Announcements – Lecture XIV – Thursday, Oct 29th

1. **Fourth Lab – Saturday, October 31st … 1-4pm … ISB 155/160 (A-E)**

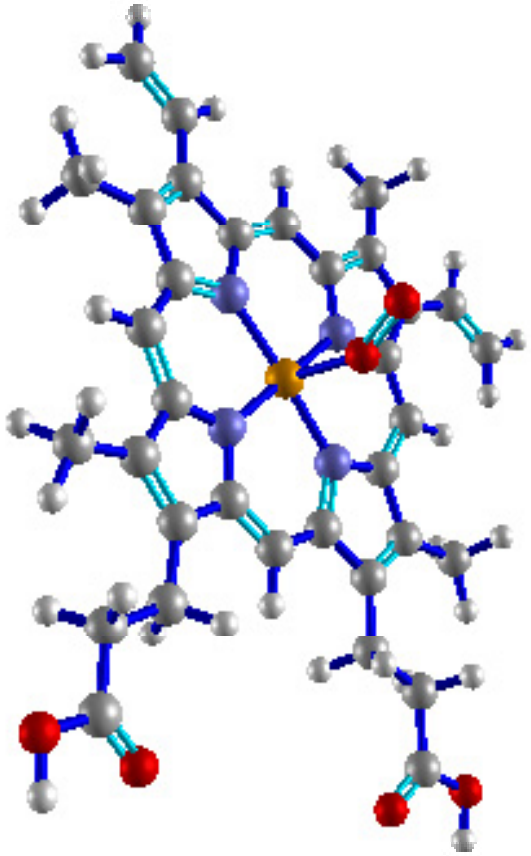
   a) *Print lab prior to coming to lab -- use the 'Print Friendly Version' located on the top left hand side of the page – this is the version that contains the 'Data Sheet' that you will hand in upon completing the lab.*

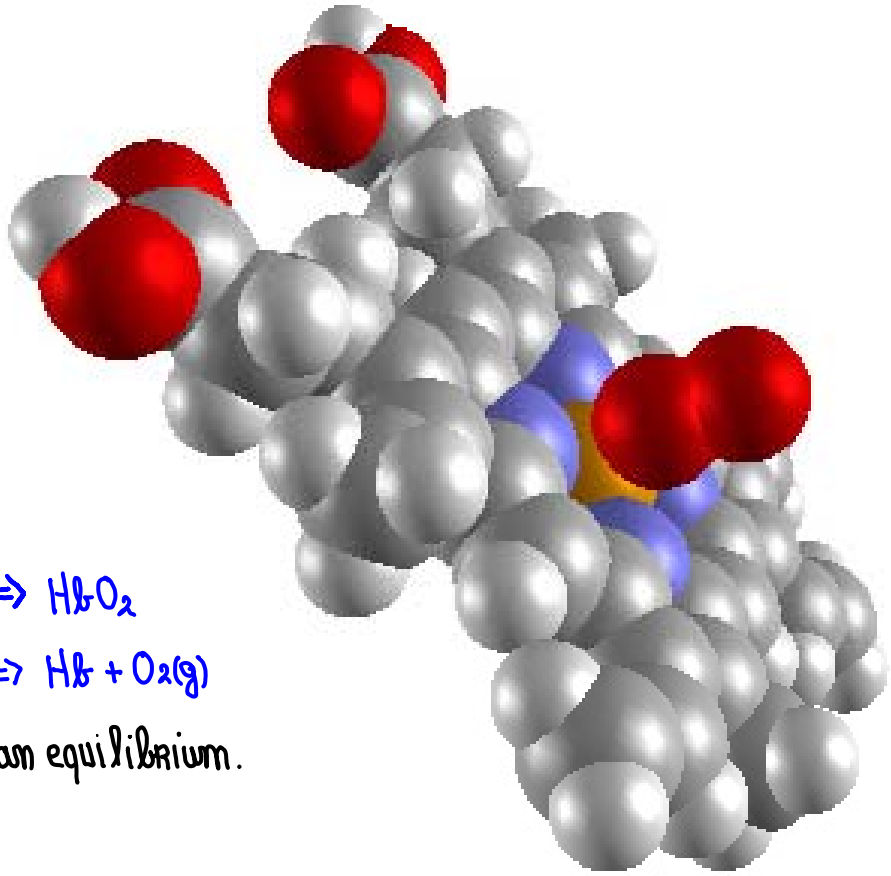
   b) *Third set of Lab Owls will appear in Owl after this lab. There are a total of 4 sets of Lab Owls and they are worth 25% of the Lab Grade.*

