CHEM 1110 – Fall 2021
Midterm Exam 4 Study Guide (Ch. 9-11)

This study guide is meant to provide only the barest direction as you study. Try to find practice problems from the textbook (both in the chapter text and in the end-of-chapter questions) rather than just relying on this guide. Note that most tables and equations will not be provided here or on the exam. You can find them in your textbook.

Chapter 9 – Solutions

- Solutions vs colloids
- Factors leading to solubility
- Recognize hydrates and using their molar mass properly
- Saturation and super-saturation
- Temperature dependence of solubility
- Henry's law and pressure dependence of solubility
- Different units of concentration
  - mass/mass percent
  - volume/volume percent
  - Molarity
  - Molality
- Question: $2.6\ g$ of NaCl are dissolved in $63.4\ g$ of water. What is the concentration in mass/mass percent, and in molality?
- Answer: 3.9% and $0.70\ molal$ in NaCl, but $1.4\ molal$ overall since NaCl dissociates into two different parts
- Dilution
- Question: How many ml of a $12.3\ M$ stock solution should you use to make $200.0\ ml$ of a $0.500\ M$ solution?
- Answer: $8.13\ ml$
- Strong vs weak electrolytes
- Equivalents and gram-equivalents
- Question: How many equivalents of positive charge are in $15.0\ g$ of $Ca(NO_3)_2$?

- Answer: $0.183\ eq$
- Question: How much is a gram-equivalent for the Ca^{2+} ion?
- Answer: $20.0\ grams$
- Boiling point elevation and freezing point depression: $\Delta T = \kappa C_{molal}$
- Question: You place $3.5\ g$ of $MgCl_2$ in a pot with $62\ g$ of water. What are the new boiling point and freezing point for the water? (for water, $\kappa_b = 0.512 \frac{^\circ C}{m}$ and $\kappa_f = -1.86 \frac{^\circ C}{m}$)
- Answer: $T_b = 100.91^\circ C$ and $T_f = -3.3^\circ C$
- Osmotic pressure: $\pi = \frac{nRT}{V}$

Chapter 10 – Acids and Bases

- Brønsted-Lowry Definition of Acids and Bases
- Acid/Base reactions with water
- Identify acid, base, conjugate acid, and conjugate base in acid/base reactions
- Weak vs. strong acids and bases (know the strong acids)
- Acid/base strength, and relationship between strength of conjugate pairs
- Acid dissociation constant $\left(K_a = \frac{[H_3O^+][A^-]}{[HA]} \right)$
- Using K_w to find $[H_3O^+]$ or $[OH^-]$
- Finding pH, pOH, and pK_a
- Use of color indicators
- Purpose and composition of a buffer solution
- Finding pH for a buffer solution (Henderson-Hasselbalch equation)
- Finding concentrations by titration
- Predicting acid/base properties of ionic compounds

Chapter 11 – Nuclear Chemistry

- Differences between α, β, and γ radiation
- Balancing nuclear equations
  - α emission
  - β emission
  - Positron emission
  - Electron capture
  - Fission
  - Fusion
- Half-life and finding a sample's remaining fraction