Hemoglobin and Oxygen Trasport

0.01 mol $O_2(g)$ per L of blood

0.0001 mol $O_2(g)$ per L of $H_2O(\ell)$

Oxygen binds to hemoglobin (Hb)

Hb can bind up to 4 molecules of $O_2(g)$

$Hb(aq) + O_2(g) \rightleftharpoons Hb(O_2)(aq)$ $\quad K_1 = 4.88$

$Hb(O_2)(aq) + O_2(g) \rightleftharpoons Hb(O_2)_2(aq)$ $\quad K_2 = 15.4$

$Hb(O_2)_2(aq) + O_2(g) \rightleftharpoons Hb(O_2)_3(aq)$ $\quad K_3 = 6.49$

$Hb(O_2)_3(aq) + O_2(g) \rightleftharpoons Hb(O_2)_4(aq)$ $\quad K_4 = 1750$

Myoglobin

$Mb(aq) + O_2(g) \rightleftharpoons Mb(O_2)(aq)$ $\quad K_6 = 271$

- Calculate K from rxn. data

  examples 9.8 and 9.9

- Calculate compositions when K is known

example 9.10

$T = 400K$ $\qquad H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

$P_{H_2} = 1.320$ atm

$P_{I_2} = 1.140$ atm

TOO SLOW AT THIS T

CHANGE $T = 600K$ $\qquad K = 92.6$

NEED PRESSURES AT 600K

$$\frac{P_1}{T_1} = \frac{P_2}{T_2} \Rightarrow \qquad P_2 = P_1 \frac{T_2}{T_1}$$

AT 600K $P^i_{H_2} = 1.980\ atm$

$P^i_{I_2} = 1.710\ atm$

	$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$		
Initial	1.980	1.710	0
Change	$-x$	$-x$	$2x$
Equilibrium	$1.980-x$	$1.710-x$	$2x$

$$K = 92.6 = \frac{(2x)^2}{(1.980-x)(1.710-x)}$$

$$88.6x^2 - 341.694x + 313.525 = 0$$

$$ax^2 + bx + c = 0$$

$$x_{\pm} = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$x = 1.504$ or ~~2.352 atm~~

$P^e_{H_2} = 0.48\ atm$ $\quad P^e_{HI} = 3.00\ atm$

$P^e_{I_2} = 0.21\ atm$ $\quad \%\ reac = \frac{0.21}{1.71} \times 100 = 12\%$

GENERAL CASE

$$2\,C_2H_6(g) + 7\,O_2(g) \rightleftharpoons 4\,CO_2(g) + 6\,H_2O(g)$$

I	$P^i_{C_2H_6}$	$P^i_{O_2}$	$P^i_{CO_2}$	$P^i_{H_2O}$
C	$-2y$	$-7y$	$+4y$	$+6y$
E	$P^i_{C_2H_6} - 2y$	$P^i_{O_2} - 7y$	$P^i_{CO_2} + 4y$	$P^i_{H_2O} + 6y$

$$K = \frac{[P^i_{CO_2} + 4y]^4 [P^i_{H_2O} + 6y]^6}{[P^i_{C_2H_6} - 2y]^2 [P^i_{O_2} - 7y]^7}$$