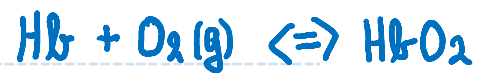# Announcements – Lecture XIII – Thursday, Oct 25rd
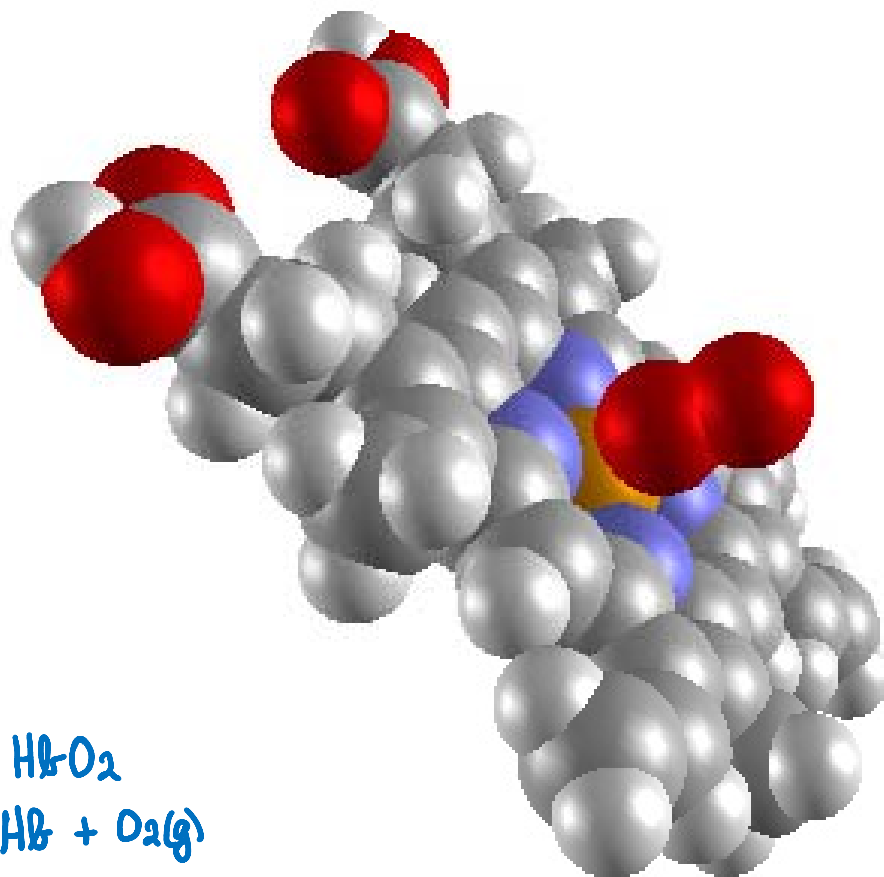
$$Hb + O_2(g) \Longleftrightarrow HbO_2$$

