**The Spring Final Exam - Topic Review**

**2016-2017**

**Unit 8**

* Name a hydrate
* Write the formula for a hydrate
* Calculate the percent by mass of water in a hydrate using a given formula
* Calculate the percent by mass of water in a hydrate using lab data
* Be prepared to solve multiple types of stoichiometry calculations. Remember that you must start with a balanced equation.
* Demonstrate how to use proper conversion factors
* Set up stoichiometry calculations
* Relate the law of conservation of mass to the mole concept with respect to stoichiometry
* Balance a chemical equation and set up a mole to mole ratio
* Define, identify, and apply limiting reagents
* Define and identify excess reagents
* Define, identify, and apply actual yield – percent yield
* Define, identify and apply theoretical yield – percent yield
* Be able to use the mole maps to convert between mass-volume-moles-particles, etc. This can be in any combination.

**Unit 9**

* Valence electrons
  + Determine the number of valance electrons
  + Apply the concept to chemical bonding
  + Define and apply the octet rule
* Ionic bonding
  + Explain ion formation – cations and anions
  + Explain bond formation – gaining or losing electrons
  + Identify basic properties of ionic compounds
* Covalent (Molecular) bonding
  + Explain bond formation – sharing pairs of electrons
  + Polar vs. non-polar bonds
  + Polar vs. non-polar molecules
  + Identify basic properties of covalent compounds
  + Single, double, triple bonds
* Polarity in Molecular Compounds
  + Make sure you know the concept of polarity.
  + Identify partial positive (δ+) and partial negative (δ-) regions in a polar molecule
  + Equal sharing of electrons vs. Non-equal sharing of electrons
  + Polar vs. non-polar bonds
  + Polar vs. non-polar molecules
* Diatomics
  + H2, N2, O2, F2, Cl2, Br2, I2
  + Single, double= only oxygen, triple bonds = only nitrogen
* VSEPR theory
  + Valence shell electron pair repulsion theory
  + Be able to NASL. Review how to NASL to help determine the Lewis dot and Molecular Geometry.
  + Geometric shapes
    - Trigonal planar, Tetrahedral, Linear, trigonal pyramidal, Bent
  + Shared electron pairs vs. unshared electron pairs (lone pairs) on the central atom
  + Polar vs. non-polar molecules
* Properties of solids
  + Ionic, molecular non-polar, molecular polar, metallic, covalent network
    - Pattern arrangement, Conductivity, Malleability, Solubility, Melting point

**Unit 10**

* Explain in detail the postulates of the kinetic theory with respect to gases – know details such as compressibility, kinetic energy, etc…
* Identify basic properties of gases with respect to spacing of molecules, shape, volume, etc…
* Define STP - standard temperature and pressure
* Complete pressure conversions – 1 atm = 760 mmHg = 101.325 kPa (conversion table will be provided)
* Compare and contrast the various gas laws (variables, direct vs. inverse relationships, graphical representations, etc…)
* The gas laws include: Boyle’s law, Charles’ law, Gay-Lussac’s law, Combined gas law, Avogadro’s hypothesis/law, Dalton’s law of partial pressures, Graham’s law, Ideal Gas Law
* Complete gas law calculations – for all gas laws (all formulas will be provided)
* Apply specific gas laws to real-world scenarios
* Ideal gas law units must be in: atm, liters, moles, and Kelvin (R constant will be provided)

