

## Announcements – Lecture XIV – Thursday, Oct 29<sup>th</sup>

### 1. Fourth Lab – Saturday, October 31<sup>st</sup> ... 1-4pm ... ISB 155/160 (A-E)

a) *Print lab prior to coming to lab -- use the 'Print Friendly Version' located on the top left hand side of the page – this is the version that contains the 'Data Sheet' that you will hand in upon completing the lab.*

b) *Third set of Lab Owls will appear in Owl after this lab. There are a total of 4 sets of Lab Owls and they are worth 25% of the Lab Grade.*

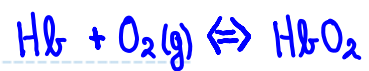
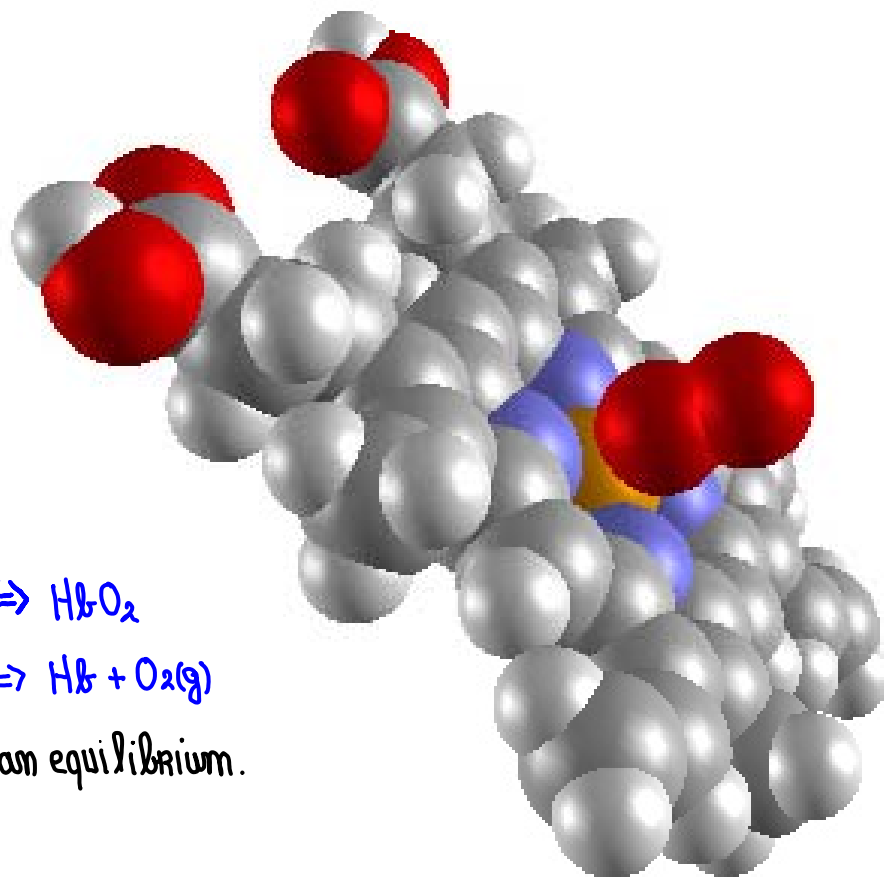
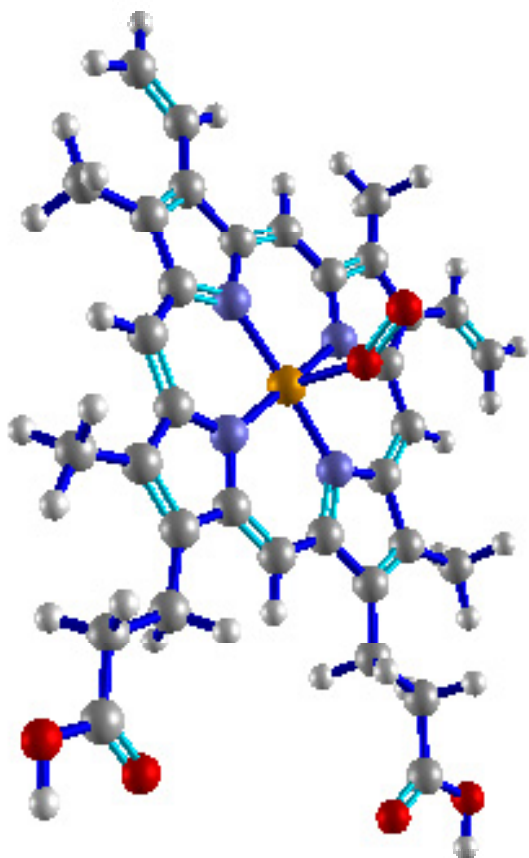
### 2.



