Announcements – Lecture XIV – Thursday, Oct 23rd

1. **Fourth Lab – Saturday, November 1st … 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.*

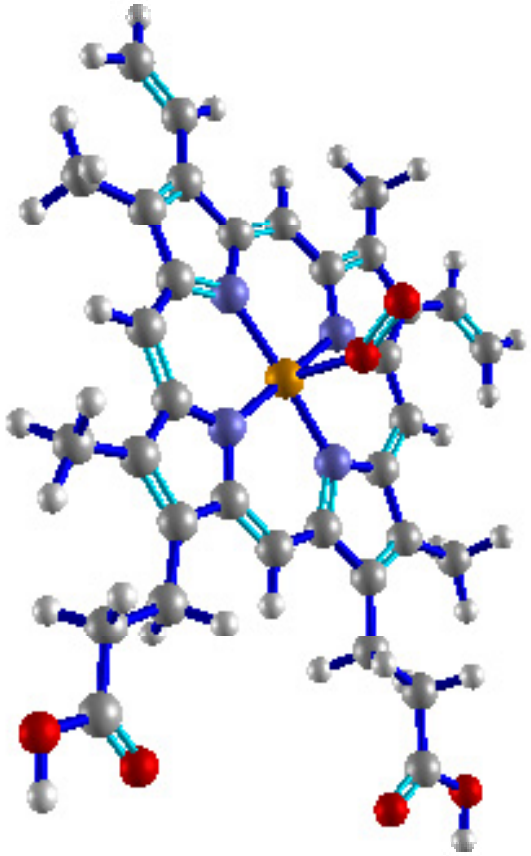
   b) *Third set of Lab Owls will appear in Owl after this lab. There are a total of 4 sets of Lab Owls and they are worth 25% of the Lab Grade.*

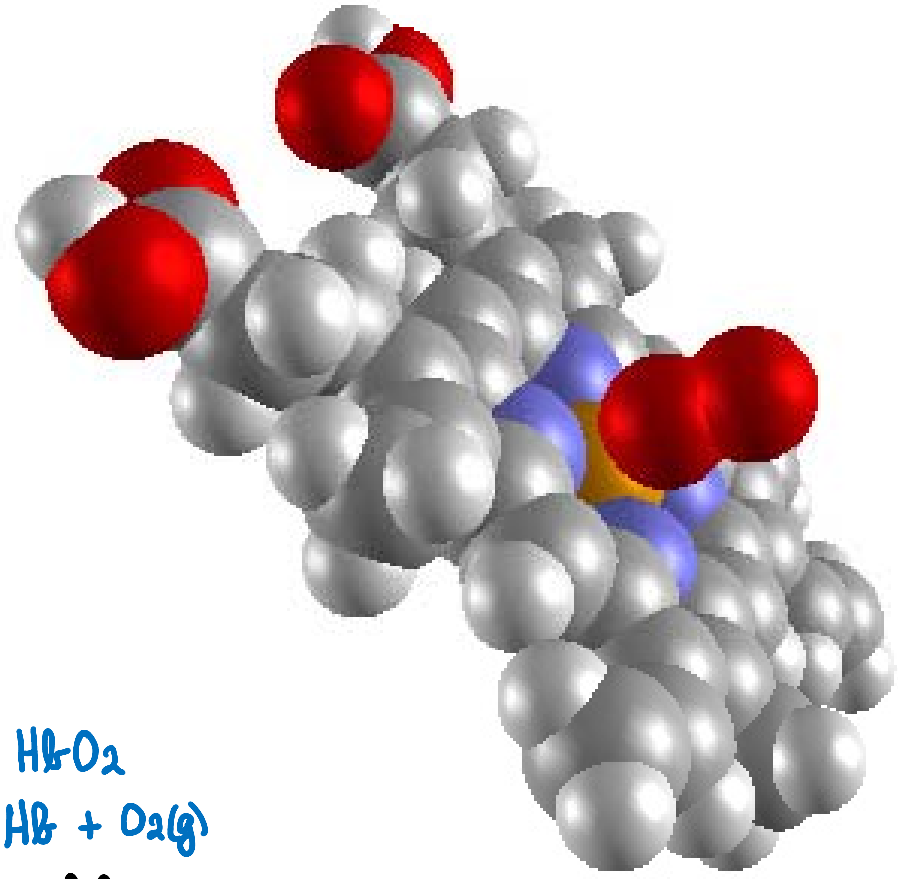
2. **Second Exam – Tuesday November 4th – 1:00-2:15pm – In Class**

3. 

