CHEM 110 – CLASS GUIDE

Solutions , Precipitation Reactions, Acids & Bases

Get Started!

How to Use this Class Guide

- Use this document as a study guide. It contains all of the information, activities, and homework assignments to be completed before each class.

- If you have any questions about these slides, or questions about your assignments, please ask!

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Chapter 4: Learning Goals

- Upon completion of Chapter 4, Sections 1 - 2, you should be able to:
  - ***Explain*** the difference between a strong and weak electrolyte.
  - ***Apply*** the solubility rules to determine which compounds are soluble in water.
  - Given two reactants, ***construct*** a complete, balanced, chemical equation for the most likely reaction that will occur.

Reading Guide: Chapter 4

- ***Read*** Chapter 4, Section 1 – GENERAL PROPERTIES OF AQUEOUS SOLUTIONS

  - Electrolytes: substances that separate into ions when dissolved in water and thus conduct electricity.

    - ***Watch*** this short movie about NaCl: Electrolytes and Non. Listen carefully! (http://www.bk.psu.edu/clt/ElectrolytesandNon.mov)

TIP! The way to learn the language of chemistry is to hear someone use it again and again. Take the time to make sure you understand the details of electrolytes.

Reading Guide: Chapter 4

- ***Read*** Chapter 4, Section 1 – GENERAL PROPERTIES OF AQUEOUS SOLUTIONS

  - Dissolving Salt (NaCl)

    - ***Watch*** this short movie about NaCl: Dissolution of NaCl in Water. Pay close attention to the way water "solvates" each ion individually. (http://www.bk.psu.edu/clt/DissolutionofNaClinWater.mov)

TIP! In water, hydrogen is 'partially positive' and oxygen is 'partially negative'. Keep this in mind when the narrator says, "notice that water molecules cluster about the anions [the negative ion, chloride ion] with the hydrogens directed toward the negatively charged ions…"

    - ***Listen*** to this podcast: Ions in Water (http://berks.psu.edu/chem/pod/IonsInWater.mp3)

IMPORTANT TIPS!

The smaller gram amount is not necessarily the limiting reagent, since the calculation goes through moles. DO THE MATH!

Be sure to practice these…avoid getting stuck on these types of questions!

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Reading Guide: Chapter 4

- ***Read*** Chapter 4, Section 1 – GENERAL PROPERTIES OF AQUEOUS SOLUTIONS

  - Dissolving Salt ($KMnO_4$)

    - ***Watch*** this short movie about: Dissolution of $KMnO_4$ and see how potassium permanganate dissolves. Notice that the permanganate ion (MnO_4^-) acts as a single ion. (http://www.bk.psu.edu/clt/DissolutionofKMnO4.mov)

    - The oxygens do not come off the manganese atom. Chemists talk about ions because the manganese with its attached to the four oxygen atoms, has a negative charge!

      SO…we write: **$KMnO_4(aq) \rightarrow K^+(aq) + MnO_4^-(aq)$**

    - ***Try*** this interactive exercise: Salt and Ion Learning Module (http://berks.psu.edu/chem/salt/SaltIons.html)

Reading Guide: Chapter 4

- ***Read*** Chapter 4, Section 1 – GENERAL PROPERTIES OF AQUEOUS SOLUTIONS

  - Compounds that dissolve completely in water are called Strong Electrolytes
  - Compounds that dissolve partially in water are called Weak Electrolytes
  - Compounds that don't dissolve in water are called Non-Electrolytes

Reading Guide: Chapter 4

- ***Read*** Chapter 4, Section 2 – PRECIPITATION REACTIONS

  - ***Listen*** to this podcast: Net Ionic Equations (http://berks.psu.edu/chem/pod/NetIonicEquations.mp3)

  - ***Watch*** this animation: Writing a Net Ionic Equation to observe the writing of a net ionic equation for the precipitation of barium sulfate. (http://www.bk.psu.edu/clt/WritingANetIonicEquation.swf)

  - Writing a net ionic equation requires that you:
    1. ***Break up*** each ionic substance
    2. ***Recombine*** the ions to form new possible ionic compounds
    3. ***Check*** solubility rules to see if a new substance will precipitate
    4. ***Write*** the net ionic (no spectator ions)

Reading Guide: Chapter 4

- ***Read*** Chapter 4, Section 3 – ACID-BASE REACTIONS
  - ***Skip*** the sections: "Acid-Base Reactions with Gas Formation" and "The Activity Series".
  - ***Acids*** are substances that ionize in water to form H^+ with a counter ion:
    Example: $HNO_3\ (aq) = H^+\ (aq) + NO_3^-\ (aq)$
  - ***Bases*** are substances that can accept the H^+ ions. They usually produce OH^- in water, but not always!
    Example: $Ca(OH)_2\ (aq) = Ca^{2+}\ (aq) + 2\ OH^-\ (aq)$
  - When acids and bases react, we usually form water and a salt. Salt here means any ionic substance, not just NaCl!
    Example: $HNO_3\ (aq) + Ca(OH)_2\ (aq) \rightarrow H_2O\ (l) + Ca(NO_3)_2\ (aq)$
    The salt in this example is $Ca(NO_3)_2$

READING GUIDE: CHAPTER 4

- ***Read*** Chapter 4, Section 3 – ACID-BASE REACTIONS
  - Some acids and bases are strong, others are weak. Thus they are strong and weak electrolytes!
  - ***Memorize*** the strong acids below from Table 4.2.

TABLE 4.2 Common Strong Acids and Bases	
Strong Acids	**Strong Bases**
Hydrochloric, HCl	Group 1A metal hydroxides (LiOH, NaOH, KOH, RbOH, CsOH)
Hydrobromic, HBr	Heavy group 2A metal hydroxides [$Ca(OH)_2$, $Sr(OH)_2$, $Ba(OH)_2$]
Hydroiodic, HI Chloric, $HClO_3$ Perchloric, $HClO_4$ Nitric, HNO_3 Sulfuric, H_2SO_4	

For the strong bases, you can assume that any compound that contains OH^- ion is a strong base.

Learning Resources

- **Chapter Learning Goals**
  - Chapter 4, Sections 1 - 3 Learning Goals
- **Interactive Exercises**
  - Salt and Ion Learning Module (http://berks.psu.edu/chem/salt/SaltIons.html)
- **Additional Chapter Resources**
  - Watch Movie: Electrolytes and Non (http://www.bk.psu.edu/clt/ElectrolytesandNon.mov)
  - Watch Movie: Dissolution of NaCl in Water (http://www.bk.psu.edu/clt/DissolutionofNaClinWater.mov)
  - Watch Movie: Dissolution of $KMnO_4$ (http://www.bk.psu.edu/clt/DissolutionofKMnO4.mov)
  - Listen to Podcast: (http://berks.psu.edu/chem/pod/IonsInWater.mp3)
  - Listen to Podcast: (http://berks.psu.edu/chem/pod/NetIonicEquations.mp3)
  - Printable Text Only Version of this Class Guide (http://www.bk.psu.edu/clt/chem110/Solutions_Printable.doc)

Practice Exercises

- Practice Exercises: Chapter 4
  - *15, 17, 19, 21, 23, 37, 39*

GREAT WORK…SEE YOU IN CLASS!

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Pre Class Assignment

- This assignment **must** be completed prior to the next class.
  - ***Complete*** the pre class assignment (http://berks.psu.edu/clt/chem110/Solutions_HW.doc)
  - ***Submit*** a copy to the dropbox located in ANGEL called "Pre Class Assignment Submission: Solutions, Precipitation, Acids & Bases"

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