

Chem 1062

Note Title

7/23/2008

* Exams Returned

* D2L Quizzes

Finding the pH of a strong acid.

$$[\text{H}_3\text{O}^+] = [\text{acid}] \quad \checkmark$$

Finding the pH of a strong base.

$$[\text{OH}^-] = [\text{base}] \times \begin{matrix} \# \text{ of hydroxide} \\ \text{ions in formula} \end{matrix} \quad \checkmark$$

Calculate the pH of:

0.0038 M HNO_3

$$[\text{H}_3\text{O}^+] = 0.0038 \text{ M}$$

$$\text{pH} = -\log [\text{H}_3\text{O}^+] = -\log (0.0038) = \boxed{2.42}$$

0.028 M $\text{Sr}(\text{OH})_2$

$$[\text{OH}^-] = 0.028 \text{ M} \times 2 = 0.056 \text{ M}$$

$$\text{pOH} = -\log [\text{OH}^-] = -\log (0.056) = 1.25$$

$$\text{pH} = 14.00 - \text{pOH} = 14.00 - 1.25 = \boxed{12.75}$$

pH of 2.0 M HCl

$$[\text{H}_3\text{O}^+] = 2.0 \text{ M}$$

$$pH = -\log(2.0) = -0.30$$

Calculate the concentration of:

a) a solution of HCl that has a $pH=4.77$
 $\xrightarrow{\text{strong acid}} [HCl] = [H_3O^+]$

$$10^{-pH} = 10^{\log[H_3O^+]}$$

$$10^{\log x} = x$$

$$[H_3O^+] = 10^{-pH} = 10^{-4.77} = 1.7 \times 10^{-5} M$$

b) a solution of KOH that has a $pH=12.50$
 $\xrightarrow{\text{strong base}} [OH^-] = [\text{base}]$

