

Advanced Chemistry
Approximate Timeline

Students are expected to keep up with class work when absent.

CHAPTER 14 – ACIDS & BASES		
Day	Plans for the day	Assignment(s) for the day
1	<ul style="list-style-type: none"> • 14.1 – The Nature of Acids & Bases <ul style="list-style-type: none"> ○ Arrhenius Concept ○ Brønsted-Lowry Model ○ Dissociation Equations • 14.2 – Acid Strength <ul style="list-style-type: none"> ○ Strong v Weak 	<ul style="list-style-type: none"> • Assignment 14.0 • Assignment 14.1
2	<ul style="list-style-type: none"> • 14.3 – The pH Scale <ul style="list-style-type: none"> ○ pH for strong acids/bases ○ pOH for strong acids/bases 	<ul style="list-style-type: none"> • Assignment 14.2
3	<ul style="list-style-type: none"> • Brønsted-Lowry Acids and Bases <ul style="list-style-type: none"> ○ Definitions ○ Dissociation Equations ○ K_a and K_b expressions ○ Conjugate acid-base pairs ○ Relative strength of acids and bases 	<ul style="list-style-type: none"> • Assignment 14.3
4	<ul style="list-style-type: none"> • Auto-Ionization of Water <ul style="list-style-type: none"> ○ Its relation to the pH scale ○ Its relation to $[H^+]$ and $[OH^-]$ ○ Its relation to K_a and K_b 	<ul style="list-style-type: none"> • Assignment 14.4
5	<ul style="list-style-type: none"> • 14.5 – Calculating the pH of Weak Acids <ul style="list-style-type: none"> ○ Dissociation equations ○ K_a expressions ○ pH of Weak Acids 	<ul style="list-style-type: none"> • Assignment 14.5
6	<ul style="list-style-type: none"> • 14.6 – Bases <ul style="list-style-type: none"> ○ Dissociation equations ○ K_b expressions ○ pH of Weak Bases 	<ul style="list-style-type: none"> • Assignment 14.6
7	<ul style="list-style-type: none"> • 14.7 – Polyprotic Acids <ul style="list-style-type: none"> ○ Step-wise dissociation of polyprotic acids ○ pH of polyprotic acids 	<ul style="list-style-type: none"> • Assignment 14.7
8	<ul style="list-style-type: none"> • 14.8 – Acid-Base Properties of Salts <ul style="list-style-type: none"> ○ Determining acidic / basic / neutral ○ Calculating the pH of a salt solution • 14.10 – The Lewis Acid-Base Model 	<ul style="list-style-type: none"> • Assignment 14.8
9	<ul style="list-style-type: none"> • Grade & discuss assignment • Review for Chapter 14 Test 	<ul style="list-style-type: none"> • Study for Chapter 14 Test
10	<ul style="list-style-type: none"> • Chapter 14 Test 	<ul style="list-style-type: none"> • Read section(s) 15.1 – 15.2

Study Guides
Chapter 14 Quizzes

Quiz 14.1 – The Nature of Acids & Bases

1. Define the following terms.
 - a. Arrhenius acid
 - b. Arrhenius base
 - c. Brønsted-Lowry acid
 - d. Brønsted -Lowry base
 - e. conjugate acid
 - f. conjugate base
 - g. hydronium ion
2. Be able to write dissociation equations for weak acids and weak bases.
3. Be able to identify and label conjugate acid base pairs in a chemical equation.

Quiz 14.2 – Acid Strength

4. Define the term “strong acid”.
5. Define the term “weak acid”.
6. Describe the relationship between the strength of an acid and the strength of its conjugate base.
7. Define the term “amphoteric”.
8. Calculate the pH of a strong acid and a weak acid.

Quiz 14.3 – the pH Scale

9. What is the pH scale?
10. The pH scale ranges from _____ to _____.
11. Where do acidic solutions fall on the pH scale?
12. Where do basic solutions fall on the pH scale?
13. Where do neutral solutions fall on the pH scale?
14. Write the mathematical equation used to calculate pH.