**iClicker:**

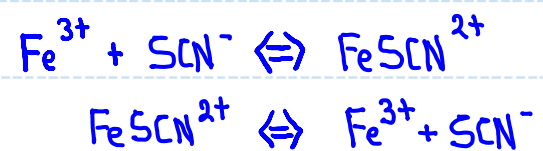
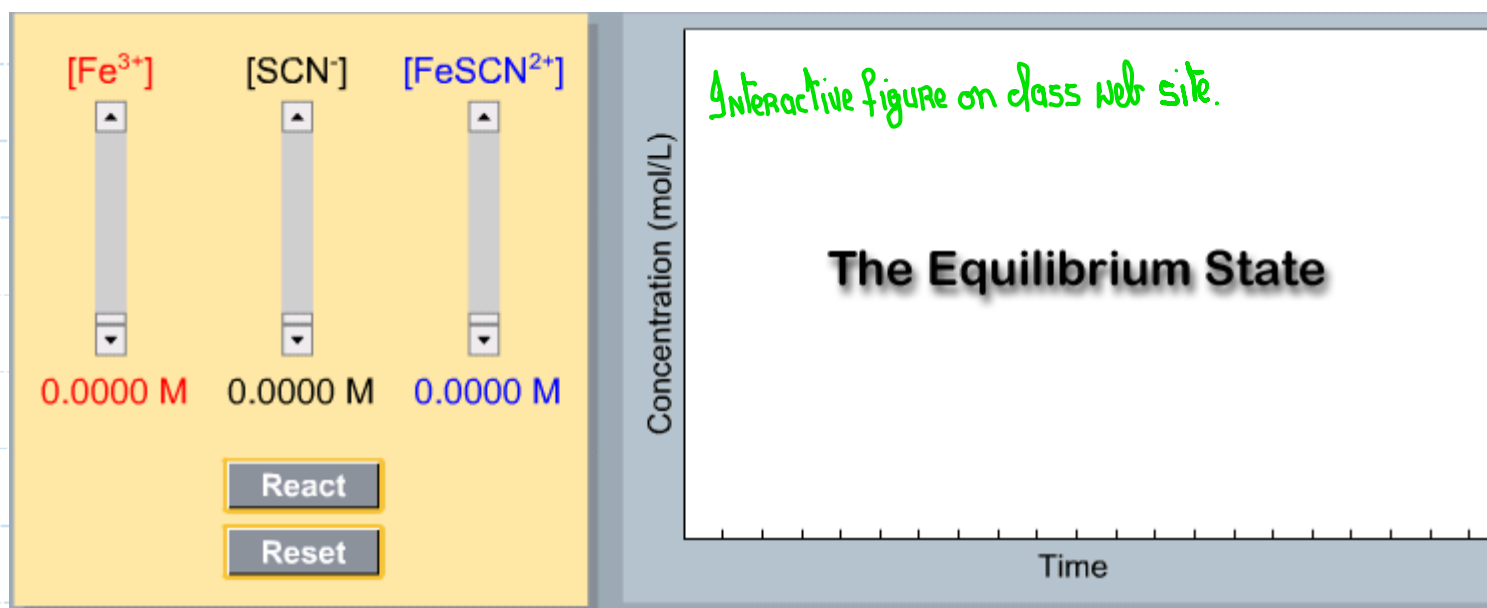
*Choose any letter: A-E*