$$pOH = 14.00 - pH$$

$$= 14.00 - 12.50$$

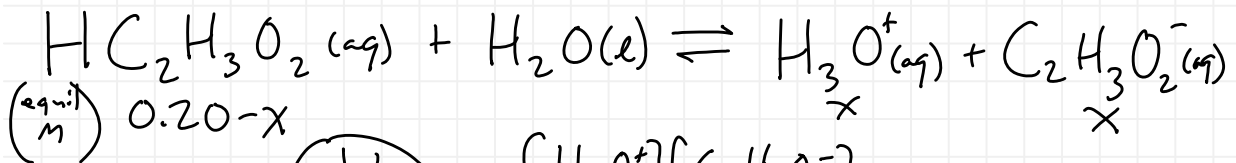
$$pOH = 1.50$$

$$10^{-pOH} = 10^{\log[OH^-]}$$

$$[OH^-] = 10^{-pOH} = 10^{-1.50} = 0.032 M$$

Calculate the pH of $0.20 M \text{HC}_2\text{H}_3\text{O}_2$

$\xrightarrow{\text{weak acid}}$



$$K_a = \frac{[H_3O^+][C_2H_3O_2^-]}{[HC_2H_3O_2]}$$

acid
ionization constant \rightarrow

Polyprotic acids

* For a solution of 0.050 M H_2CO_3 , find

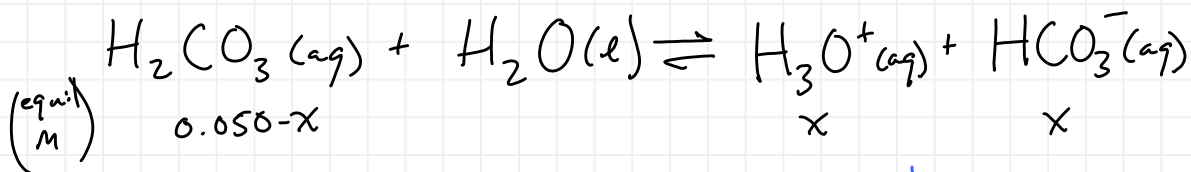
a) $\text{pH} = 3.83$

b) $[\text{HCO}_3^-] = 1.5 \times 10^{-4} \text{ M}$

c) $[\text{CO}_3^{2-}] = 4.8 \times 10^{-11} \text{ M}$

d) $[\text{OH}^-] = 6.8 \times 10^{-11} \text{ M}$

← weak acid
diprotic acid
→ will also be true for most polyprotic acids



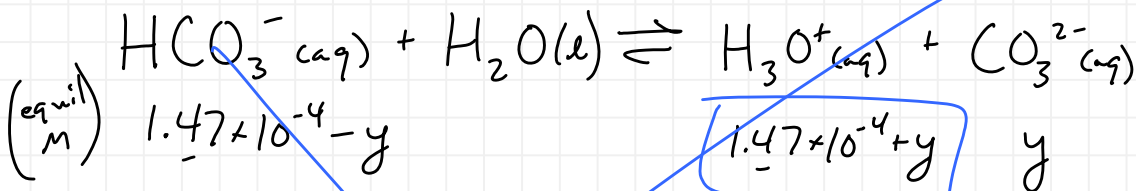
$$K_{a1} = \frac{[\text{H}_3\text{O}^+][\text{HCO}_3^-]}{[\text{H}_2\text{CO}_3]}$$

$$4.3 \times 10^{-7} = \frac{x^2}{0.050 - x}$$

Assume $x \ll 0.050$
Assumption valid
 $\text{pH} = -\log[\text{H}_3\text{O}^+]$
 $\text{pH} = -\log(1.47 \times 10^{-4})$
 $= 3.83$

$$\sqrt{2.15 \times 10^{-8}} = \sqrt{x^2}$$

$$1.47 \times 10^{-4} \text{ M} = x = [\text{H}_3\text{O}^+] = [\text{HCO}_3^-]$$



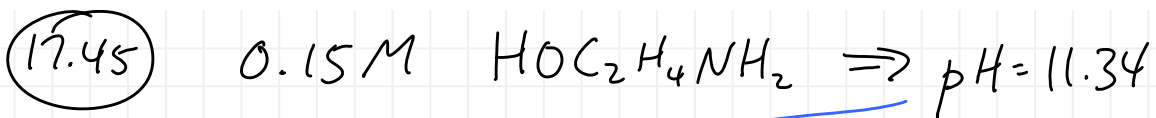
$$K_{a2} = \frac{[\text{H}_3\text{O}^+][\text{CO}_3^{2-}]}{[\text{HCO}_3^-]}$$

$$4.8 \times 10^{-11} = \frac{(1.47 \times 10^{-4} + y)(y)}{1.47 \times 10^{-4} - y}$$

Assume $y \ll 1.47 \times 10^{-4}$
Assumption valid

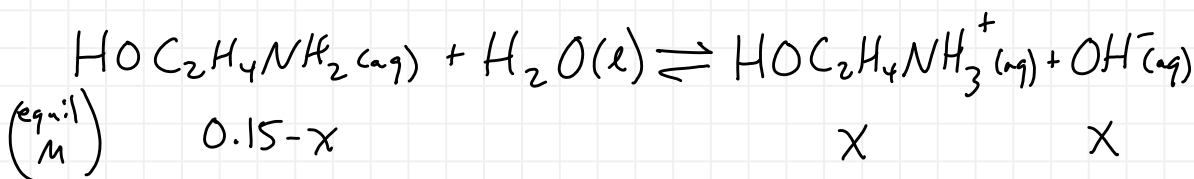
$$4.8 \times 10^{-11} \text{ M} = y = [\text{CO}_3^{2-}]$$

$$\text{pOH} = 14.00 - \text{pH} = 14.00 - 3.83 = 10.17$$



$K_b = ?$

$\text{pOH} = 14.00 - 11.34 = 2.66$



$$K_b = \frac{[\text{HOCH}_2\text{CH}_2\text{NH}_3^+][\text{OH}^-]}{[\text{HOCH}_2\text{CH}_2\text{NH}_2]}$$

$$= \frac{x^2}{(0.15 - x)}$$

$$= \frac{(10^{-2.66})^2}{0.15 - 10^{-2.66}}$$

$x = [\text{OH}^-]$

$[\text{OH}^-] = 10^{-\text{pOH}} = 10^{-2.66}$

$$= 3.2 \times 10^{-5}$$

Tell whether the following salts are acidic, basic, or neutral.

acid + base \rightarrow salt + water

① $\text{NaCl} \Rightarrow$ neutral salt

from strong acid & strong base

② $\text{NH}_4\text{NO}_3 \Rightarrow$ acid salt

from weak base & strong acid

③ $\text{KCN} \Rightarrow$ basic salt

from weak acid & strong base

④ $\text{NH}_4\text{CN} \Rightarrow$ basic salt

$K_b(\text{NH}_3) = 1.8 \times 10^{-5}$

$K_a(\text{HCN}) = 4.9 \times 10^{-10}$

Stronger