

AQUEOUS CHEMISTRY SYLLABUS

REACTIONS IN AQUEOUS SOLUTIONS & SOLUTION STOICHIOMETRY

I. Major Topics:

- A. General Properties of Aqueous Solutions
- B. Precipitation/Metathesis/Double Displacement Reactions
- C. Acid-Base Reactions/Titrations
- D. Redox Reactions/ Titrations
- E. Molarity
- F. Molecular vs. Net Ionic Equations
- G. Gravimetric Analysis

II. Objectives/Guidelines:

1. Be able to distinguish a solution, solvent, solute, and an aqueous solution.
2. Be able to define, distinguish between, and give examples of a strong electrolyte, weak electrolyte and a non-electrolyte.
3. Be able to describe and/or illustrate the concept of hydration. Understand how hydration explains why ionic compounds with very strong bonds are able to dissociate.
4. Be able to write a dissociation expression for any electrolyte. Make sure you know if a compound will dissociate 100% or not. Be careful with the product arrows you use.
5. KNOW THE SOLUBILITY RULES! You will NOT be given this info on the quiz.
6. Be able to identify and predict the products of double displacement reactions. Keep in mind that there ALWAYS has to be a precipitate formed. Be able to recognize spectator ions and write net reactions.
7. MEMORIZE THE 6 STRONG ACIDS! - HCl, HBr, HI, H₂SO₄, HNO₃, HClO₄ - ANY OTHER ACIDS ARE CONSIDERED WEAK.
8. Be able to identify a strong base - any soluble ionic compound involving the OH⁻ ion - and recognize that any other base is considered weak. (hydroxides of alkali metals and Ca, Ba, Sr).
9. Be able to recognize and predict the products of acid/base neutralization reactions.
10. Be able to write a dissociation expression which illustrates why NH₃ is basic.
11. Be able to recognize the double replacement reactions that result in the formation of a gas.
12. What does an oxidation number represent?
13. Be able to determine the oxidation number of any atom in any compound. Review the *Rules for Assigning Oxidation Numbers*.
14. Be able to identify RedOx reactions and label what is being reduced and oxidized as well as what is the reducing agent and oxidizing agent. Some mnemonics that may help:
 - OIL-RIG {Oxidation Involves Loss (of electrons), Reduction Involves Gain (of electrons)}
 - LEO says GER {Loss of Electrons is Oxidation, Gain of Electrons is Reduction}
15. Practice writing half-reactions for balanced RedOx reactions. Be sure to incorporate all subscripts and coefficients. Be sure that the number of electrons for both half reactions are the same. The oxidized electrons have to be gained somewhere, right?
16. Be able to identify the 5 major types of RedOx reactions: Combination, Decomposition, Single Displacement, Disproportionation and Combustion. Understand which ones are ALWAYS RedOx and why.
17. Be able to use the activity series that was provided to you (labeled Standard Reduction Potentials) to determine the products of single displacement reactions. Practice writing these equations in net ionic form.
18. How is the activity series of metals and halogens organized?
19. Be able to balance RedOx reactions. Remember, that if the RedOx reaction does not take place in an aqueous solution, you can balance it without ions. As for redox reactions in acidic and basic mediums, practice makes perfect - know the process! **Chapter 20.2** [Start with half reactions. Then balance all non O and H atoms. Use H₂O to balance H's and O's. Balance electrons with coefficients if needed. Combine half reactions. Watch your waters, H⁺ and OH⁻! Acidic solutions should result in H⁺, and basic solutions with OH⁻]
20. Practice interpreting and balancing redox reactions that are written in their molecular form.

21. Know and understand the equation for Molarity. Realize that molarity is a measurement of concentration and is an intensive property (does not depend on mass).
22. Know the procedure for preparing a solution of known molarity using a volumetric flask.
23. Realize that molarity refers only to the amount of solute originally dissolved in water and does not take into account the dissociation of ions. For example: a 1 M BaCl_2 solution has a 1 M $[\text{Ba}^{2+}]$ and a 2 M $[\text{Cl}^-]$.
24. Be able to prepare a less concentrated solution from a more concentrated stock solution by using the process of dilution: $M_1V_1=M_2V_2$. The moles of solute aren't changing. You are just adding more solvent.
25. Be able to explain and perform calculations involving the process of Gravimetric analysis. Remember gravimetric analysis always involves the production and analysis of a precipitate.
26. Under what conditions will gravimetric analysis not produce accurate results. (refer to your notes)
27. Be able to explain and perform calculations involving the process of Acid-Base titrations. (It's really just stoichiometry.....limiting reactants, mole ratios, etc.)
28. What does the equivalence point represent? How does it differ with the end-point?
29. What are some common acid-base indicators? Why are indicators helpful tools to use when titrating?
30. Be able to explain and perform calculations involving the process of RedOx titration. How is a RedOx reaction similar and different from an acid-base reaction? What does an equivalence point represent in a RedOx titration?
31. What are some common indicators used in redox titrations and how are they different from acid-base indicators?

Good Luck with *your* studies!
THIS UNIT IS AN ABSOLUTE BEAST!
Hang in there!
GET ORGANIZED!
Use flashcards!

Complete the following problems from your Brown, LeMay & Bursten chemistry text. Show all of your work! (No Work = No Credit). The answers to the odd numbered problems are in the back of your text. It is your responsibility to get yourself in an academic position to conquer ALL of these problems. If needed – PLEASE ASK ME FOR HELP!

Problem Set #2: problems 4.2, 4.6, 4.9, 4.11, 4.12, 4.13, 4.14, 4.17, 4.18, 4.23, 4.24, 4.26, 4.32, 4.33

Due Date: _____

Problem Set #3: problems 4.35, 4.39, 4.40, 4.43, 4.44, 4.45, 4.46. In addition to the book problems, also complete the handout *DOUBLE DISPLACEMENT MADNESS*. Work all problems on a separate sheet. Do NOT just scribble in the margins of the handout.

Due Date: _____

Problem set #4: problems 4.49, 4.50, 4.51, 4.52, 4.55, 4.59, 4.60, 4.65, 4.66, 4.71, 4.74. In addition to the book problems, also complete the handout *INVIGORATING REACTION WRITING PRACTICE*. Work all problems on a separate sheet. Do NOT just scribble in the margins of the handout.

Due Date: _____

