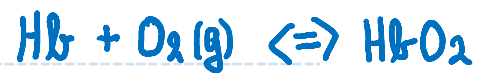
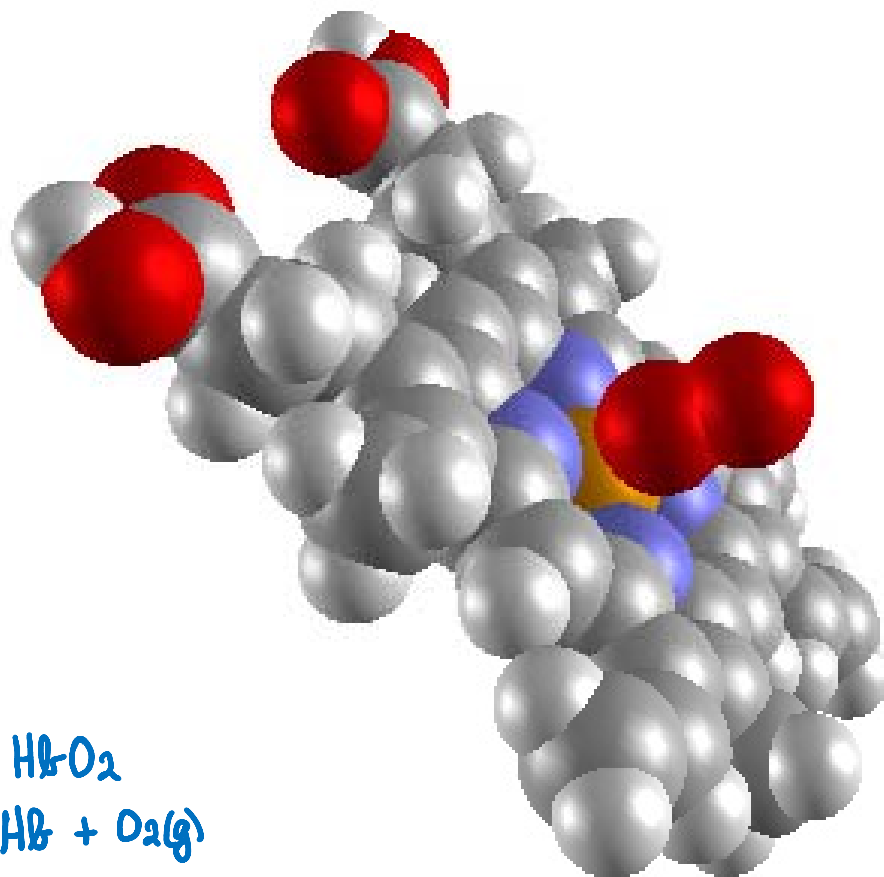
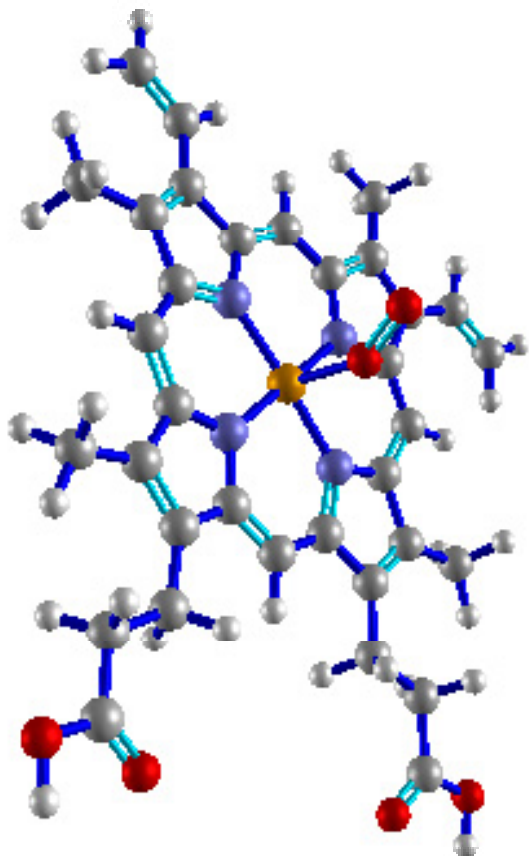


