



NEET Chemistry

Short Notes

Entropy

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In this article, we are discussing Second Law of Thermodynamics (Entropy). This is an important section to pay attention from the Chapter Thermodynamics. Let's begin!!

Spontaneity

Spontaneity means 'having the potential to proceed without the assistance of external agency'.

A spontaneous process is an irreversible process and may only be reversed by some external agency.

Criterion: decrease in enthalpy, increase in entropy

Entropy

It is a state function entropy is a measure of the degree of randomness or disorder in the system. The decrease of regularity in structure would mean an increase in entropy. For a given substance, the crystalline solid state is the state of lowest entropy (most ordered), The gaseous state is state of highest entropy.

S is related to q and T for a reversible reaction as:

$$S = q_{\text{rev}}/T$$

The total entropy change (S_{total}) for the system and surroundings of a spontaneous process is given by $S_{\text{total}} = S_{\text{system}} + \Delta S_{\text{surr}}$

When a system is in equilibrium, the entropy is maximum, and the change in entropy, $\Delta S = 0$.

Neither decrease in enthalpy nor increase in entropy alone can determine the direction of spontaneous change for these systems.

Gibbs free energy related to spontaneity

we define a new thermodynamic function the Gibbs energy or Gibbs function, G, as

$$G = H - TS$$

Gibbs function, G is an extensive property and a state function.

At constant temperature, T 0

$$\Delta G = \Delta H - T\Delta S$$

G gives a criteria for spontaneity at constant pressure and temperature.

- If G is negative (< 0), the process is spontaneous.
- If G is positive (> 0), the process is non Spontaneous.
- $\Delta G = 0$; system is in equilibrium.



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Remember:

- Value of ΔS is very small as compared to ΔH .
- All exothermic reactions are spontaneous at low temperatures.

Gibbs Energy Change and Equilibrium

Reversible reaction indicates that a given reaction can proceed in either direction simultaneously, so that a dynamic equilibrium is set up. This means that the reactions in both the directions should proceed with a decrease in free energy, which seems impossible. It is possible only if at equilibrium the free energy of the system is minimum. Hence under equilibrium $\Delta_r G = 0$.

Gibbs energy for a reaction in which all reactants and products are in the standard state, ${}_rG^0$ is related to the equilibrium constant (when the reaction is at equilibrium) of the reaction as follows:

$$0 = {}_rG^0 + RT \ln K$$

$$\text{or } {}_rG^0 = -RT \ln K$$

$$\text{or } {}_rG^0 = -2.303 RT \log K.$$

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