3. Effect of Temperature:

$$A + B \rightleftharpoons C + \text{Heat}$$

shift ←

$$A + B + \text{Heat} \rightleftharpoons C$$

shift →

Le chatelier's Principle:

When stress is applied on a system, the in equilibrium the system tends to adjust itself so as to reduce the stress.

1. Effect of change in concentration: The equilibrium will shift in the direction that minimizes the change in concentration.

↑ reactant : forward

↑ product : backward.

Added

$A + B \rightleftharpoons C$

Equilibrium shift

removal

$A + B \rightleftharpoons C$

Equilibrium shift.

2. Effect of pressure:

$N_2O_4 \rightleftharpoons 2NO_2$

pressure given : ← backward.

$N_2 + 3H_2 \rightleftharpoons 2NH_3$.

pressure : → forward.

Kc

S.P-1: $2SO_2 + O_2 \rightleftharpoons 2SO_3$

$$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$$

$$= \frac{(0.33)^2}{(\ )^2(\ )}$$

$$= 3.7 \text{ mol } L^{-1}$$

$[SO_3] = 0.33 \text{ mol } L^{-1}$

$[SO_2] = 0.27$ "

$[O_2] = 0.40$ "

S.P-4: $H_2 + I_2 \rightleftharpoons 2HI$

$(0.100 - x)$ $(0.100 - x)$ $2x$

Given, $[I_2] = 0.020$

$\Rightarrow (0.100 - x) = 0.020$

$\Rightarrow x = 0.080$

$\therefore [H_2] = 100 - 0.080$
$= 0.020$

$\therefore [HI] = 2x = 0.160$

$\therefore [H_2] = 0.020$

$\Rightarrow 0.100 - x = 0.020$

$$\therefore K_c = \frac{[HI]^2}{[H_2][I_2]}$$

Solved -2 :

$$N_2O_5 \rightleftharpoons NO_2 + O_2$$

$$\Rightarrow 2N_2O_5 \rightleftharpoons 4NO_2 + O_2$$

$$\therefore K_c = \frac{[NO_2]^4 [O_2]}{[N_2O_5]^2}$$

K_p

Solved ~~20~~:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

$$K_p = \frac{(P_{NH_3})^2}{(P_{N_2})(P_{H_2})^3}$$

Page-632 ;

S.P-1 :

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

$T = 500^\circ C = 773K$

$K_c = 6 \times 10^{-2}$

$R = 0.0821$

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

$$\Delta n = 2 - 4 = -2$$

$$\therefore K_p = 6 \times 10^{-2} \times [0.0821 \times 773]^{-2}$$

$$= 1.5 \times 10^{-5}.$$

মাধ্যমিক ও উচ্চমাধ্যমিক শিক্ষা বোর্ড, ঢাকা

এসএসসি/এইচএসসি পরীক্ষা ২০ .....

[সঠিকটিতে টিক (✓) চিহ্ন দিতে হবে]

অতিরিক্ত উত্তরপত্র

পরীক্ষার বিষয় : _____ পত্র : _____ বিষয় কোড : _____

পরীক্ষার তারিখ : _____ দিন : _____

প্রত্যবেক্ষকের স্বাক্ষর : _____

এ স্থান হতে উত্তর লেখা আরম্ভ করতে হবে

* $aA + bB \rightleftharpoons cC + dD$

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

Solved –1 : $N_2 + 3H_2 \rightleftharpoons 2NH_3$

1) equation is balanced.

2) Concentration of Product NH_3 is $[NH_3]^2$

3) Product of concentration of reactants $[N_2][H_2]^3$

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

Law of Mass Action:

The rates of a chemical reaction is proportional to the active masses of the ~~reaction~~ reactants.

$$[H_2] = 0.5 \quad \text{and} \quad [I_2] = 0.5$$

Equilibrium Constant:

