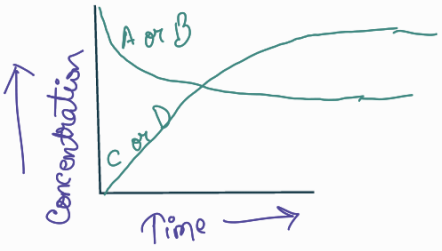
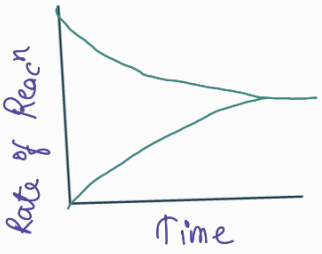
Chemical Equilibrium

* Reversible Rxn :-
Combustion, Redox
Neutralisation and precipitate Rxn

* Irreversible Rxn :-
Rest all are irreversible Rxn.

* Graph





* Characteristics of chemical equilibrium :->
(i) Permanency of chemical equilibrium.
(ii) Dyamic nature of equilibrium.
(iii) Incompleteness of reac^n at equilibrium
(iv) Approachability of equilibrium from either direc^n.
(v) Catalyst can't alter the state of equilibrium.

* Law of Mass action :-
Rate of Rxn $\propto$ Molarity (Molar concentration).

* Mathematical expression for K_c / K_p, K_x (equilibrium const.) :-
for a chemical rxn :-> $aA + bB \rightleftharpoons cC + dD$.

$$K_c = \frac{[D]^d [C]^c}{[A]^a [B]^b}$$

$$K_p = \frac{[P_D]^d [P_C]^c}{[P_A]^a [P_B]^b}$$

$$K_x = \frac{[x_D]^d [x_C]^c}{[x_A]^a [x_B]^b}$$

* Relation b/w :->

K_p v/s K_c

$$K_p = K_c (RT)^{\Delta n}$$

K_p v/s K_x

$$K_p = K_x \times (P)^{\Delta n}$$

K_c v/s K_x

$$K_c = K_x \left(\frac{P}{RT}\right)^{\Delta n}$$

* Rxn Quotient (Q) :-

Same as K_c calculation :-

$$Q_c = \frac{[D]^d [C]^c}{[A]^a [B]^b}$$

Cases-I

(i) If $Q_c < K_c$, then Rxn will move towards right (forward direction)

(ii) If $Q_c > K_c$, Rxn will move towards backward or towards left direction.

(iii) If $Q_c = K_c$, Rxn is in equilibrium.

* Gibbs free Energy

Formulas to be kept in mind

(i) $\Delta G^\circ = -2.303 RT \log K$

(ii) $K = e^{-\Delta G^\circ / RT}$

(iii) $\Delta G = RT \ln \frac{Q}{K}$.

NOTE →

if $\Delta G^\circ < 0$, $K > 1$

if $\Delta G^\circ > 0$, $K < 1$.

* Le Chatelier's Principal.

Read the theory from book.