Unit 9: Acids and Bases Notes

Introduction and Review

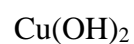1. Define Acid:

2. Name the following acids:

   HCl H_2SO_4 H_2SO_3 H_2S

3. Bases usually contain _____
4. Name the following bases:

   NaOH $Ca(OH)_2$ $Cu(OH)_2$ NH_4OH

Properties of Acids and Bases

1. List some properties of acids

2. List some properties of bases

3. Define indicator:

4. Common Acid/Base Indicators:

Indicator	Color in acid (pH < 7)	Color at pH = 7	Color in base (pH > 7)
Phenolphthalein			
Bromothymol Blue			
Red Litmus			
Blue Litmus			

5. Uses of Common Acids:
   a. H_2SO_4

   b. HNO_3

   c. H_3PO_4

   d. HCl

   e. CH_3COOH (Acetic acid)

6. Uses of Common Bases:
   a. $Mg(OH)_2$

   b. NaOH

   c. $Ca(OH)_2$

7. Why are acids and bases electrolytes?

8. Write an ionization equation for HBr

9. Write an ionization equation for NH_3

Acid/Base Strength

1. Explain the difference between concentration and strength.

2. Define strong acid/base:

3. Define weak acid/base:

4. Fill in the following tables and **MEMORIZE THEM**:

Acids	
Strong Acids	Weak Acids

Bases	
Strong Bases	Weak Bases

5. How do you recognize an organic acid? Are they strong or weak?

6. Write the dissociation equations for KOH and $Cu(OH)_2$. How do strong and weak bases (or acids) differ?

Acid and Base Theories

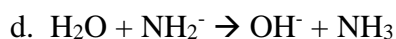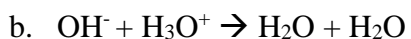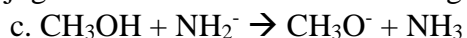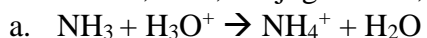| Theory	Acid Definition	Base Definition
Arrhenius		
Bronsted-Lowry		

1. What happens when you mix an Arrhenius acid with an Arrhenius base?

2. General neutralization reaction:

3. Define salt:

4. Write the ionic and net ionic equations for the following neutralization reaction:
   $LiOH(aq) + HBr(aq) \rightarrow LiBr(aq) + H_2O(l)$

5. Name the salt produced and write the balanced reaction:
   a. Sodium hydroxide and hydrochloric acid

   b. Calcium hydroxide and sulfuric acid

   c. Potassium hydroxide and nitric acid

6. Copy the Bronsted-Lowry reactions:

7. Define monoprotic acid and give examples:

8. Define polyprotic acid and give examples:

9. What is an amphoteric substance? Show equations as well.

Bronsted-Lowry Conjugate Acids and Bases
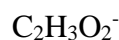   1. Define conjugate acid:

   2. Define conjugate base:

3. Label the acid, base, conjugate acid, and conjugate base in each of the following:
   a. $NH_3 + H_3O^+ \rightarrow NH_4^+ + H_2O$
      c. $CH_3OH + NH_2^- \rightarrow CH_3O^- + NH_3$

   b. $OH^- + H_3O^+ \rightarrow H_2O + H_2O$
      d. $H_2O + NH_2^- \rightarrow OH^- + NH_3$

4. Write the conjugate base
   H_3O^+ H_2SO_4 HCO_3^- $HOCl$ NH_4^+

5. Write the conjugate acid
   I^- SO_3^{2-} PO_4^{3-} $C_2H_3O_2^-$ $H_2BO_3^-$

6. What is the relationship between strength and conjugates?

Ionization of Water

1. Pure water ionizes slightly according to the following equation:

2. The product of the concentrations (molarity) of the ions is equal to the constant K_w. Write the formula:

3. In **neutral** solutions:

4. In **acidic** solutions:

5. In **basic** solutions:

pH and pOH

1. What is pH? Write its scale.

2. What is pOH? Write its scale.

3. How do pH and [H⁺] relate?

4. What is the [H⁺] difference between a pH of 1 and a pH of 4?

5. **Important formulas:**
    $pH = -\log[H_3O^+]$ $pOH = -\log[OH^-]$
    $[H_3O^+] = 10^{-pH}$ $[OH^-] = 10^{-pOH}$ $pH + pOH = 14$

6. Find the pH of the following:
    a) $[H_3O^+] = 1.00 \times 10^{-3}$ M

    b) $[H_3O^+] = 6.59 \times 10^{-10}$ M

    c) $[H_3O^+] = 7.01 \times 10^{-6}$ M

7. Find the $[H_3O^+]$ of the following:
    a) pH = 3

    b) pH = 6.61

    c) pH = 2.52

8. Find the pH of the following:
    a) pOH = 2

    b) pOH = 1.26

    c) pOH = 4.98

9. Find the pH of the solutions having following [OH⁻]:
    a) $[OH^-] = 1.00 \times 10^{-11}$ M

    b) $[OH^-] = 2.64 \times 10^{-13}$ M

    c) $[OH^-] = 3.45 \times 10^{-8}$ M

10. Find the $[H_3O^+]$:
  a) $[OH^-] = 1.00 \times 10^{-6}M$

  b) $[OH^-] = 4.97 \times 10^{-10}M$

  c) $[OH^-] = 2.93 \times 10^{-2}M$

11. Find the pH of the following:
  d) 0.054 M HCl

  e) 0.178 M NaOH

  f) 0.033M H_2SO_4

  g) 3.0 M HF (8.1% dissociation)

Acid/Base Titration

1. Define **buffered solution**:

2. What is a **titration**?

3. Define **endpoint:**

4. Define **equivalence point:**

5. Define **indicator:**

6. Define **standard solution:**

7. Sketch titration curves for each combination of strong and weak acids:

8. Sketch a titration curve for a diprotic acid:

9. If it takes 54 mL of 0.1M NaOH to neutralize 125mL of an HCl solution, what is the concentration of the HCl?

10. What is the molar concentration of a 50.0mL solution of NaOH that is titrated to an endpoint with 15.0mL of a 0.00300M solution of H_2SO_4?