2/15/11

$0.025M\ Ba(OH)_2 \xrightarrow{H_2O} Ba^{2+}_{(aq)} + 2OH^-_{(aq)}$

$[OH^-] = 0.050M$ $pOH = 1.30$

$pH = 14 - 1.30 = 12.70$ $[H^+] = 10^{-12.70} = 2.0\times10^{-13}\ M$

$\underset{acid}{HF_{(aq)}} + NO_{2\ (aq)}^- \rightleftharpoons F^-_{(aq)} + \underset{acid}{HNO_2}$

K > 1? K < 1?

stronger : $\boxed{HF}$ / HNO_2 K > 1

weak acid strength is measured by Ka

$HA \rightleftharpoons H^+ + A^-$ "acid ionization constant"

$Ka = \frac{[H^+][A^-]}{[HA]}$ the larger the Ka, the stronger the acid

$\boxed{ex}$ What is the pH of a 0.30 M HNO_2 sol'n @ 25°C?

$Ka = 4.5\times10^{-4}$

HNO_2	$\rightleftharpoons$	H^+	+	NO_2^-
0.30		0.0		0.0
$-x$		$+x$		$+x$
$0.30-x$		x		x

* if % ionization is 5% ↓, use the "ignore x" approximation

$Ka = \frac{x^2}{\underset{\approx 0.30}{(0.30-x)}} = 4.5\times10^{-4}$

$x = 0.012 = [H^+]$

$pH = -\log x$
$= 1.92$

$\% = \frac{x}{[HA]_0} \times 100\%$

$\frac{0.012}{0.30} \times 100\% = \boxed{4\%}$

2/15/11

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$x = 0.012 = [H^+]$

$\frac{0.012}{0.30}\times100\% = \boxed{4\%}$

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$= 1.92$

What is the pH of a 0.003M HNO_2 solution?

$$K_a = \boxed{4.5\times10^{-4} = \frac{x^2}{0.003-x}}$$

$0.003 - x \approx 0.003 \Rightarrow x = 0.0012$

$$\frac{0.0012}{0.003}\times 100\% = 40\%$$

$$0 = x^2 + 4.5\times10^{-4}x - 1.35\times10^{-6}$$

$x = 9.6\times10^{-4}, \cancel{-1.4\times10^{-3}}$

pH = 3.02

weak acid $[HA]\downarrow$, % ionization $\uparrow$

$$HA \rightleftharpoons H^+ + A^-$$

add $H_2O \Rightarrow [H^+], [A^-] \downarrow \Rightarrow$ shift product side

acid ionization $\uparrow$

K_b

$$\underset{\text{base}}{B} + H_2O \rightleftharpoons HB^+ + OH^-$$

$$K_b = \frac{[HB^+][OH^-]}{[B]}$$

$pOH = -\log x$

$pH = 14 - pOH$

the stronger the acid,

the weaker the conjugate base

$$\boxed{K_a \cdot K_b = K_w = 1\times10^{-14}}$$

K_a of CH_3COOH is 1.8×10^{-5}

What is the pH of a 0.050M $NaCH_3COO$ sol'n?

CH_3COO^-

$$K_b = \frac{10^{-14}}{1.8 \times 10^{-5}} = 5.6 \times 10^{-10}$$

$$CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + OH^-$$

0.050		0.0	0.0
$-x$		$+x$	$+x$
$0.050-x$		x	x

(x is negligible)

$$K_b = 5.6 \times 10^{-10} = \frac{x^2}{0.050}$$

$$x = 5.3 \times 10^{-6} = [OH^-]$$

$$pOH = -\log x = 5.28$$

$$\boxed{pH = 8.72}$$