



Study Smarter Not Harder

يوجد **شرح تفصيلي** لهذا الملف على شكل فيديوهات .
كما يتوفر شروحات تفاعلية **أونلاين** باستمرار على مدار الفصل .
للحصول على الشروحات المصورة أو **التسجيل في الدورات**
يرجى التواصل على الرقم :

00962-781466917

General Chemistry Review Chapter 13 : **Chemical Equilibrium** Mustafa Kharma



[La Medica Academy](#)



[lamedicaacademy](#)



[La Medica](#)



[La Medica](#)



[La medica Channel \(1st year\)](#)



[La medica Chat \(1st year\)](#)

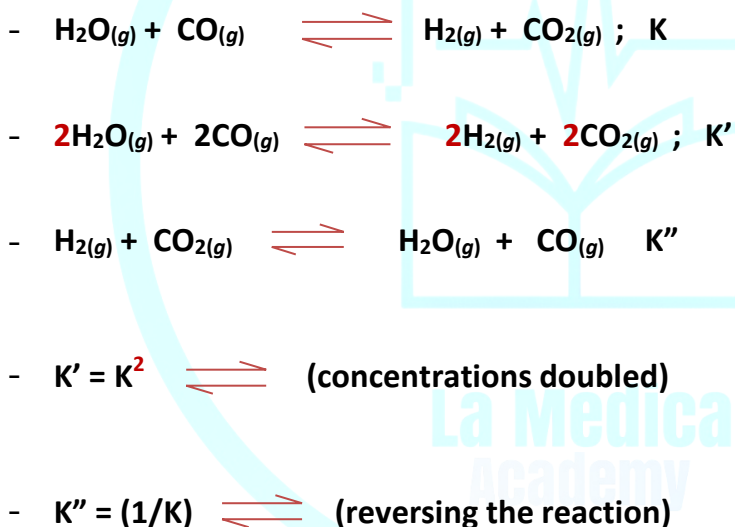


Chapter 13 – Chemical Equilibrium

⇒ **The Equilibrium Constant:**

- **K** is the equilibrium expression in terms of concentrations.
- **K_p** is the equilibrium expression in terms of the partial pressures of the gaseous constituents of the reaction

⇒ **Consider The Following Equilibria:**



⇒ **The Relationship Between K and K_p**

$$K_p = K(RT)^{\Delta n_g}$$

$$\Delta n_g = n_g (P) - n_g (R)$$



Using the value of K_p (3.9×10^4) from the previous example, **calculate the value of K at 35°C .**

$$K_p = K(RT)^{\Delta n_g}$$

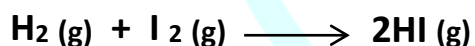
$$3.9 \times 10^4 = K(0.0821 \text{ L.atm/mol.K} \times 308\text{K})^{2-4}$$

$$K = 2.5 \times 10^7$$

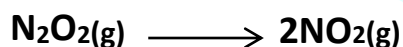
Note: $K_p < K$ (Δn_g is negative)

▪ $K_p = K(RT)^{\Delta n_g}$; $\Delta n_g = n_g(\text{P}) - n_g(\text{R})$

▪ $K_p = K$ when $\Delta n_g = 0$



▪ $K_p > K$ when $\Delta n_g > 0$



- If the equilibrium **lies to the right** (toward the products), the value for **K** is **Larger than 1**.
- If the equilibrium **lies to the left** (towards the reactants), the value for **K** is **Smaller than 1**.

⇒ **Calculations:**

At equilibrium: $[C] = 3.0M$

| | $A_{(g)}$ | $+ 2B_{(g)}$ | $C_{(g)}$ |
|-----------------|-----------|--------------|-----------|
| Initially: | 8 | 10 | 0 |
| Change: | -3 | -6 | +3 |
| At equilibrium: | 5 | 4 | 3 |

$$K = \frac{[C]}{[B]^2[A]} = \frac{3}{4^2 \cdot 5} = 0.0375$$

Calculate K_p at $25^\circ C$?

If the Initial concentrations are: $10.0 M Fe^{3+}$ and $8.00 M SCN^-$, **What is the equilibrium concentration of $FeSCN^{2+}$ ($K=0.3333$)** The equilibrium reaction is shown below:

| | $Fe^{3+}_{(aq)}$ | $+ SCN^-_{(aq)}$ | $FeSCN^{2+}_{(aq)}$ |
|------------------|------------------|------------------|---------------------|
| Initially: | 10.0 M | 8.0 M | 0 |
| At Equilibrium.: | $(10.0 - x)$ | $(8.0 - x)$ | x |

$$K = \frac{x}{(8.0-x)(10.0-x)} = 0.3333 \quad 5.00 M FeSCN^{2+}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

It is found that $x=5M$ so, At eq.: $[Fe^{3+}] = 10 - 5 = 5$, $[SCN] = 8 - 5 = 3$, $[FeSCN] = 5$

⇒ **Reaction Quotient, Q:**

- $Q = K$; The system is at equilibrium. No shift will occur.
 - $Q > K$; The system shifts to the **left**. **After equilibrium** ←
 - Consuming products and forming reactants, until equilibrium is achieved.
 - $Q < K$; The system shifts to the **right**. **Before equilibrium** →
 - Consuming reactants and forming products, to attain equilibrium.
- Consider the reaction represented by the equation:



- Consider the following initial concentrations

| | Fe^{3+} | SCN^{-} | FeSCN^{+2} | Q |
|------------|------------------|------------------|---------------------|---------------|
| Q1: | 9.00 M | 5.00 M | 1.00 M | 0.0222 |
| Q2: | 3.00 M | 2.00 M | 5.00 M | 0.8333 |
| Q3: | 2.00 M | 9.00 M | 6.00 M | 0.3333 |

$K = 0.3333$

Find the equilibrium concentrations for all species.

⇒ Le Châtelier's Principle:

- 1. Concentration:** The system will shift away upon addition of any component that is a part of the system. If a component is removed, the opposite effect occurs.
- 2. Temperature:** K will change depending upon the temperature.
(endothermic – energy is a reactant; exothermic – energy is a product).
- 3. Pressure effect at constant temperature,** pressure that is due to a volume change
(volume pressure): Favor the reaction that decreases the number of gas molecules.
- 4. Addition of inert gas** does not affect the equilibrium position.