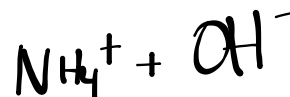
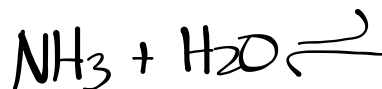
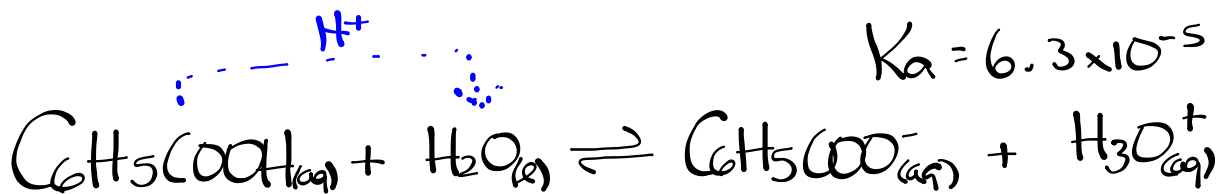


Acid-Base Chemistry Review

- Arrhenius Concept of Acid and Bases (Old and Revised)
- Bronsted-Lowry Acid-Base Concept
(Identify acids/bases, amphiprotic)
- Conjugate Acids and Bases
- Water Equilibrium
- Strong/weak Acids/Bases *
- Predicting Acid-Base Equilibria



Calculate the pH and hydronium ion concentration if a 0.227 mol/L solution of benzoic acid is added to water.



$$K_a = 6.3 \times 10^{-5}$$

0.227 mol/L

$$K_a = \frac{[\text{C}_6\text{H}_5\text{COO}^-]_{(aq)} [\text{H}_3\text{O}^+]_{(aq)}}{[\text{C}_6\text{H}_5\text{COOH}_{(aq)}]}, \quad [\text{C}_6\text{H}_5\text{COO}^-] = [\text{H}_3\text{O}^+]$$

$$K_a = \frac{[\text{H}_3\text{O}^+]^2}{[\text{C}_6\text{H}_5\text{COOH}_{(aq)}]}$$

$$\text{pH} = -\log[\text{H}_3\text{O}^+]$$

$$\text{pH} = -\log[3.78 \times 10^{-3}]$$

$$[\text{H}_3\text{O}^+] = \sqrt{(6.3 \times 10^{-5})(0.227)}$$

$$\text{pH} = 2.423$$

$$[\text{H}_3\text{O}^+] = 3.78 \times 10^{-3} \text{ M}$$

$$\text{pH} + \text{pOH} = 14.000$$

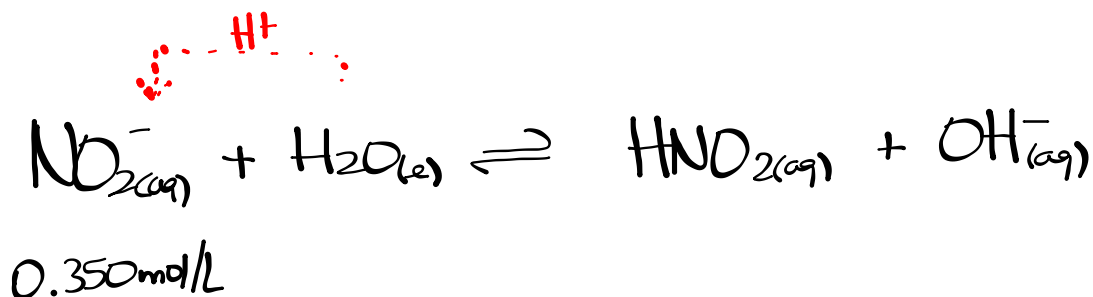
$$\text{pOH} = 14.000 - 2.423$$

$$K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 1.0 \times 10^{-14}$$

$$\text{pOH} = 11.577$$

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

Calculate the pOH of a 0.350 mol/L solution of nitrite ions added to water.



$$K_b = \frac{[\text{HNO}_2][\text{OH}^-]}{[\text{NO}_2^-]}, \quad [\text{HNO}_2] = [\text{OH}^-]$$