**Unit 11**

* Apply the concept of kinetic energy to the various states of matter
* Define “boiling point” – identify the relationship between pressure and temperature
* Heating curve (stair-step) phase change diagram applications:
  + Use a diagram to identify solids, liquids, gases, melting/freezing points, vaporization/condensation points, etc…
  + Define and apply enthalpy of fusion and enthalpy of vaporization
  + Calculations…
* Explain the concept of “phase change” (energy and temperature)
* Explain the concept of dynamic equilibrium with respect to the states of matter
* Define and apply the concept of “specific heat”
* Define and apply the concept of “energy” with respect to changes in temperature and the state of matter
* Phase change and heat calculations:
  + Calculate the amount of energy given off or absorbed for a temperature change
  + Calculate the amount of energy required for a phase change
  + Calculate for any missing variable
  + Complete multi-step calculations (3 step)
* Vapor pressure curve diagram applications:
  + Compare and contrast boiling points for given substances
  + Identify boiling point for given conditions
  + Identify normal boiling point
* Phase change diagram applications:
  + Identify solid, liquid, gas, melting point, boiling point, triple point, critical point, etc…
  + Determine what occurs as pressure and temperature are changed
* Identify the factors that influence the rate of reaction
* Explain the concept of the “collision theory” – apply the concept to given situations
* Activation energy diagram applications:
  + Identify reactants, products, activated complex, activation energy, ΔH, etc…
  + Apply diagrams for the forward and reverse reactions
  + Define and apply the concept of a “catalyst”
  + Differentiate between energy levels for reactants and products
  + Determine if ΔH is positive or negative for a given diagram
  + Identify reactions as exothermic or endothermic – know common examples with respect to phase changes
* Define and apply the concept of “enthalpy” - use given phase changes to determine enthalpy
* Calculate ΔHreaction using given heats of formation
* Define and apply the concept of “entropy” – use given phase changes to determine if entropy increases or decreases

**Unit 12**

* Solutions and Solubility
  + Detail the properties and chemistry of water – polarity, bond types, VSEPR shape, shared vs. unshared electrons, etc…
  + Explain how hydrogen bonds form between water molecules
  + Discuss the importance of hydrogen bonding and water’s basic properties with respect to surface tension, high specific heat, low vapor pressure, high heat of vaporization, phase density, etc…
  + Differentiate between cohesive and adhesive forces
  + Define and apply the concept of “solvation”
  + Identify the basic components of a solution – solute vs. solvent
  + List the factors that affect solubility – for solids and gases
  + Determine if a solute will be soluble in a solvent based on its polarity – “like dissolves like”
  + Compare and contrast the terms saturated, unsaturated, and super-saturated
  + Read solubility curves for accuracy – manipulate variables accordingly
  + Apply the concepts of saturation, unsaturation, and super-saturation to solubility curves
  + Identify the colligative properties for a solution – decrease in vapor pressure, decrease of freezing point, elevation of boiling point
  + Explain how the colligative properties are affected with the additional and removal of a solute
* Solution Calculations
  + Define and apply the concept of molarity – moles of solute per liter of solution
  + Complete molarity calculations – solve for any missing variable
  + Define and apply the concept of molality – moles of solute per kilogram of solvent
  + Complete molality calculations – solve for any missing variable
  + Calculate mass percentage for the component of a solution – solve for solute and solvent
  + Calculate molarity by dilution for a given solution

**Unit 13**

* Acids and Bases:
  + Identify the general properties of an acid
  + Identify the general properties of a base
  + Differentiate between the main postulates of the acid-base theories
    - Arrhenius – Acid produces H+; Base produces OH-
      * Monoprotic acids– contains one H+
      * Diprotic acids– contains two H+
      * Triprotic acids– contain three H+
    - Bronsted-Lowry – Acid donates H+; Base accepts H+
      * Conjugate acids and bases
    - Lewis – Acids accept electron pairs; Bases donate electron pairs
  + Name binary acids
  + Name acids containing polyatomic ions
  + Name common bases
  + Determine if a substance is acidic or basic
  + Explain and apply the pH scale
  + Define and apply the concept of amphoterism
  + Complete various pH calculations
  + Apply the Bronsted-Lowry acid-base theory
  + Identify acid and base conjugates
  + Match together acids or bases with their respective conjugates
* Titration (Neutralization):
  + Identify the reactants and products of a balanced neutralization reaction
  + Determine what type of reaction best characterizes a neutralization reaction
  + Explain and apply the concept of titration
  + Solve for missing variables in a neutralization reaction
  + (H+)(Ma)(Va) = (OH-)(Mb)(Vb)
* Electrolytes:
  + Determine if compounds will exhibit electrolytic behavior
  + Compare and contrast electrolytes and non-electrolytes – identify substances accordingly