iClicker:
Choose any letter: A-E

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



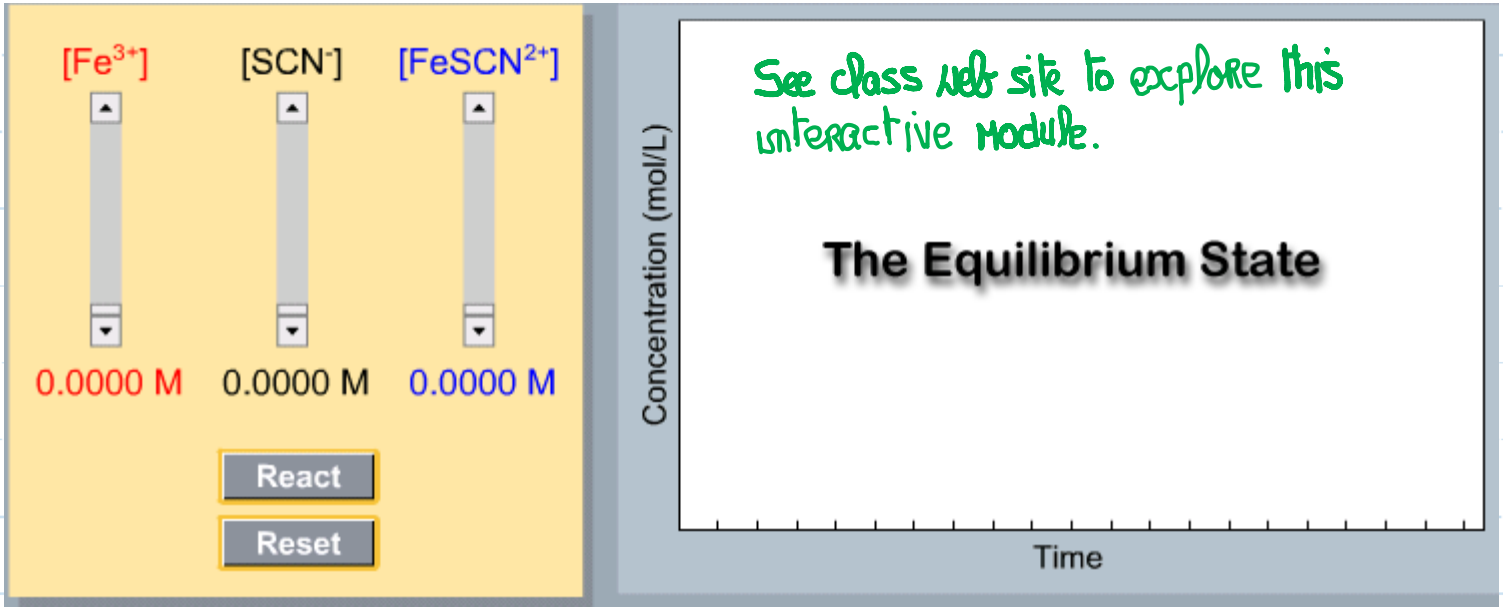


$Hb + O_2(g) \rightleftharpoons Hb\text{-}O_2$

$Hb\text{-}O_2 \rightleftharpoons Hb + O_2(g)$

"$\rightleftharpoons$" used to indicate an equilibrium

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



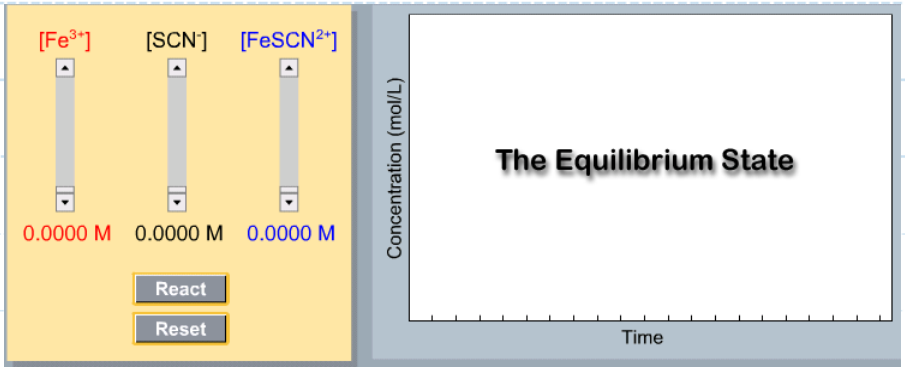
See class web site to explore this interactive module.

$$Fe^{3+} + SCN^- \rightleftharpoons FeSCN^{2+}$$

$$FeSCN^{2+} \rightleftharpoons Fe^{3+} + SCN^-$$

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

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

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

Writing Equilibrium Expressions

1) K = [Products]/[Reactants] K = Equilibrium constant.

