Chapter 1. Introduction
- Know terms related to the scientific method

Chapter 2. Scientific Measurements
- Define and know units associated with mass, weight, length and volume
- Determine number of significant figures in a measured number.
- Perform math operations (+,-,x, ÷) & round answer to appropriate number of sig figs
  ⇒ Adding, subtracting: round to fewest decimal places
  ⇒ Multiplying, dividing: round to fewest sig figs
- Set up and solve conversion problems using dimensional analysis

Chaper 3. The Metric System
- Perform metric - metric conversions (Know factors for kilo-, centi-, milli-)
- Find volume by calculation or displacement
- Know the density equation: density = mass/volume
- Calculate the density, mass or volume of an object
- Make temperature conversions between °C, °F and K.

Chapter 4. Matter And Energy
- Recognize how atoms exist and move at the molecular level for solids, liquids and gases
- Know terms for changes of state (e.g. melting, boiling, etc.)
- Identify the type of matter as an element, compound or mixture
- Identify the physical state and type of matter for a given molecular level image
- Identify properties of metals vs. nonmetals & classify an element as a metal, nonmetal or semi-metal
- Write names of common elements
- Classify changes and properties as either chemical or physical

Chapter 5. Models of the Atom
- subatomic particles
  ⇒ Proton: +1 charge & is inside the nucleus
  ⇒ Neutron: no charge & is inside nucleus
  ⇒ Electron: -1 charge & is outside the nucleus
- Determine the number of protons, neutrons, electrons, the atomic number & mass number given either the atomic notation or the element name and mass number
- Isotopes of an element have the same atomic # but different mass #'s and different # of n's
- Know terms associated with quantum model (levels, sublevels, orbitals)
- Know number of electrons in each sublevel and orbital
- Write electron configurations for the first 20 elements using full notation

Chapter 6. The Periodic Table
- Know terms associated with periodic table: representative vs. transition elements, periods, groups, names of Group IA, IIA, VIIA and VIIIA columns
- Know trends for atomic size, metallic character, and ionization energy
- Give the number of valence electrons for any Group A element
- Identify ionic charges for Group A cations and anions
- Identify isoelectronic ions and atoms

Chapter 12. Chemical Bonding
- ionic bond: electrons are transferred from metal cation to nonmetal anion
- covalent bond: electrons are shared between 2 nonmetals
- Size of ionic radii: cations < neutral atoms < anions
- Draw **electron dot formulas** for molecular compounds
- Use a molecule's electron dot formula and the provided Table of Molecular Shapes to determine the **molecular geometry (shape) and bond angles** for a given molecule.
- Know electronegativity trends for Group A nonmetals
- Determine if **a covalent bond is polar or nonpolar**
  ⇒ **Polar bond:** unequal sharing of e- between 2 different nonmetals (C-H is exception)
- Identify if a given bond is **ionic, polar covalent, nonpolar covalent, or metallic**
- Determine if **a molecule is polar or nonpolar**

Chapter 7. The Language of Chemistry
- Identify ionic and molecular compounds
- Write names and formulas for ionic compounds (metal and nonmetal(s))
- Naming Metal Cations
  - IA, IIA, IIIA, Ag^+, Zn^{2+}, Cd^{2+}: **No Roman numeral**
  - **Other Metals: Use Roman numeral for charge**

- Naming Nonmetal Anions $\Rightarrow$ stem of name + "ide"
- Use the names and formulas of polyatomic ions provided on the CHM130 Periodic table
- Write names and formulas for molecular compounds (nonmetals only)
    - $\Rightarrow$ This is the only time you use the Greek prefixes of di, tri, etc.!
    - $\Rightarrow$ The second element only ends in –ide
- Write names and formulas for these acids: HCl, H_2SO_4, HNO_3, $HC_2H_3O_2$, H_3PO_4