$$HbO_2 \Longleftrightarrow Hb + O_2(g)$$
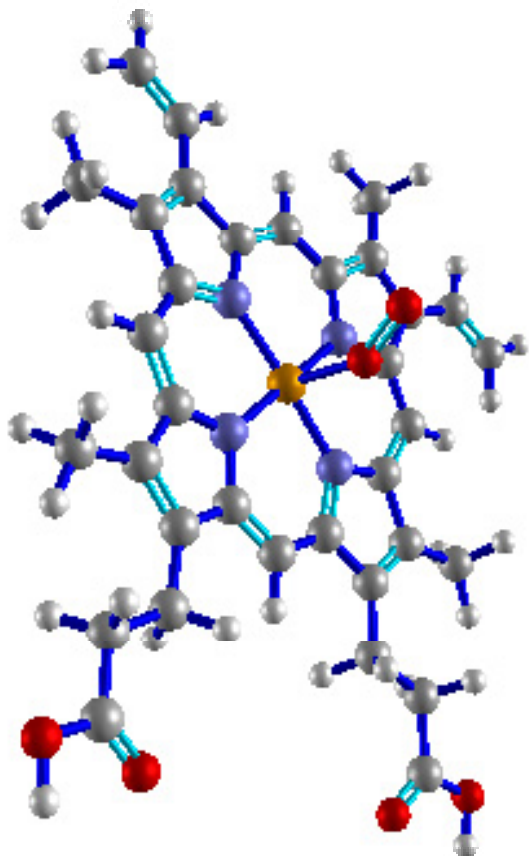
" $\Longleftrightarrow$ " used to indicate an equilibrium
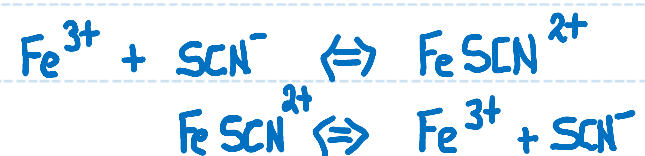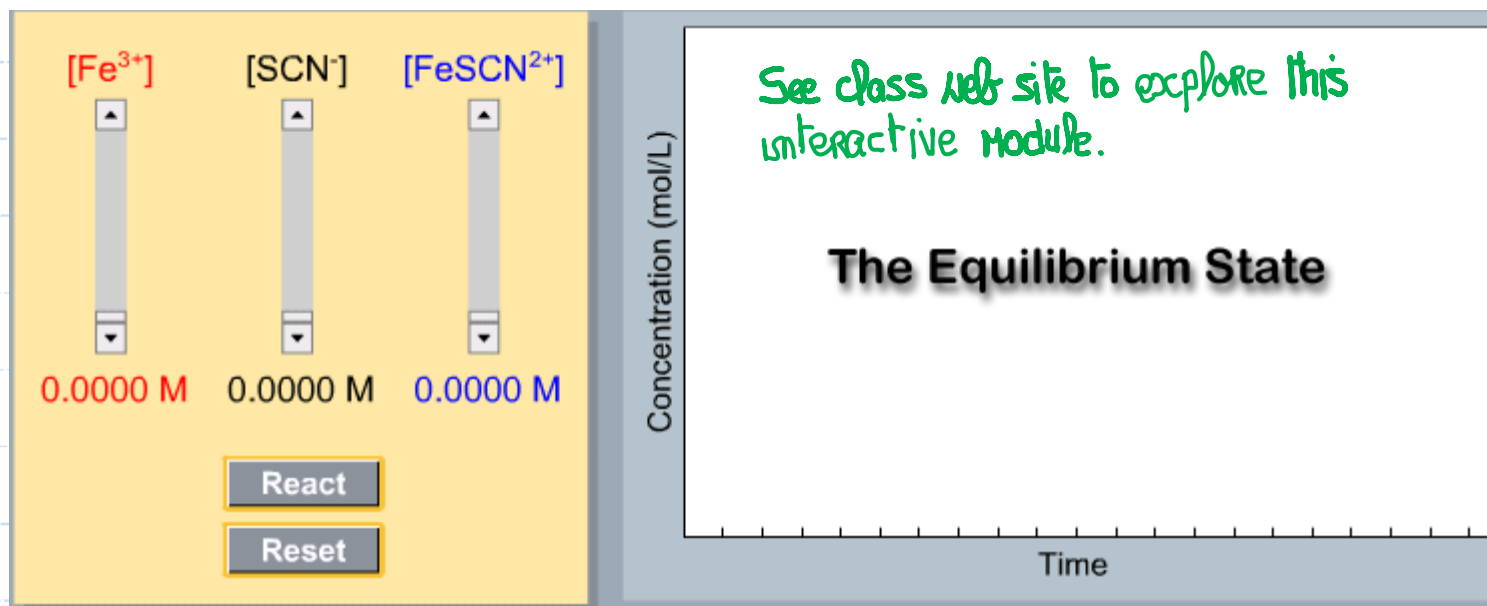
[Fe^{3+}]	[SCN$^-$]	[FeSCN^{2+}]
▲	▲	▲
▼	▼	▼
0.0000 M	0.0000 M	0.0000 M

React

Reset

Concentration (mol/L)

See class web site to explore this interactive module.

