Chemical Equilibrium

For
B.Sc Chemistry(Part-I)
Physical Chemistry
Paper-IA
Lecture-01

By
Dr. Supriya kumari
Sher Shah College, Sasaram
V.K.S.U,Ara
supriyachemu@gmail.com

Rate law for elementary reaction

- Law of mass action applies

Rate of reaction α Product of active masses of reactants

Active mass molar concentration raised to power of number of species

Examples:

$$A \longrightarrow P+Q \quad rate=K_1[A]$$

$$A \longrightarrow P+Q \quad rate=K_2[A]^1[B]^2$$

$$2A + B \longrightarrow E+F+G \quad rate=K_3[A]^2[B]^1$$

Calculation of the equilibrium constant

For the reaction

$$aA + bB \rightleftharpoons cC + dD$$

The relationship between the value of the equilibrium constant k and the concentrations of reactant and product is given by

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

K_c is fixed value for a particular rxn at Sp.Temp.

The equilibrium NO_2 Conc. is x M and N_2O_4 is y M:

Calculation of the equilibrium constant

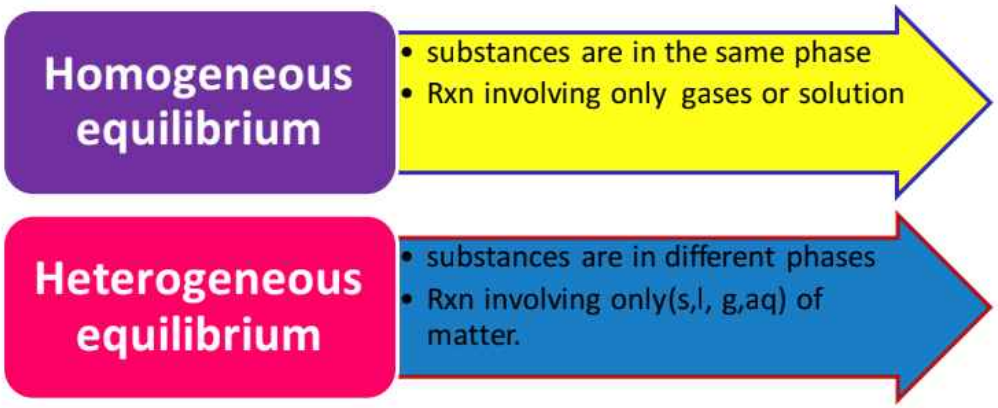
$$K = \frac{[N_2O_4]}{[NO_2]} = \frac{[x]}{[y]^2}$$

Note: K is unitless and only temperature changes the value of K_c

K is measured from the ratio of products to reactants at equilibrium on

Homogeneous equilibrium & Heterogeneous equilibrium

K = Reactants at equilibrium/Products at equilibrium



Homogeneous equilibria:

Ex: $N_2O_{4(g)} \rightleftharpoons 2\,N_2O_{(g)}$ =0.212at 100 ^{0}c

$$K = \frac{[N_2O_4]}{[NO_2]} = \frac{[x]}{[y]^2}$$

Ex: $CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$ at 500^0c

lime

Heterogeneous equilibrium

$$K_{c/eq} = [CO_2]$$

$$K_p = P\,CO_2$$