Chem 1062

Note Title 7/21/2008

* Exam 2 tomorrow
  * begin as early a 7:45
  * work until 9:08 - lecture resumes @ 9:10
  * Ch 12 (last ½), 14, 15
* D2L Quizzes due @ 2 am — answers available at that time — Ch 12, 14, 15
* We will begin Ch. 16 in last half of lecture today - it will not be on tomorrows exam

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15.62

M

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$

	N_2	O_2	$2NO$
Initial	0.10625	0.10625	0
Change	$-x$	$-x$	$+2x$
Equil	$0.10625 - x$	$0.10625 - x$	$2x$
	$= 0.101\ M$ ✓	$= 0.101\ M$ ✓	$= 0.0112\ M$ ✓

8.00-L vessel contains 0.850 mol each of N_2 & O_2. $K_c = 0.0123$ @ 3900°C. What is composition of equil mixture?

$$M\ N_2 = M\ O_2 = \frac{0.850\ mol}{8.00\ L} = 0.10625\ M$$

$$K_c = \frac{[NO]^2}{[N_2][O_2]} = 0.0123 = \frac{(2x)^2}{(0.10625 - x)^2}$$

$$0.1109 = \frac{2x}{0.10625 - x}$$

$$0.01178 - 0.1109x = 2x$$

$$\frac{0.01178}{2.1109} = \frac{2.1109x}{2.1109}$$

$$x = 0.005582$$

(5.65) $CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$ $K_c = 3.92$

(M)				
Initial	0.1000	0.3000	0	0
Change	$-x$	$-3x$	$+x$	$+x$
Equil	$0.1000 - x$	$0.3000 - 3x$	x	x
	$= 0.0613\,M$	$= 0.1839\,M$	$= 0.03869\,M$	$= 0.03869\,M$

1.000 mol CO & 3.000 mol H_2 in a 10.00 L vessel.
What is the equilibrium composition?

$$M\,CO = \frac{1.000\ mol\ CO}{10.00\ L} = 0.1000M \qquad M\,H_2 = \frac{3.000\ mol\ H_2}{10.00\ L} = 0.3000\ M$$

$$K_c = \frac{[CH_4][H_2O]}{[CO][H_2]^3} = \frac{x^2}{(0.1000-x)(0.3000-3x)^3} = 3.92$$

$$(0.3000-3x)^3 = [3(0.1000-x)]^3 = 27(0.1000-x)^3$$

$$\sqrt{27\,\frac{x^2}{27(0.1000-x)^4}} = \sqrt{105.84} = \frac{x}{(0.1000-x)^2} = 10.29$$

$$\frac{x}{0.01000 - 0.2000x + x^2} = 10.29$$

$ax^2 + bx + c = 0$

$$x = 0.1029 - 2.058x + 10.29x^2$$

$$10.29x^2 - 3.058x + 0.1029 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{+3.058 \pm \sqrt{(-3.058)^2 - 4(10.29)(0.1029)}}{2(10.29)}$$

$$x = 0.2585 \text{ or } 0.03869$$

Le Chatlier's Principle

Concentration

$$H^+(aq) + 2CrO_4^-(aq) \rightleftharpoons Cr_2O_7^{2-}(aq) + OH^-(aq)$$

yellow — orange

$$Q_c = \frac{[Cr_2O_7^{2-}][OH^-]}{[H^+][CrO_4^{2-}]^2}$$

Pressure

$$CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$$

$PV = nRT$

Temp

$$\text{heat} + N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

↑ reddish-brown

$\Delta H = (+)$

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \quad \Delta H = (-)$$

What are 5 ways to increase the production of NH_3? (resume @ 9:22)

1. add N_2
2. high P (increase P)
3. Keep T low (decrease T)
4. add H_2
5. remove NH_3 as it is produced

Ch. 16 - Acids & Bases

Strong Acids	Weak Acids	Strong Bases	Weak Bases
$HClO_4$	all other acids	Group IA hydroxides,	all other hydroxides
H_2SO_4	HF	Group IIA hydroxides (except Mg, Be)	NH_3
HNO_3	$HC_2H_3O_2$		amines
HCl	H_3PO_4		most carbonates
HBr			
HI			

Definitions of Acids & Bases

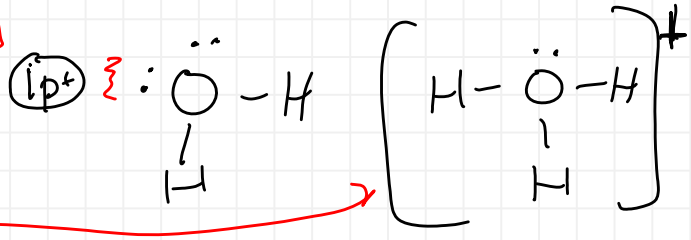
Arrehnius Theory

acid - produce H_3O^+ when dissolved in H_2O

base - produce OH^- " " " " "

H^+ = proton

hydronium ion



Examples:

$$HCl_{(aq)} + H_2O_{(l)} \rightarrow H_3O^+_{(aq)} + Cl^-_{(aq)}$$

✓ $$\overset{A}{HC_2H_3O_2}_{(aq)} + \overset{B}{H_2O}_{(l)} \rightleftharpoons \overset{A}{H_3O^+}_{(aq)} + \overset{B}{C_2H_3O_2^-}_{(aq)}$$

$$NaOH_{(aq)} \rightarrow Na^+_{(aq)} + OH^-_{(aq)}$$

✓ $$\overset{B}{NH_3}_{(aq)} + \overset{A}{H_2O}_{(l)} \rightleftharpoons \overset{A}{NH_4^+}_{(aq)} + \overset{B}{OH^-}_{(aq)}$$

Bronstad-Lowry Theory

$$\overset{B}{NH_3}_{(g)} + \overset{A}{HCl}_{(g)} \rightleftharpoons \overset{A}{NH_4^+} + \overset{B}{Cl^-}$$

conjugate acid-base pairs

acid (proton donor) - species that donates H^+ in an acid-base reaction

base (proton acceptor) - species that accepts H^+ in an acid-base reaction

amphiprotic - may either accept a proton or donate a proton

HCO_3^- ⇒ conjugate acid is H_2CO_3

conjugate base is CO_3^{2-}