$$K_b = \frac{[\text{OH}^-]^2}{[\text{NO}_2^-]}$$

$$K_a K_b = K_w$$

$$K_b = \frac{K_w}{K_a} = \frac{1.0 \times 10^{-14}}{7.2 \times 10^{-4}}$$

$$[\text{OH}^-] = \sqrt{(1.39 \times 10^{-11})(0.350)}$$

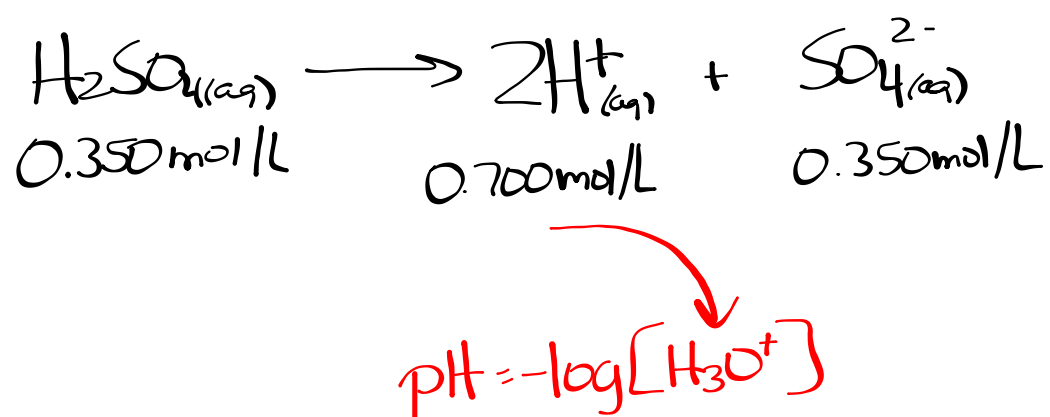
$$K_b = 1.39 \times 10^{-11}$$

$$[\text{OH}^-] = 2.21 \times 10^{-6} \text{ M}$$

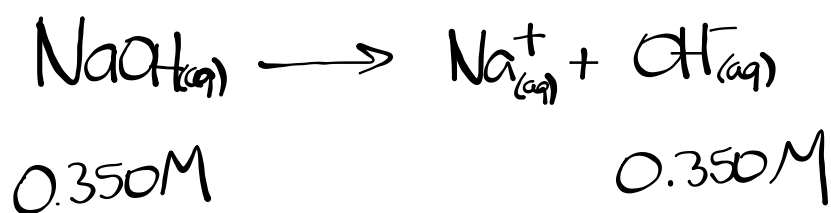
$$\text{pOH} = -\log[2.21 \times 10^{-6}]$$

$$\text{pOH} = 5.656$$

Calculate the pH and hydronium ion concentration of a 0.350 mol/L solution of sulfuric acid.



Calculate the pH and hydronium ion concentration of a 0.350 mol/L solution of sodium hydroxide.



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

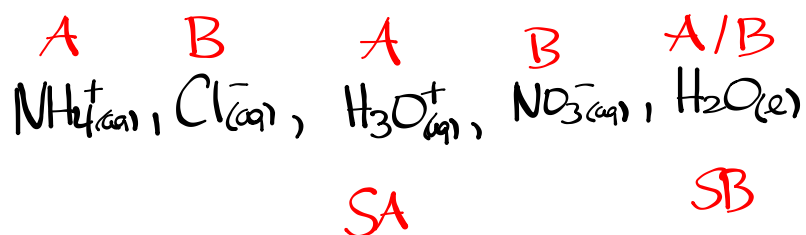
$$\text{pH} + \text{pOH} = 14.00$$

Predicting Acid-Base Reactions

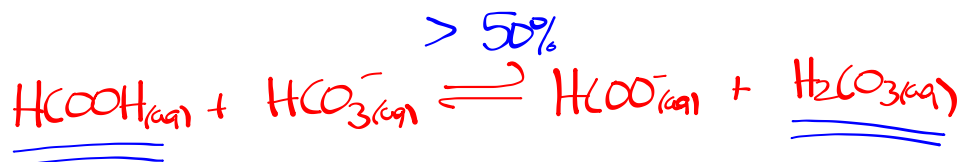
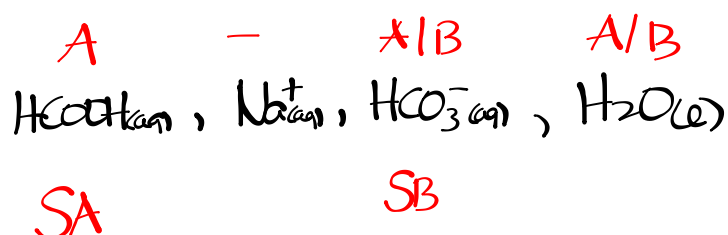
1. List all entities (ions, atoms, or molecules) initially present.
2. Identify all possible acids and bases, using Bronsted-Lowry definition.
3. Identify the strongest acid and strongest base, using table of acids and bases.
4. Transfer one proton from the acid to the base and predict the conjugate acid and conjugate base as products.
5. Predict the position of the equilibrium.

Use the five-step method to predict the following acid-base equilibria:

NH_4^+ Cl^-
- Ammonium chloride is added to a nitric acid solution.



Na^+ HCO_3^-
- Methanoic acid is added to a sodium hydrogen carbonate solution.



Worksheet