Chapter 8. Chemical Reactions
- Endothermic reactions absorb heat (the container feels cold) and exothermic reactions release heat (the container feels hot).
- Balance any given reaction
- Identify Reaction Type (Combination, Decomposition, Single Replacement, Double Replacement Precipitation, Acid-Base Neutralization or Combustion)
- Complete and balance Combustion rxns: Products are always $CO_2(g)$ and $H_2O(g)$
- Use activity series to determine if a Single Replacement reaction occurs.
- Complete and balance Single Replacement reactions
- Identify the reactant that is oxidized (reducing agent) and the reactant that is reduced (oxidizing agent)
- LEO says GER! (lose e-'s = oxidation and gain e-'s = reduction)
- Use solubility rules to determine if an ionic compound is soluble (aq) or insoluble (s).
- Complete and balance Acid-Base Neutralization rxns ($HX(aq) + MOH(aq) \rightarrow H_2O(l) + MX(aq)$)

Chapter 9. The Mole Concept
- Convert from # particles $\leftrightarrow$ moles (use Avogadro's number: 6.02×10^{23} particles = 1 mole)
- Determine molar mass (g/mol)
- Convert from g $\leftrightarrow$ moles (use molar mass as unit factor) and g $\leftrightarrow$ L (use molar volume = 22.4 L/mol)
- STP conditions: T = 0 $^\circ$C = 273 K, P = 1 atm, molar volume = 22.4 L/mol

Chapter 10. Stoichiometry
- Perform mole $\leftrightarrow$ mole conversions using the mole-mole ratio from the balanced reaction
- Perform g $\leftrightarrow$ g conversions using the molar masses of the substances and the mole-mole ratio from the balanced reaction.
- Perform g $\leftrightarrow$ L conversions using the molar masses, the mole-mole ratio and the molar volume at STP.

Chapter 11: Gases
- Identify the properties of gases
- Know how the motion of gas particles changes with temperature.
- Know how changes in volume, temperature, and number of particles affect gas pressure.
- Given 2 sets of conditions, solve problems using combined gas law. Note: T must be in Kelvin: K = $^\circ$C + 273

Chapter 13: Solids and Liquids
- Recognize properties of liquids and solids
- Intermolecular Forces = IMF
    - Identify the type of IMF as London dispersion force, dipole-dipole force, or hydrogen bond
    - Know the relative strengths of these three IMF's
    - Know how IMF's affect physical properties, such as vapor pressure, boiling point, viscosity, and surface tension
- Given a bond or IMF, identify it as polar covalent, nonpolar covalent, ionic, London dispersion, dipole-dipole, or hydrogen bond.
- Given the chemical formula or description, identify a solid as ionic, molecular, or metallic
- Identify regions on heating curves, including solid, liquid, gas, solid-liquid, liquid-gas, melting point and boiling point

Chapter 14: Solutions
- solution: a solute dissolved in solvent; know definitions of solute and solvent
- Know how temperature and pressure affect solubility of gases in solution
- Know effects of temperature on solubility of solid in solution
- Use "Like dissolves like" Rule and Solubility Rules to predict what substances are soluble in/miscible with water or other solvent
- Calculate the mass percent concentration or the molarity for a solution:

Chapter 15: Acids and Bases
- pH scale: Given the pH of a solution, determine if it's neutral, acidic, or basic.
- Calculate pH using $[H^+] = 10^{-pH}$
- Know definitions of Arrhenius vs. Bronsted-Lowry acids and bases and identify these in reactions
- Identify strong, weak and nonelectrolytes.
- Identify strong acids, weak acids, strong bases and weak bases.
- Indicate whether a molecular picture represents a strong acid, weak acid, strong base or weak base.

Chapter 16. Chemical Equilibrium
- Know factors that affect the number of successful collisions
- Know how we can increase the rate of reaction: increase concentration, increase temperature or add a catalyst.
- Identify features of endothermic and exothermic Energy profile diagrams