Quiz 14.2 – Acid Strength

15. Calculate the pH of a strong base and a weak base.

Quiz 14.7 – 14.8*14.7 Polyprotic Acids*

16. Define the term “polyprotic acid”.

14.8 – Acid-Base Properties of Salts

17. Define the term "salt".
18. "For any salt whose cation has neutral properties (such as Na^+ or K^+) and whose anion is the conjugate base of a weak acid, the aqueous solution will be _____.
19. "In general, salts in which the anion is not a base and the cation is the conjugate acid of a weak base produce _____ solution.

Study Guide
Chapter 14 Test
Advanced Chemistry

At the completion of chapter 14 you should...

1. Know the definitions of the following terms.
 - a. Arrhenius acid
 - b. Arrhenius base
 - c. Brønsted-Lowry acid
 - d. Brønsted-Lowry base
 - e. Hydronium ion
 - f. Conjugate acid
 - g. Conjugate base
 - h. Strong
 - i. Weak
 - j. Amphoteric substance
 - k. Polyprotic acid
2. Be able to calculate the pH and pOH of a strong acid.
3. Be able to calculate the pH and pOH of a strong base.
4. Use the pH of a strong acid or strong base to calculate its concentration.
5. Identify conjugate acid-base pairs.
6. Write and balance acid dissociation equations.
7. Understand the relationship between K_a and acid strength.
8. Understand the relationship between K_a , K_b , and K_w .
9. Calculate the percent dissociation of a weak acid.
10. Be able to calculate the pH and pOH of a weak acid.
11. Be able to calculate the pH and pOH of a weak base.
12. Use the pH of a weak acid or weak base to calculate its concentration.
13. Calculate the pH of polyprotic acids.
14. Estimate the pH of salt solutions.

Assignment 14.0 – Vocabulary

Define each of the following terms.

1. Arrhenius acid
2. Arrhenius base
3. Brønsted-Lowry acid
4. Brønsted-Lowry base
5. Hydronium ion
6. Conjugate acid
7. Conjugate base
8. Strong
9. Weak
10. Amphoteric substance
11. Polyprotic acid

Assignment 14.1 - Arrhenius Acids & Bases

Short Answer: Answer each question in the space provided. Write or print clearly. IF I CAN'T READ IT... IT'S WRONG.

1) Give the definitions for an Arrhenius acid and an Arrhenius base.

A) Acid

B) Base

2) Give both the name and formula of the 6 strong acids.

A) _____

B) _____

C) _____

D) _____

E) _____

F) _____

3) Give both the name and formula of the 6 strong bases.

A) _____

B) _____

C) _____

D) _____

E) _____

F) _____

Assignment 14.2 - pH & pOH of Strong Acids & Bases

Problems: Solve each of the following problems. In order to receive full credit you must do three things: (1) write the equation, (2) plug in the numbers with units, and (3) circle your answer expressed with the correct number of significant digits and units.

- 1) Calculate the pH and pOH for each of the following solutions.
A) 0.0100 M HCl

B) 0.00250 M HNO₃

C) 3.00×10^{-4} M H₂SO₄

D) 0.0500 M NaOH

E) 0.00825 M LiOH

F) 7.50×10^{-3} M Ba(OH)₂

Assignment 14.3 – Brønsted-Lowry Acids & Bases

Short Answer: Answer each question in the space provided. Write or print clearly. ***IF I CAN'T READ IT... IT'S WRONG.***

- 1) Give the definitions for a Brønsted-Lowry acid and a Brønsted-Lowry base.
 - A) Acid
 - B) Base

- 2) Write the dissociation reaction and the corresponding K_a equilibrium expression for each of the following acids in water.
 - A) HCN

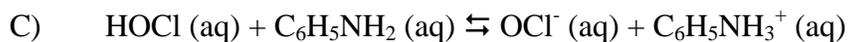
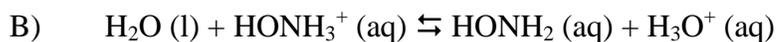
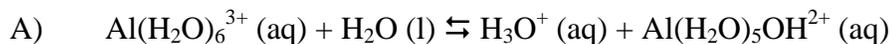
 - B) HOC_6H_5

 - C) $\text{C}_6\text{H}_5\text{NH}_3^+$

3) Write the dissociation reaction and the corresponding K_b equilibrium expression for each of the following bases in water.



