spontaneity i.e spreading of a drop of ink in water, diffusion of two gases, in these cases ΔH = 0, but still that is spontaneous. Hence another factor is required to explain it that is randomness of system or Entropy.

Entropy (ΔS):- The randomness or disorderness of the system is measured in form of degree or delta. So the measurement degree of randomness or disorderness of system is called entropy. It represents it by ΔS.

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$$\Delta S = \frac{q_{rev}}{T}$$

It's unit is JK^{-1} but during transformation, The unit is $JK^{-1}mol^{-1}$.

ΔS for solid < liquid < Gas

or $\Delta S_G > \Delta S_L > \Delta S_S$ ....

For example when

i) Ice is heated it sublime hence ΔS increases, it goes from solid to Gas.

ii) When water is heated it converts in vapour where liquid state converts into gaseous state so ΔS increases, or $\Delta S = +ve$

iii) water is freezed, water converts into Ice, liquid to solid, $\Delta S = -ve$.

It is extensive properties.

It is state function because it is temperature dependent.

Transformation of one form to another form of substance & change in entropy:—

When one mole of any substance is changed from one state to another state then the change in entropy is called molar entropy change.

Teacher's Signature :

$$\Delta S_v = \frac{\Delta H_v}{T_b}$$

Where ΔS_v = Change in entropy for vaporisation

ΔH_v = Change in enthalpy for vaporisation

T_b = Boiling point or boiling temp.

$$\Delta S_{fus} = \frac{\Delta H_{fus}}{T_m}$$

or ΔS_{fusion} = Change in entropy during fusion

ΔH_{fus} = change in enthalpy during fusion

T_m = Temperature of melting

or $\Delta S_{sub} = \frac{\Delta H_{sub}}{T_s}$

ΔS_{sub} = change in entropy for Sublimation

ΔH_{sub} = Change in enthalpy for Sublimation

T_s = Temperature of Sublimation

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