Chemistry 102 **Discussion 7** **March 1 and 3, 2010**

Last Name_____ First Name_____
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1) The pK_b of hypoiodite ion, IO^-, is 3.36.

(a) Determine the K_b of the hypoiodite ion.

a) $K_b = 10^{-3.36} = 4.36 \times 10^{-4}$

(b) Determine the pH of a 2.0 M solution of hypoiodic acid.

b) $pH = -\log(H^+) = 5.17$

$K_a = \frac{K_w}{K_b} = \frac{1 \times 10^{-14}}{4.36 \times 10^{-4}}$

	HIO	$\rightleftharpoons$	H^+	+	IO^-
	2.0		0		0
	$-x$		$+x$		$+x$
	$2-x$		x		x

$\frac{x^2}{2} = 2.29 \times 10$

$x = \sqrt{4.58 \times 10^{-11}} =$

$6.77 \times 10^{-6} = [H^+]$

2) 0.41 g of sulfurous acid, H_2SO_3, is added to enough water to make 30. mL. If the pK_a of the acid is 1.82, the pH of the resulting solution is? [at. Mass of H = 1.008, S = 32.07, O = 16.000]

$\frac{.41\text{g } H_2SO_3 \times \frac{1\text{ mol}}{82.086\text{g}}}{.030\text{L}} = 0.1665\text{ M } H_2SO_3$

$K_a = 10^{-1.82} = 1.51 \times 10^{-2}$

$\frac{x^2}{.1665 - x} = .0151$ need to use quadratic →

$pH = 1.36$

3) Calculate the pH of a 0.024 M aqueous solution of nitrous acid (HNO_2, $K_a = 4.5 \times 10^{-4}$).

see Key

$\frac{-K_a + \sqrt{(K_a)^2 + 4K_aC}}{2}$

$\frac{-.0151 + \sqrt{(.0151)^2 + 4(.0151)(.1665)}}{2}$

$x = .04316 = [H^+]$

(2.) $\frac{x^2}{.1625 - x} = .0151$

$2.514 \times 10^{-3} - .0151x = x^2$

$x^2 + .0151x - 2.514 \times 10^{-3} = 0$

$$-.0151 \pm \frac{\sqrt{(.0151)^2 - 4(1)(-2.514 \times 10^{-3})}}{2}$$

$2.2801 \times 10^{-4} + .010056 = \sqrt{.010280401}$

$> .10141008$

$+ .04316$

$-.05826$ - extraneous root

$x = .04316 = [H^+]$

$pH = -\log(.04316) = \boxed{1.36}$

Discussion 7 - Dr. Walleway
(CJ - Dr. WG-J)

#3 (not on Dr. WG-J sheet)

pH = 2.51

$x = .00307$

$$\frac{x^2}{.024 - x} = .00047$$

$$x^2 = 1.08 \times 10^{-5}$$

$$x = .00329$$

$$\frac{.00329}{.024} \times 100 = 13.7\%$$

violates 5% rule

must solve using quadratic

+ cannot neglect the (−x) part

$$1.08 \times 10^{-5} - .00047x = x^2$$

$$x^2 + .00047x - 1.08 \times 10^{-5} = 0$$

$$\frac{-.00047 \pm \sqrt{(.00047)^2 - 4(1)(-1.08 \times 10^{-5})}}{2(1)}$$

$2.047 \times 10^{-7} + 4.32 \times 10^{-5}$

6.59×10^{-3}

3.07×10^{-3}

-3.72×10^{-3}

invalid

4) Identify the Bronsted Lowry acid base conjugate pairs in the reverse direction of the following reactions:

a) $\overset{CB}{NH_3}(aq) + \overset{CA}{HBrO}(aq) \rightarrow \overset{A}{NH_4^+}(aq) + \overset{B}{BrO^-}(aq)$

b) $\overset{CB}{Al(H_2O)_5(OH)^+}(aq) + \overset{CA}{H_3O^+}(aq) \rightarrow \overset{A}{Al(H_2O)_6^{2+}}(aq) + \overset{B}{H_2O}(aq)$

c) $\overset{CA}{H_2S}(aq) + \overset{CB}{F^-}(aq) \rightarrow \overset{B}{HS^-}(aq) + \overset{A}{HF}(aq)$

d) $\overset{CA}{H_2PO_4^-}(aq) + \overset{CB}{HSO_3^-}(aq) \rightarrow \overset{A}{H_2SO_3}(aq) + \overset{B}{HPO_4^{2-}}(aq)$

5) 125 mL of 0.125 M sulfuric acid is added to 50 mL of 0.300 M calcium hydroxide solution. What is the final pH?

$H_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + 2H_2O$

.015625	.015		
−.015	−.015	+.015	—
.000625	0		

$.125\,L \times \frac{.125\ mol}{L} = .015625\ mol\ H_2SO_4$

$.050\,L \times \frac{.3\ mol}{L} = .015\ mol\ Ca(OH)_2$

$\text{excess moles acid} = \frac{.000625\ mol}{.175\,L} = 3.57 \times 10^{-3}\ M\ H^+$

$pH = -\log(H^+) = 2.45$