2. 

iClicker:
Choose any letter: A-E

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



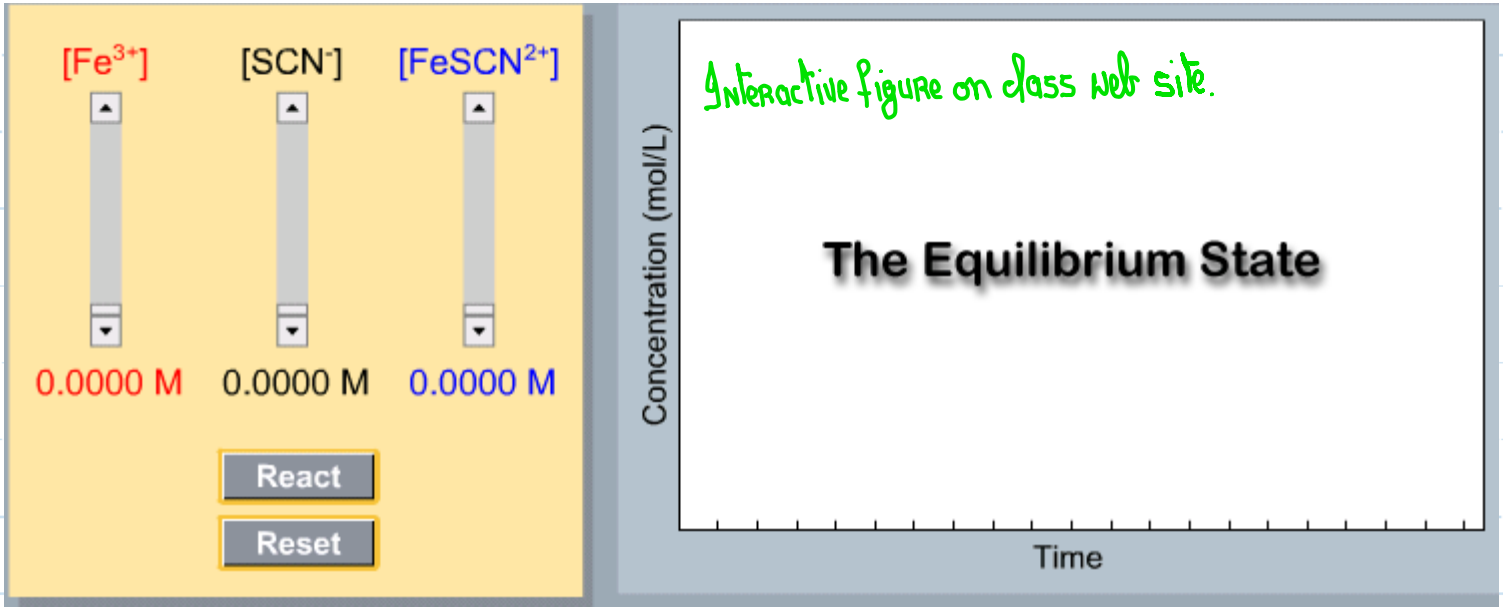


$Hb + O_2(g) \Leftrightarrow HbO_2$

$HbO_2 \Leftrightarrow Hb + O_2(g)$

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

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

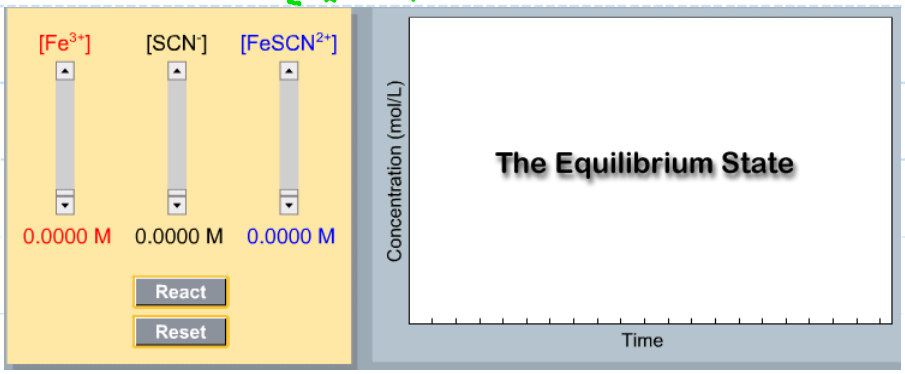


$Fe^{3+} + SCN^- \rightleftharpoons FeSCN^{2+}$

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

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

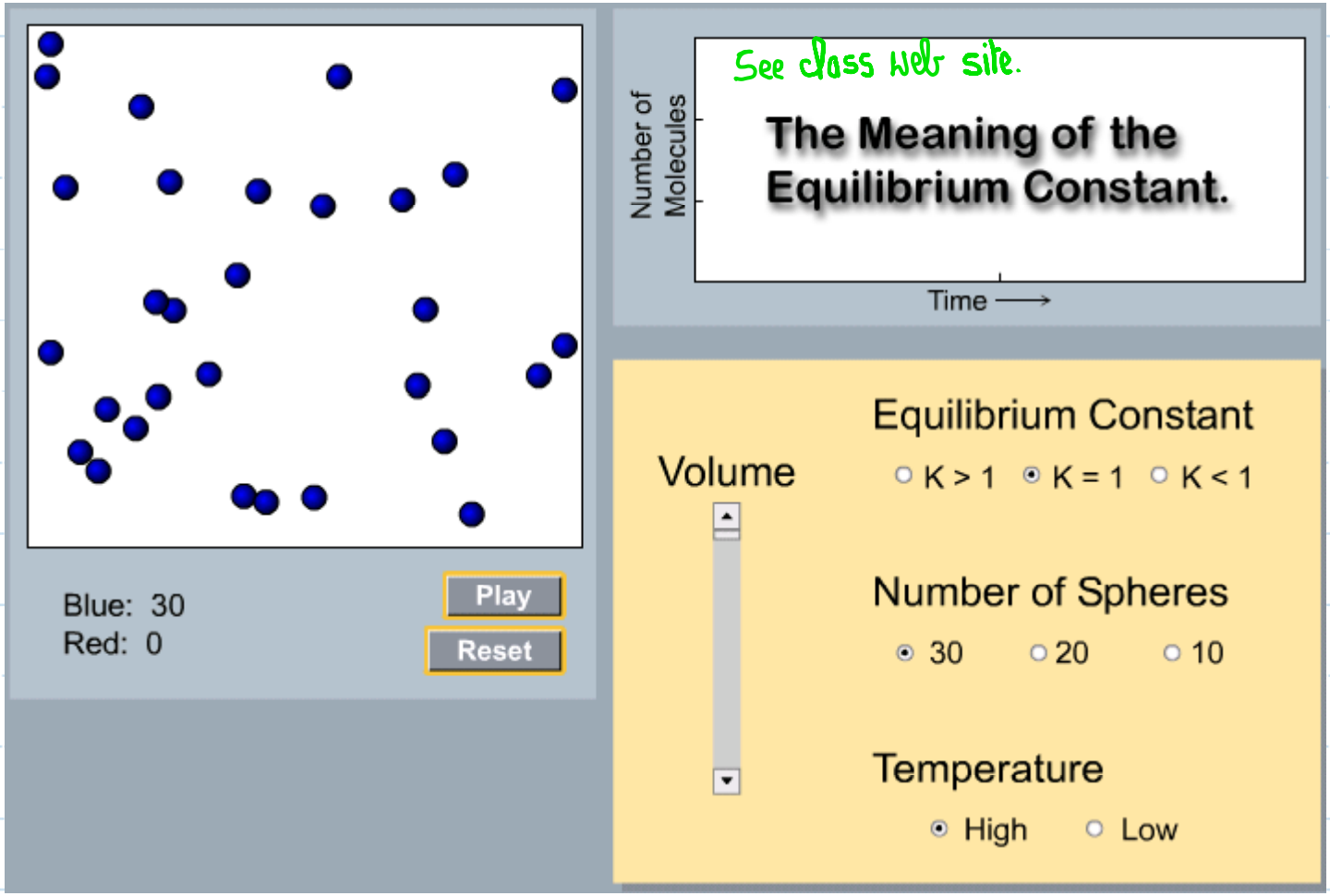
$$K = [Ag^+][Cl^-]$$

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

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.

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

$K = 3.5 \times 10^{8}$ @ 25°C

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

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

$K = 7.6 \times 10^{-5}$ @ 25°C

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

3) $H_2 + O_2 \Leftrightarrow H_2O_2$

$K \approx 12$ @ 25°C

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