Announcements – Lecture XIII – Thursday, Oct 25rd

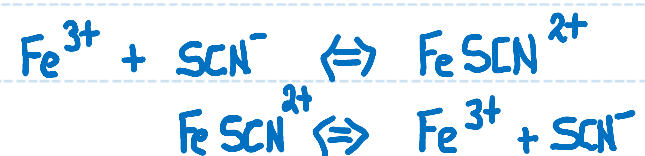
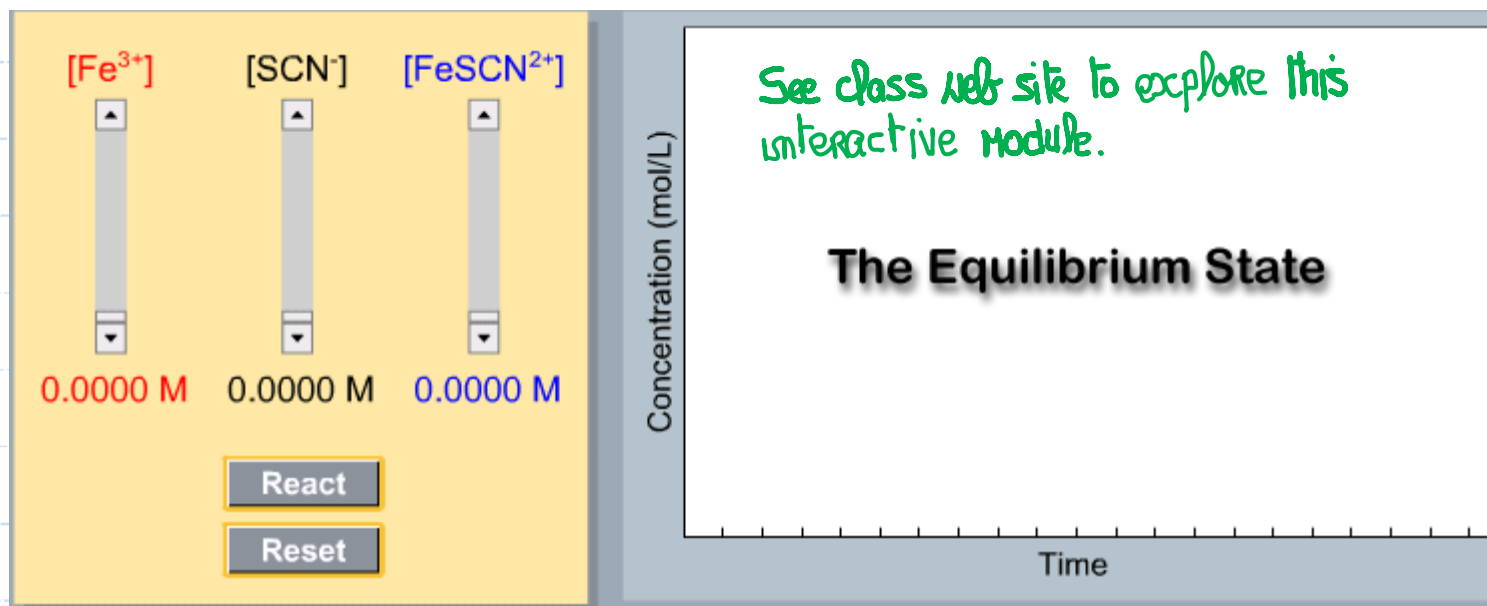


7.5 What Does It Mean to Say That a Reaction Has Reached Equilibrium



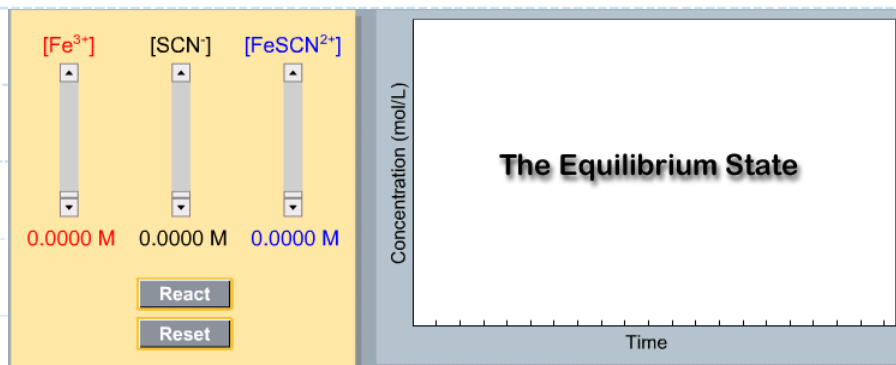
" \rightleftharpoons " used to indicate an equilibrium

7.5 What Does It Mean to Say That a Reaction Has Reached Equilibrium



7.5 What Does It Mean to Say That a Reaction Has Reached Equilibrium

* [] : mol. L⁻¹



Starting Concentrations			
	[Fe ³⁺]	[SCN ⁻]	[FeSCN ²⁺]
#1	0.004	0.007	0
#2	0	0	0.007
#3	0.004	0.003	0.004