$$A + B \rightleftharpoons C + D$$

Rate of forward reaction $\propto [A][B] = K_1[A][B]$

" " Backward " $\propto [C][D] = K_2[A][B]$

at equilibrium,

$$K_1[A][B] = K_2[C][D]$$

$$\therefore \frac{K_1}{K_2} = \frac{[C][D]}{[A][B]}$$

$$\therefore K_c = \frac{[C][D]}{[A][B]}$$

3. Equi Can not be attained in closed vessel :

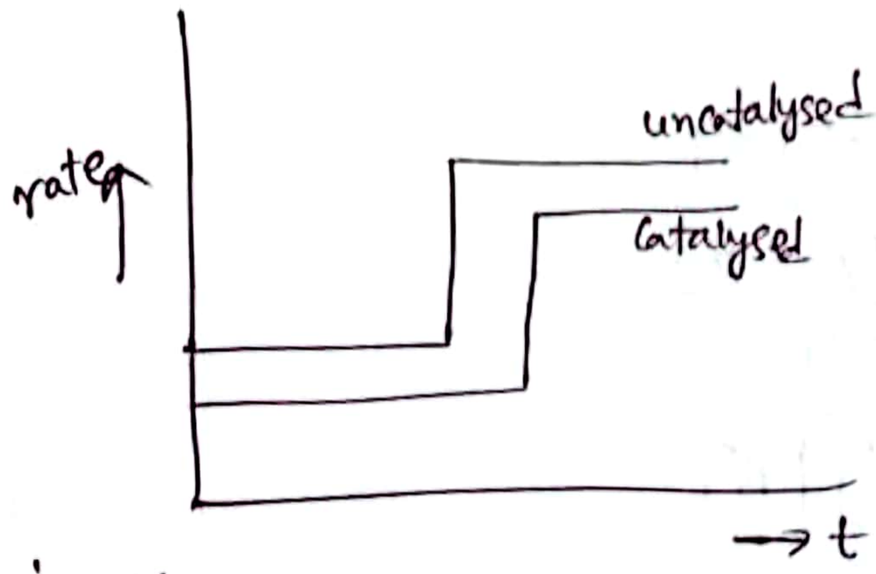
Equi is possible when the reaction vessel is closed and no part of the reactant or products escape out. [such as gaseous products]

4. Catalyst can't change equi point:

catalyst ~~spt~~ speeds up the rate of both the forward and the reverse reaction to an equal extent. ~~So, it can helps the equi to~~ A catalyst can't change the equi point except that, is acheived earlier.

5. Value of equi constant doesn't depend upon initial Concentration of reactants:

Equi constant must be the same when the concentrations of reacting species are varied over a wide range.



6. At equi, $\Delta G = 0$:

At equi the ~~gi~~ Gibbs free energy (ΔG) is minimum and ardy chage taking place at equilibrium proceeds without change in free energy that is, $\Delta G = 0$.

Characteristics of chemical Equilibrium:

1. **Constancy of concentration:**

When a chemical equilibrium is established in a closed vessel at constant temperature, concentration of the various species in the reaction mixture become constant.

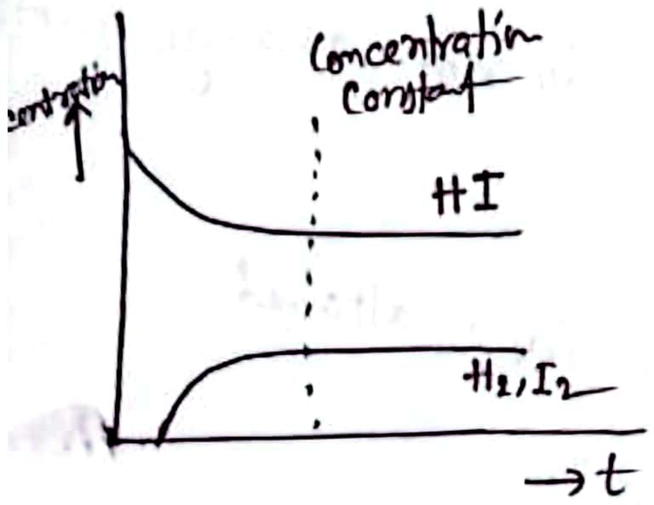
The reaction mixture at equi is called Equi... mixture

" Concentration " " " Equi Concentration.

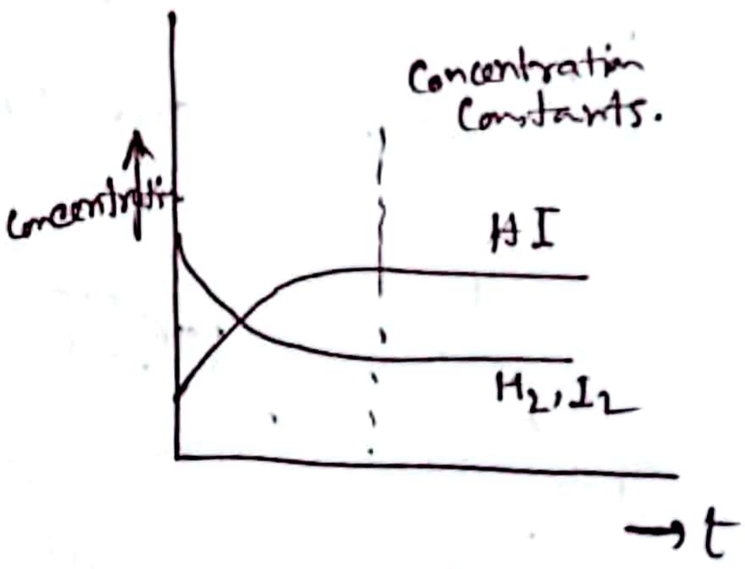
2. **Equi can be initiated from either side:**

The state of equilibrium of a reversible reaction can be approached whether we start with the reactants or products. For example,

$$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$$



This shows for equi starts from H_2 and I_2



This shows equi started from 2HI.