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



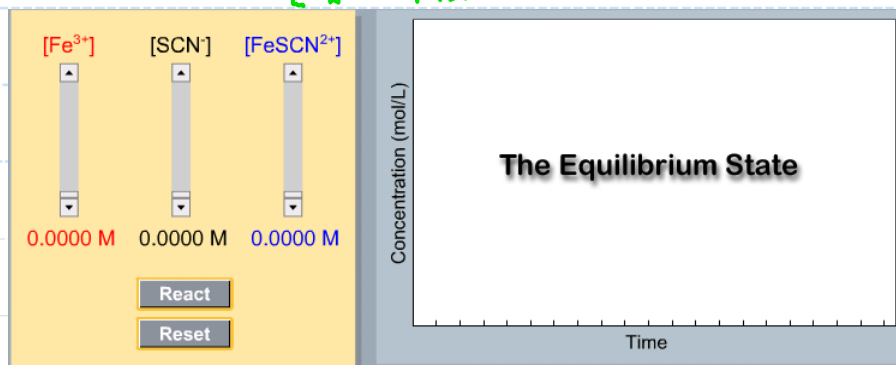
" $\rightleftharpoons$ " used to indicate an equilibrium.

## 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<sup>-1</sup>



Starting Concentrations			
	[Fe <sup>3+</sup> ]	[SCN <sup>-</sup> ]	[FeSCN <sup>2+</sup> ]
#1	0.004	0.007	0
#2	0	0	0.007
#3	0.004	0.003	0.004

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

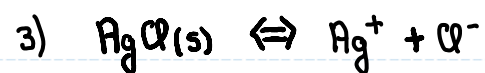
1)  $K = \frac{[\text{Products}]}{[\text{Reactants}]}$

$K = \text{equilibrium constant.}$

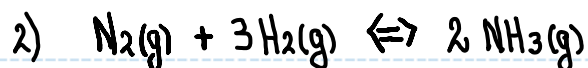
2) When writing equilibrium expressions (equations) ... pure solids and liquids do NOT appear in the expression.



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

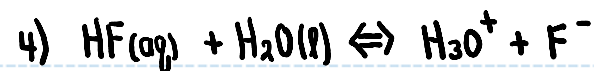


$$K = [\text{Ag}^+][\text{Cl}^-]$$



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

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



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

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

### The Significance of the Magnitude of K

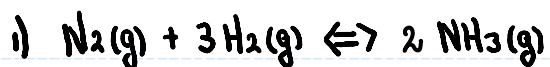
The simulation interface is divided into several sections:

- Top Left:** A square box containing 30 blue spheres representing molecules.
- Top Right:** A graph with a vertical axis labeled "Number of Molecules" and a horizontal axis labeled "Time". A green handwritten note above the graph reads "See class web site." Below the graph, the text "The Meaning of the Equilibrium Constant." is displayed.
- Bottom Left:** A control panel showing "Blue: 30" and "Red: 0". It includes "Play" and "Reset" buttons.
- Bottom Right:** A yellow control panel with three sections:
  - Equilibrium Constant:** Radio buttons for  $K > 1$ ,  $K = 1$  (selected), and  $K < 1$ .
  - Number of Spheres:** Radio buttons for 30 (selected), 20, and 10.
  - Temperature:** Radio buttons for High and Low (selected).

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

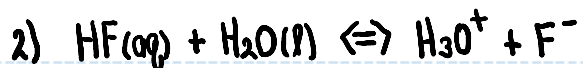
### The Significance of the Magnitude of K

- 1)  $K \gg 1$  : At equilibrium the reaction favors products.
- 2)  $K \ll 1$  : At equilibrium the reaction favors reactants.
- 3)  $K \sim 1$  : At equilibrium significant quantities of products and reactants present.



$$K = 3.5 \times 10^8 \text{ @ } 25^\circ\text{C}$$

$K \gg 1$  : Product favored at equilibrium.



$$K = 7.6 \times 10^{-5} \text{ @ } 25^\circ\text{C}$$

$K \ll 1$  : Reactant favored at equilibrium.



$$K \approx 12 \text{ @ } 25^\circ\text{C}$$

$K \sim 1$  : Significant quantities of reactants and products present at equilibrium.