Equilibrium Concentrations					
	[Fe ³⁺]	[SCN ⁻]	[FeSCN ²⁺]	[Fe ³⁺][SCN ⁻]/[FeSCN ²⁺]	[FeSCN ²⁺]/[Fe ³⁺][SCN ⁻]
#1	2.285 × 10 ⁻³	5.285 × 10 ⁻³	1.714 × 10 ⁻³	7.046 × 10 ⁻³	141.9
#2	4.333 × 10 ⁻³	4.333 × 10 ⁻³	2.666 × 10 ⁻³	7.042 × 10 ⁻³	142.0
#3	5.069 × 10 ⁻³	4.069 × 10 ⁻³	2.930 × 10 ⁻³	7.040 × 10 ⁻³	142.0

$$\frac{[\text{Fe}^{3+}][\text{SCN}^-]}{[\text{FeSCN}^{2+}]} = \text{Constant}$$

$$\frac{[\text{FeSCN}^{2+}]}{[\text{Fe}^{3+}][\text{SCN}^-]} = \text{Constant}$$



7.6 What is an Equilibrium Constant and How Do We Use It?

Writing Equilibrium Expressions

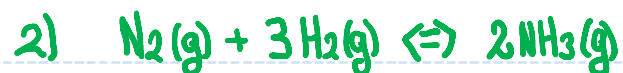
1) $K = \frac{[\text{Products}]}{[\text{Reactants}]}$

$K = \text{Equilibrium constant.}$

2) When writing equilibrium expressions (equations) ... pure solids and liquids do not appear in the expression.



$$K = \frac{[\text{H}_2\text{O}_2]}{[\text{H}_2][\text{O}_2]}$$



$$K = \frac{[\text{NH}_3][\text{NH}_3]}{[\text{N}_2][\text{H}_2][\text{H}_2][\text{H}_2]}$$

$$K = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3}$$



$$K = [\text{Ag}^+][\text{Cl}^-]$$



$$K = \frac{[\text{H}_3\text{O}^+][\text{F}^-]}{[\text{HF}]}$$



7.6 What is an Equilibrium Constant and How Do We Use It?

The Significance of the Magnitude of K

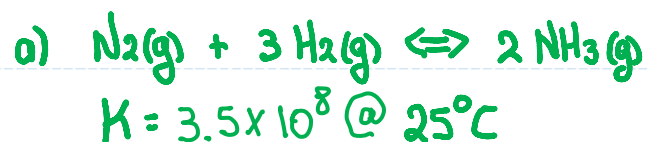
The simulation interface is divided into several sections:

- Top Left:** A square box containing 30 blue spheres representing molecules.
- Top Right:** A graph with the y-axis labeled "Number of Molecules" and the x-axis labeled "Time". Inside the graph area, the text "See class web site" is written in green, and "The Meaning of the Equilibrium Constant." is written in black.
- Bottom Left:** A status bar showing "Blue: 30" and "Red: 0". Below this are two buttons: "Play" and "Reset".
- Bottom Right (Yellow Panel):** A control panel with three sections:
 - Equilibrium Constant:** Three radio buttons labeled $K > 1$, $K = 1$, and $K < 1$. The $K = 1$ option is selected.
 - Number of Spheres:** Three radio buttons labeled 30, 20, and 10. The 30 option is selected.
 - Temperature:** Two radio buttons labeled High and Low. The High option is selected.

7.6 What is an Equilibrium Constant and How Do We Use It?

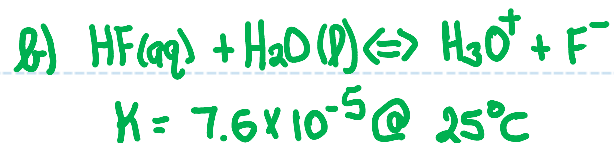
The Significance of the Magnitude of K

- a) $K \gg 1$: At equilibrium the reaction favors products
- b) $K \ll 1$: At equilibrium the reactions favors reactants
- c) $K \sim 1$: At equilibrium significant quantities of products and reactants present.



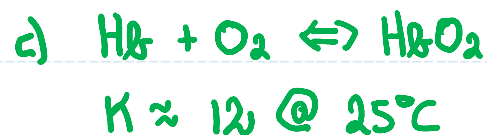
$$K \gg 1$$

Product favored at equilibrium.



$$K \ll 1$$

Reactant favored at equilibrium



$$K \sim 1$$

Significant quantities of reactants and products present at equilibrium.