4) For each of the following aqueous reactions, label each species as acid or base, draw lines connecting the conjugate acid-base pairs.



5) Use Table 14.2 to order the following from the strongest to the weakest acid.
 HClO_2 , H_2O , NH_4^+ , HClO_4

6) You may need Table 14.2 to answer the following questions.

- A) Which is the stronger base, Cl^- or H_2O ?
- B) Which is the stronger base, H_2O or NO_2^- ?
- C) Which is the stronger base, CN^- or OC_6H_5^- ?

Assignment 14.4 – Auto-ionization of Water and the pH Scale

Problems: Solve each of the following problems. In order to receive full credit you must do three things: (1) write the equation, (2) plug in the numbers with units, and (3) circle your answer expressed with the correct number of significant digits and units.

- 1) Calculate the $[H^+]$ of each of the following solutions at $25^\circ C$. Identify each solution as neutral, acidic, or basic.

A) $[OH^-] = 1.5 \text{ M}$

B) $[OH^-] = 3.6 \times 10^{-15} \text{ M}$

C) $[OH^-] = 1.0 \times 10^{-7} \text{ M}$

D) $[OH^-] = 7.3 \times 10^{-4} \text{ M}$

2) Calculate $[H^+]$ and $[OH^-]$ for each solution at $25^\circ C$. Identify each solution as neutral, acid, or basic.

A) $pH = 7.40$ (the normal pH of blood)

B) $pH = 15.3$

C) $pH = -1.0$

D) $pH = 3.20$

E) $pOH = 5.0$

F) $pOH = 9.60$

Assignment 14.5 – Solutions of Weak Acids

Problems: Solve each of the following problems. In order to receive full credit you must do three things: (1) write the equation, (2) plug in the numbers with units, and (3) circle your answer expressed with the correct number of significant digits and units.

1) For 0.100 M propanoic acid ($\text{HC}_3\text{H}_5\text{O}_2$, $K_a = 1.3 \times 10^{-5}$), determine

A) the concentration of all species present at equilibrium,

B) the pH

C) the percent dissociation

2) Calculate the pH of each of these solutions.

A) 0.250 M HOC_6H_5

B) 0.250 HCN

3) An acid HX is 25% dissociated in water. If the equilibrium concentration of HX is 0.30 M, calculate the K_a value for HX.

Assignment 14.6 – Solutions of Weak Bases

Problems: Solve each of the following problems. In order to receive full credit you must do three things: (1) write the equation, (2) plug in the numbers with units, and (3) circle your answer expressed with the correct number of significant digits and units.

1) Calculate the pH of each of these solutions.

A) 0.250 M aniline, $C_6H_5NH_2$

B) 0.250 M dimethylamine, $(CH_3)_2NH$ ($K_b = 5.4 \times 10^{-4}$)

2) Calculate $[\text{OH}^-]$, $[\text{H}^+]$, and the pH of 0.20 M solutions of each of the following amines (the K_b values are found in Table 14.3).

A) aniline

B) methylamine

Assignment 14.7 – Polyprotic Acids

Short Answer: Answer each question in the space provided. Write or print clearly. ***IF I CAN'T READ IT... IT'S WRONG.***

1) Write out the stepwise dissociation reactions for:

A) citric acid ($\text{H}_3\text{C}_6\text{H}_5\text{O}_7$).

B) phosphoric acid (H_3PO_4).

C) carbonic acid (H_2CO_3).

Assignment 14.8 – Acid-Base Properties of Salts

Short Answer: Answer each question in the space provided. Write or print clearly. ***IF I CAN'T READ IT... IT'S WRONG.***

1) Predict the pH (acidic, basic, or neutral) for each of the following solutions.

A) 0.120 M KNO_2 _____

B) 0.450 M NaOCl _____

C) 0.400 M NH_4ClO_4 _____

Problems: Solve each of the following problems. In order to receive full credit you must do three things: (1) write the equation, (2) plug in the numbers with units, and (3) circle your answer expressed with the correct number of significant digits and units.

2) Calculate the pH of each of the solutions below.

A) 0.120 M KNO_2

B) 0.450 M NaOCl

C) 0.400 M NH_4ClO_4