Chapter 16: Homework Assignment # 48

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16) a) i) $HCOO^-$ b) i) HSO_4^-

ii) PO_4^{3-} ii) $CH_3NH_3^+$

20) a) $\overset{\text{base}}{H_2C_6H_7O_5^-}_{(aq)} + \overset{\text{acid}}{H_2O_{(l)}} \rightleftharpoons \overset{\text{c.a}}{H_3C_6H_7O_5} + \overset{\text{c.b.}}{OH^-}$

b) $\overset{\text{acid}}{H_2C_6H_7O_5^-}_{(aq)} + \overset{\text{base}}{H_2O_{(l)}} \rightleftharpoons \overset{\text{c.b}}{HC_6H_7O_5^{2-}} + \overset{\text{c.a}}{H_3O^+}$

25) a) $\overset{\text{base}}{O^{2-}}_{(aq)} + \overset{\text{acid}}{H_2O_{(l)}} \rightleftharpoons \overset{\text{c.b.}}{OH^-}_{(aq)} + \overset{\text{c.a}}{OH^-}_{(aq)}$ (right)

b) $\overset{\text{acid}}{CH_3COOH_{(aq)}} + \overset{\text{base}}{HS^-_{(aq)}} \rightleftharpoons \overset{\text{c.a}}{H_2S_{(aq)}} + \overset{\text{c.b}}{CH_3COO^-_{(aq)}}$ (right)

c) $\overset{\text{base}}{NO_2^-}_{(aq)} + \overset{\text{acid}}{H_2O_{(l)}} \rightleftharpoons \overset{\text{c.a}}{HNO_2}_{(aq)} + \overset{\text{c.b.}}{OH^-}_{(aq)}$ (left)

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#2) a) HY → more H^+ ions present

b) if HY is a stronger acid, then Y^- is a weak base, X^- is a stronger base

c) HY is the stronger acid, equilibrium will lie to the left $K_c < 1$

#29) a) $[OH^-] = .00045\ M$

$[H^+][OH^-] = 1.0 \times 10^{-14}$

$$[H^+] = \frac{1.0 \times 10^{-14}}{.00045} = 2.2 \times 10^{-11}\ M \quad \text{(basic)}$$

b) $[OH^-] = 8.8 \times 10^{-9}\ M$

$[H^+][OH^-] = 1.0 \times 10^{-14}$

$$[H^+] = \frac{1.0 \times 10^{-14}}{8.8 \times 10^{-9}} = 1.1 \times 10^{-6}\ M \quad \text{(acidic)}$$

c) $[OH^-] = 100[H^+]$

$[H^+][OH^-] = [H^+](100[H^+]) = 1.0 \times 10^{-14}$

$$[H^+] = \sqrt{\frac{1.0 \times 10^{-14}}{100}} = 1.0 \times 10^{-8}\ M$$

(basic)

#33) a) $\Delta pH = pH_2 - pH_1 = -(\log [H^+]_2 - \log [H^+]_1)$

$$= -\log \frac{[H^+]_2}{[H^+]_1}$$

#36) a) $K_w = [H^+][OH^-]$

if HNO_3 is added H_2O,

$HNO_3 \longrightarrow H^+ + NO_3^-$

$[OH^-]$ does not necessarily decrease

$[H^+]$ increases, pH decreases

b) $[OH^-] = .014$ M

$pOH = -\log .014 = 1.85$

$pH = 14 - pOH = 14.00 - 1.85 = 12.15$ (basic)

c) $pH = 6.6 = -\log [H^+]$

$[H^+] = 10^{-6.6} = 2.5 \times 10^{-7}$ M

$pOH = 14.00 - 6.6 = 7.4$

$[OH^-] = 10^{-7.4} = 4.0 \times 10^{-8}$ M

#38)

$[H^+]$	$[OH^-]$	pH	pOH	
$\underline{7.5 \times 10^{-3}}$	1.3×10^{-12}	2.12	11.88	acidic
2.8×10^{-5}	$\underline{3.6 \times 10^{-10}}$	4.56	9.44	acidic
5.6×10^{-9}	1.8×10^{-6}	$\underline{8.25}$	5.75	basic
5.0×10^{-9}	2.0×10^{-6}	8.3	$\underline{5.70}$	basic

#40) $pH = -\log [H^+]$

$5.2 = -\log [H^+]$

$[H^+] = 10^{-5.2} = 6 \times 10^{-6}$ M

$pOH = 14.0 - 5.2 = 8.8$

$[OH^-] = 10^{-8.8}$

$= 2 \times 10^{-9}$ M

$5.6 = -\log [H^+]$

$[H^+] = 10^{-5.6} = 3 \times 10^{-6}$ M

$14.0 - 5.6 = 8.4$

$[OH^-] = 10^{-8.4}$

$= 4 \times 10^{-9}$ M