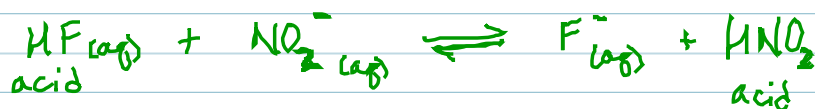




$[OH^{-}] = 0.050M$ $pOH = 1.30$

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



$K > 1? K < 1?$

stronger: $(HF) / HNO_2$ $K > 1$

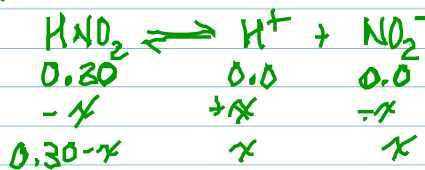
Weak acid strength is measured by K_a



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

Ex) What is the pH of a 0.30M HNO_2 sol'n @ 25°C?

$K_a = 4.5 \times 10^{-4}$

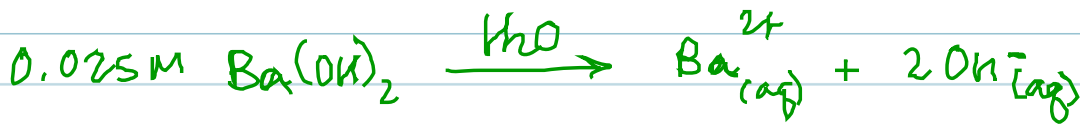


* if % ionization is 5% or less, use the "ignore x" approximation
 $\% = \frac{x}{[HA]_0} \times 100\%$

$K_a = \frac{x^2}{(0.30-x)} = 4.5 \times 10^{-4}$
 ≈ 0.30 $x = 0.012 = [H^{+}]$

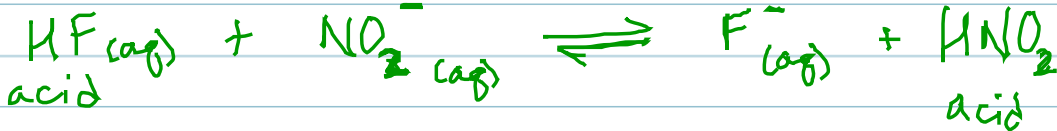
$\frac{0.012}{0.30} \times 100\% = 4\%$

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

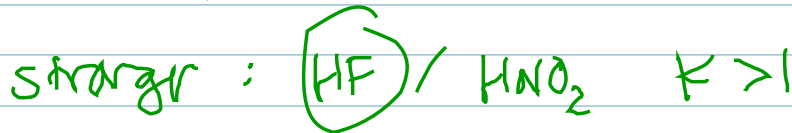


$$[\text{OH}^{-}] = 0.050\text{ M} \quad \text{pOH} = 1.30$$

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



$$K > 1? \quad K < 1?$$



Weak acid strength is measured by K_a

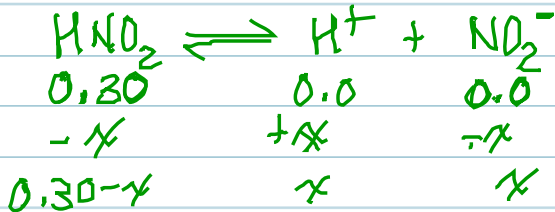


$$K_a = \frac{[\text{H}^{+}][\text{A}^{-}]}{[\text{HA}]}$$

the larger the K_a , the stronger the acid

ex What is the pH of a 0.30 M HNO_2 sol'n @ 25°C?

$$K_a = 4.5 \times 10^{-4}$$



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

$$K_a = \frac{x^2}{(0.30-x)} = 4.5 \times 10^{-4}$$

≈ 0.30 $x \approx 0.012 = [\text{H}^{+}]$

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

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

$$\text{pH} = -\log x = 1.92$$

What is the pH of a 0,003M HNO_2 solution?

$$K_a = 4.5 \times 10^{-4} = \frac{x^2}{0.003 - x}$$

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

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

$$0 = x^2 + 4.5 \times 10^{-4}x - 1.35 \times 10^{-6}$$

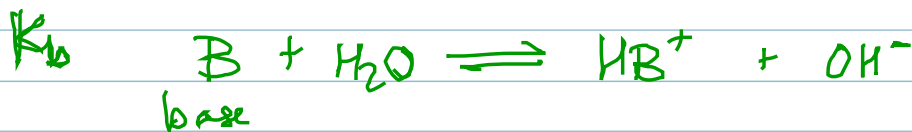
$$\text{pH} = 3.02$$

$$\Delta = 9.6 \times 10^{-4}, -1.4 \times 10^{-3}$$

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



add $\text{H}_2\text{O} \Rightarrow [\text{H}^+], [\text{A}^-] \downarrow \Rightarrow$ shift product side
acid ionization \uparrow



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

$$\text{pOH} = -\log x$$
$$\text{pH} = 14 - \text{pOH}$$

the stronger the acid,

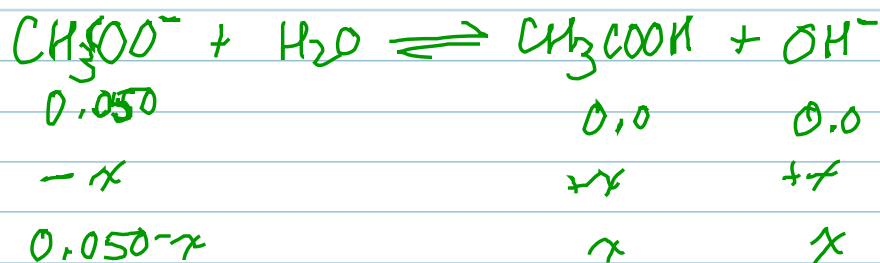
the weaker the conjugate base

$$K_a \cdot K_b = K_w = 1 \times 10^{-14}$$

K_a of CH_3COOH is 1.8×10^{-5}

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

$$\text{CH}_3\text{COO}^- \quad K_b = \frac{10^{-14}}{1.8 \times 10^{-5}} = 5.6 \times 10^{-10}$$



(x is negligible)

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

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

$$\text{pOH} = -\log x = 5.28$$

$$\text{pH} = 8.72$$