The Equilibrium State

Time

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

$* [\ ]: mol. L^{-1}$
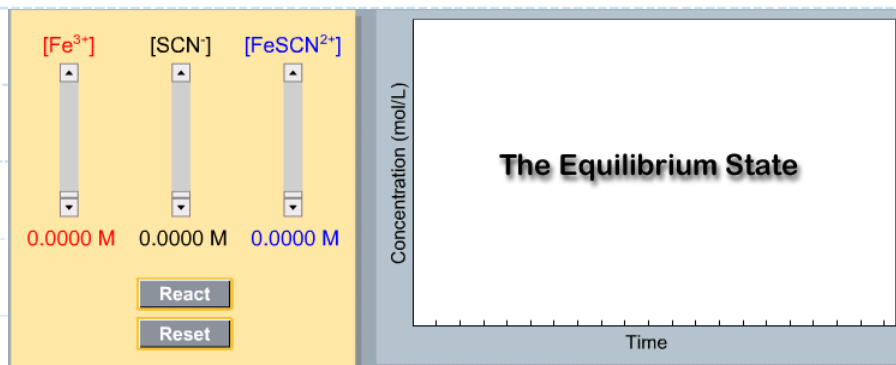
Starting Concentrations			
	$[Fe^{3+}]$	$[SCN^-]$	$[FeSCN^{2+}]$
#1	0.004	0.007	0
#2	0	0	0.007
#3	0.004	0.003	0.004

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

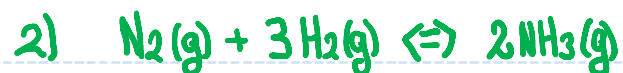$$\frac{[Fe^{3+}][SCN^-]}{[FeSCN^{2+}]} = Constant \qquad \frac{[FeSCN^{2+}]}{[Fe^{3+}][SCN^-]} = Constant$$

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

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

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1) $H_2 + O_2 \Leftrightarrow H_2O_2$

$$K = \frac{[H_2O_2]}{[H_2][O_2]}$$

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) $HF(aq) + H_2O(l) \Leftrightarrow H_3O^+ + F^-$
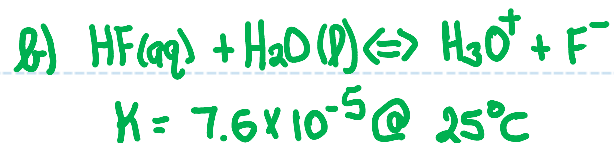
$$K = \frac{[H_3O^+][F^-]}{[HF]}$$

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

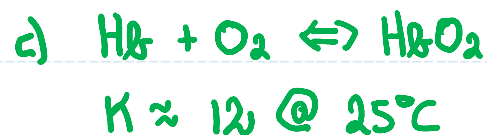c) $K \sim 1$: At equilibrium significant quantities of products and reactants present.

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

$K = 3.5 \times 10^8$ @ 25°C
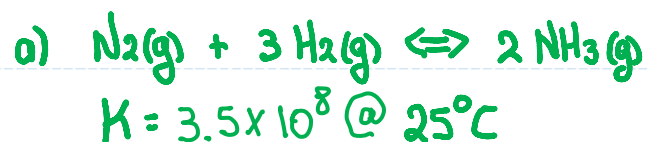
$K \gg 1$

Product favored at equilibrium.

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

$K = 7.6 \times 10^{-5}$ @ 25°C

$K \ll 1$

Reactant favored at equilibrium

c) $H_2 + O_2 \Longleftrightarrow H_2O_2$

$K \approx 12$ @ 25°C

$K \sim 1$

Significant quantities of reactants and products present at equilibrium.