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

1) $HBr + O_2 \Leftrightarrow HBrO_2$

$$K = \frac{[HBrO_2]}{[HBr][O_2]}$$

2) $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

$$K = \frac{[NH_3][NH_3]}{[N_2][H_2][H_2][H_2]}$$

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

3) $AgCl(s) \Leftrightarrow Ag^+ + Cl^-$

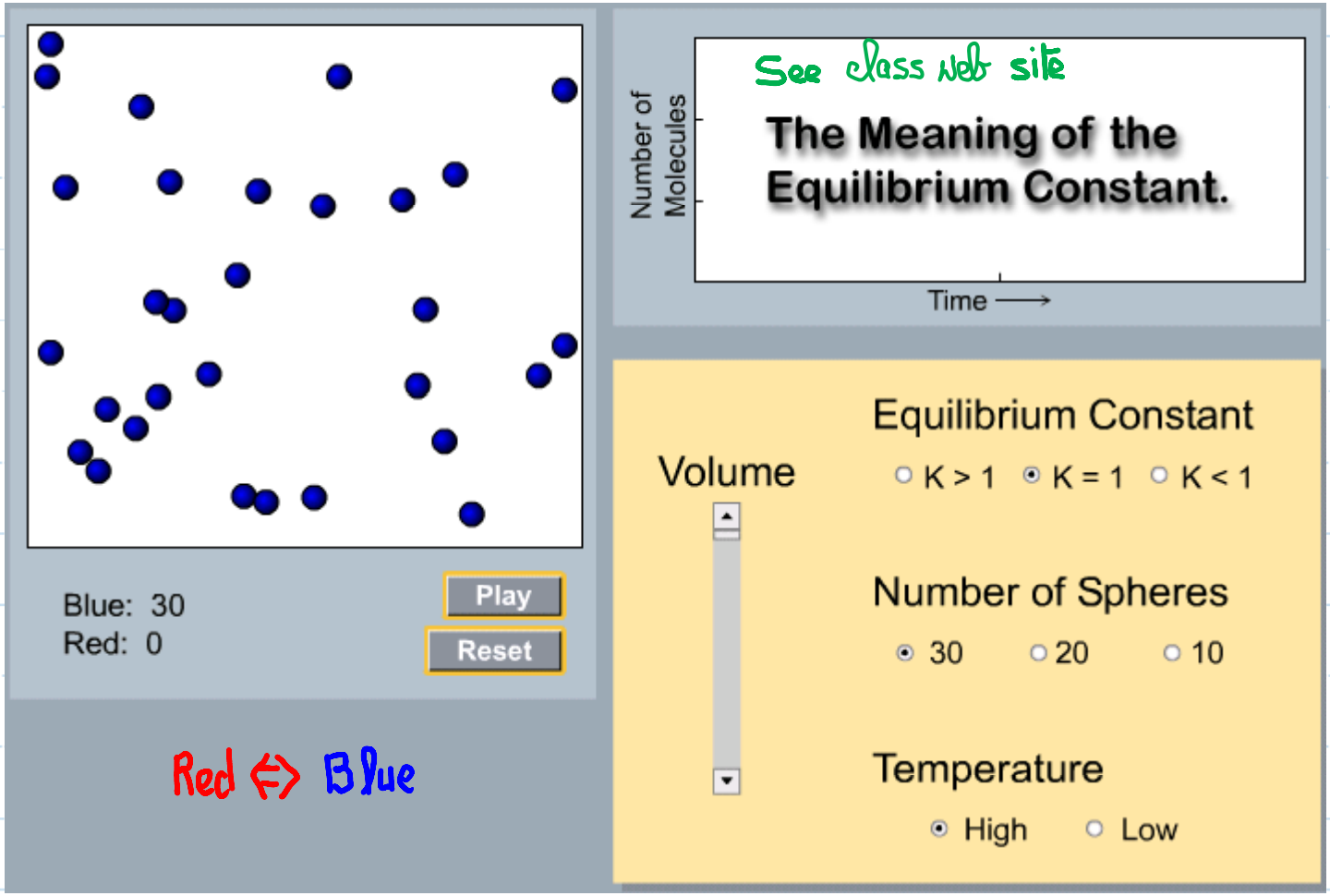
$$K = [Ag^+][Cl^-]$$

4) $HF(aq) + H_2O(l) \Leftrightarrow H_3O^+ + F^-$

$$K = \frac{[H_3O^+][F^-]}{[HF]}$$

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

The Significance of the Magnitude of K



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.

a) $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

$K = 3.5 \times 10^8$ @ 25°C

$K \gg 1$

Product favored at equilibrium.

b) $HF(aq) + H_2O(l) \Leftrightarrow H_3O^+ + F^-$

$K = 7.6 \times 10^{-5}$ @ 25°C

$K \ll 1$

Reactant favored at equilibrium

c) $H_2 + O_2 \Leftrightarrow H_2O_2$

$K \approx 12$ @ 25°C

$K \sim 1$

Significant quantities of Reactants and products present at equilibrium.