মাধ্যমিক ও উচ্চমাধ্যমিক শিক্ষা বোর্ড, ঢাকা

এসএসসি/এইচএসসি পরীক্ষা ২০ .....

[সঠিকটিতে টিক (✓) চিহ্ন দিতে হবে]

অতিরিক্ত উত্তরপত্র

পরীক্ষার বিষয় : _____ পত্র : _____ বিষয় কোড : _____

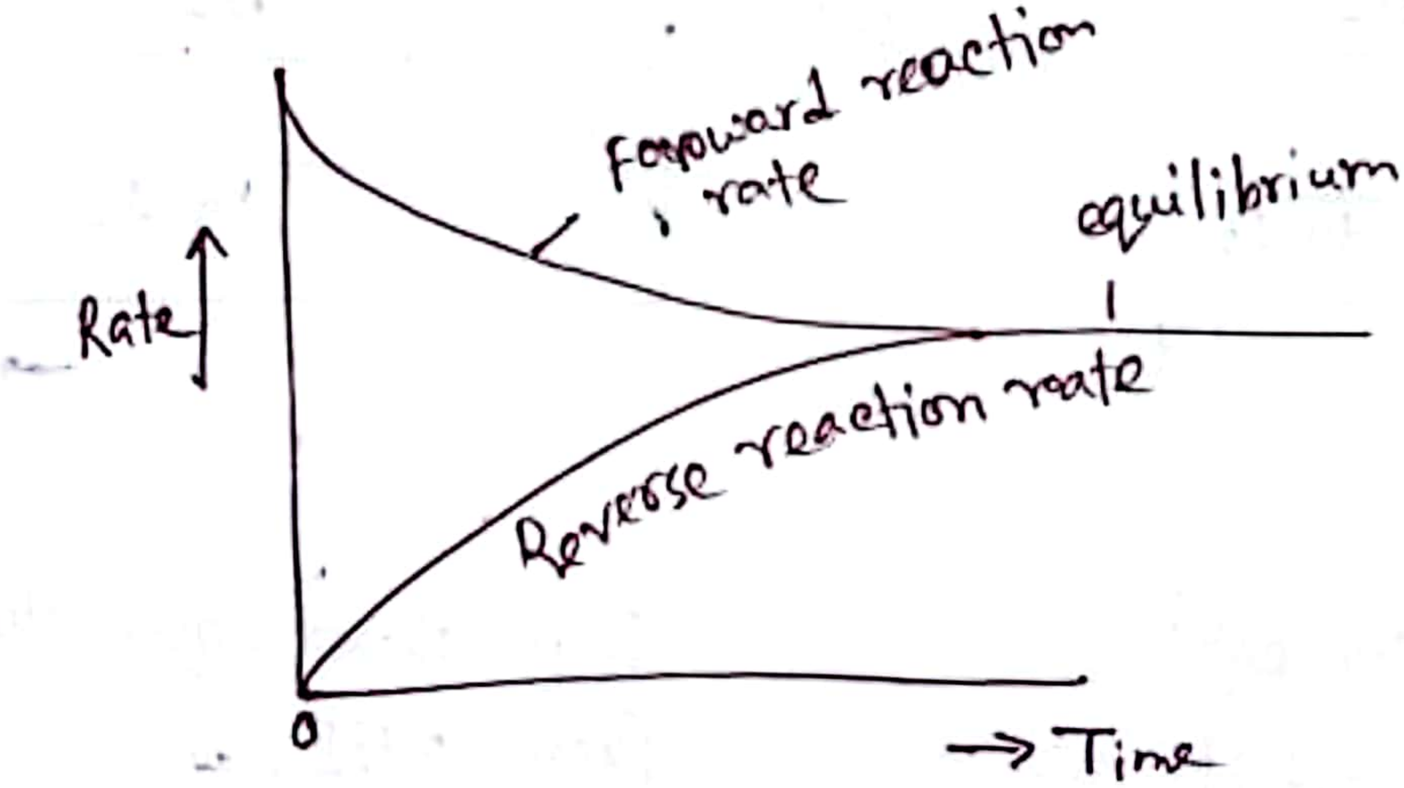
পরীক্ষার তারিখ : _____ দিন : _____

প্রত্যবেক্ষকের স্বাক্ষর : _____

এ স্থান হতে উত্তর লেখা আরম্ভ করতে হবে chap - 17

Chemical Equilibrium

Chem. Equilibrium: The state of ~~rea~~ a reversible reaction when the two opposing reactions occur at the same rate and the concentrations of reactants and products do not change with time.



* Page-870; variation of Conductance with temperature.
* Strong and weak electrolyte.

Ionic Mobility

Page : 894.

P-888: Transport Number or, transference Number
↳ [only cation charge]

$t_+ =$ ——

$t_- =$ ——

$t_- = \frac{1}{1+r}$

* Kohlrush's law : 894 page. ⟶ Application.

Q: Establish relationship bet^n eqvt conductance and ionic conductance. & transport Number.