Examples :- $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

$$K_C = \frac{[PCl_3][Cl_2]}{[PCl_5]}$$

$2NH_3 \rightleftharpoons N_2 + 3H_2$

$$K_C = \frac{[N_2][H_2]^3}{[NH_3]^2}$$

Relation between Kc and no. of moles of reactants :-

$PCl_5 \rightleftharpoons PCl_3 + Cl_2$

a	0	0	(Initial $t=0$)
$a-x$	x	x	At equilibrium.

(since one mole of PCl_5 gives 1 mole of PCl_3 and 1 mole of Cl_2, so x moles of PCl_5 gives x moles of PCl_3 & Cl_2 each.)

$$\therefore \frac{a-x}{V} = \frac{x}{V} + \frac{x}{V}.$$

Hence $[PCl_5]$ at equm $= \frac{a-x}{V}$

$[PCl_3]$ at equm $= x/V$; $[Cl_2]$ at equm $= \frac{x}{V}$.

$$\therefore K_C = \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{x/V \times x/V}{\frac{a-x}{V}} = \frac{x^2}{(a-x)V}$$

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Heterogeneous Equilibrium — Here reactants and products have different phases e.g.

$$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$$

$$AgCl(s) + H_2O(l) \rightleftharpoons AgCl(aq)$$

Law Of Mass Action — At constant temperature, the rate of a chemical reaction is either directly proportional to the products of the active masses or the partial pressures (for gaseous reactants) of the reacting substances.

$$\text{Active Mass} \rightarrow \frac{\text{Number of moles}}{\text{Volume in litres}}$$

calculate

Active mass of 4gm. of NaOH dissolved in 250 cc. soln.:

Mol. wt. of NaOH = 40

$$n_{NaOH} = \frac{4}{40} = \frac{1}{10} = 0.1 \Rightarrow \text{moles of NaOH}$$

$$V_{litre} = \frac{250}{1000} = \frac{1}{4} = 0.25$$

$$\text{Active mass} = \frac{0.1}{0.25} = \frac{10}{25} = 0.4.$$

For A general equilibrium reaction $aA + bB \rightleftharpoons mC$ -

$$\text{Equilibrium Constant} \Rightarrow K_c = \frac{[C]^m[D]^n}{[A]^a[B]^b}.$$