AP Chemistry

First Semester

Final Exam Topics for Review

Name: _____

Date: _____ Per: _____

Chapter 1

- Nature of Matter
- Pure Substances v. Mixtures
- Elements v. Compounds
  - Law of Definite Proportions
- Physical v. Chemical Properties
- Chemical & Physical Changes
- Separation Techniques
  - Filtration
  - Distillation
  - Chromatography (paper, gas, column)
  - Net Ionic equations and spectator ions.
- Dimensional Analysis
- Significant Figures

Chapter 2

- Dalton's Atomic Theory
- Thompson & the Cathode Ray Tube
- Millikan's Oil Drop Experiment
- Rutherford's Gold Foil Experiment
- Radioactivity
  - Definition
  - Alpha Decay
  - Beta Decay
  - Gamma Radiation
- Modern Atomic Theory
  - Nucleons
  - Electron Cloud
  - Isotopic Notation
- Atomic Weights
  - Basis
  - Finding from isotopic mass & abundance
  - Mass Spectrometry
- Periodic Table
  - Groups
  - Periods
  - Family Names
  - Classification
    - s,p,d,f Blocks
    - Main-group/Transition/Inner transition
    - Metals/Non-Metals/Metalloids
    - BrINClHOF
- Formulas
  - Empirical v. Molecular
- Naming Ions & Ionic Compounds
  - Predicting Monatomic Charges
  - Common Polyatomic Ions
- Naming Binary Molecular Compounds
- Simple Organic Compounds
  - Alkanes, Alkenes, Alkynes
  - Simple substituted hydrocarbons
  - Basic Functional Groups
    - Alcohol: -OH
    - Amine: $-NH_2$

Chapter 3

- Chemical Reactions
  - Writing formula equations from word equations
  - Balancing Equations
  - Types
    - Synthesis
    - Decomposition
    - Single Replacement
    - Combustion
- Calculating Formula Weights
  - Molar masses (gram formula mass)
  - Calculating Percent Compositions
  - Finding Empirical Formulas from % Composition
- Mole Conversions
  - Mass – mole, mole – mass
  - Mole – particles, particles – moles
- **Combustion Analysis**
  - $HC + O_2 \rightarrow CO_2 + H_2O$
- Stoichiometry
  - Mole-Mole Stoichiometry
  - Mass-Mass Stoichiometry
  - Mole-Mass, Mass-Mole Stoichiometry
  - Limiting Reactants
    - Finding Excess Reactants
  - Theoretical Yield
  - Percent Yield

Chapter 4

- Solutions
  - Properties, Definitions
- Electrolytes
  - Weak v. Strong
  - Non-Electrolytes
- Precipitation Reactions
  - Solubility
  - Solubility Rules (memorize)
- Double Replacement Reactions (metathesis)
- Ionic Equations
  - Complete ionic equations v. net ionic equations
- Acid-Base Reactions
  - Acid/Base Definitions
    - Definitions of Acid & Base
    - Properties of Acids & Bases
  - Strong v. weak acids & bases
  - Neutralization Reactions
    - acid + MOH → salt & water
    - Gas producing reactions
      - Sulfides → H_2S
      - Carbonates, Bicarbonates → CO_2
- Redox Reactions
  - Determining Oxidation Numbers
  - Oxidation v. Reduction
  - Oxidizing Agents v. Reducing Agents
- Single Replacement Reactions
  - Hydrogen-producing reactions (acid & metal)
  - Activity Series
- Concentrations

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- Molarity
  - Diluting Concentrated Solutions ($M_sV_s=M_dV_d$)
- Titration
  - Definitions
  - Calculations ($M_aV_a = M_bV_b$)
- Redox Reactions
  - Balancing
  - Half-Reactions

Chapter 5

- Energy & Work
  - Types of Energy
  - Definition of a Thermodynamic System
- Internal Energy
  - $\Delta E = q+w$
  - State Functions
- Enthalpy
  - ΔE v. ΔH
  - PV Work
- Enthalpy of Reaction
  - Positive v. Negative
  - Enthalpy Diagrams for Endothermic & Exothermic
- Calorimetry
  - Specific Heat
  - $Q=mc\Delta T$
  - $q_{rxn} = -q_{sur}$
- **Hess' Law**
- **Enthalpies of Formation**
  - Standard states

Chapter 6

- Wave Nature of Light
  - Properties of Light
  - $c = \lambda\nu$
- Quantized Energy & Photons
  - Wave-particle duality
  - $E = h\nu$
- Line Spectra
  - Emission v. Absorption Spectra
- Bohr Model
  - Ground State & Excited State
  - Movement of Electrons & Emission of Light
    - $\Delta E = Ef - Ei = Ephoton = h\nu$
- Wave Behavior of Light
- Heisenberg Uncertainty Principle
- Quantum Mechanics
  - Atomic Orbital Theory
    - Energy Levels, Sublevels, Orbitals, Spins
    - Quantum Numbers
    - Shapes of Orbitals
    - Orbital Distribution in Principal Energy Levels and Sub Levels
  - Electron Distributions
    - Aufbau Principle
    - Hund's Rule
    - Pauli Exclusion Principle
  - Electron Configurations
    - Orbital Diagrams
    - Noble Gas Notations
    - Bohr Models
    - Core Electrons
    - Valence Electrons
- Use Periodic Table to Write Electron Configurations

Chapter 7

- **Effective Nuclear Charge**
  - **Coulomb's Law**
  - Calculating effective Nuclear Charge
    - **Shielding Effect**
    - Core Electron Screening
  - Trends in Effective Nuclear Charge (Periodic & Group)
- Atomic & Ionic Radius Trends (Be able to explain, not just state)
  - Periodic & Group Trends for Radius
  - Ionic radius trends for cations & anions
- Ionization Energy Trends (Be able to explain, not just state)
  - First Ionization v. Successive Ionization Energies
  - Effect of noble gas/inner core configuration
  - Periodic & Group Trends
  - Irregularities in Trends
  - Cation/Anion Formation
- Electron Affinity
  - Periodic & Group Trends
  - Positive Values for Noble Gases

Chapter 8

- Chemical Bonds
  - Octet Rule
  - Ionic Bonds
  - Covalent Bonds
  - Metallic Bonds
- Ionic Bonds
  - Formation
  - Elements Involved
  - Lattice Energy
    - Definition
    - Calculating
    - Born-Haber Diagram
      - Endothermic & exothermic steps
      - Use of Hess's Law
    - Magnitude based on charge & radius (Coulomb's Law)
  - Predicting Ionization (charges) of Metals & Non-metals
  - Properties of Ionic Compounds
- Covalent Bonds
  - Formation
  - Properties
  - Lewis Structures
    - Single & Multiple Bonds
      - Strength
      - Length

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- Sigma & Pi
- Dilution problems
- Bond Polarity
  - Electronegativity Differences
    - Non-Polar ΔEN <0.4
    - Polar 0.4< ΔEN <2.0
    - Ionic ΔEN > 2.0
    - Symbols for polarity
  - Dipole Moment
    - Coulomb's Law
- Naming Binary Molecules
- Drawing Lewis Structures
  - Exceptions to Octet Rule
    - Partial Octets (H, Be, B)
    - Expanded Octets (Possible in groups 15-18 starting in 3rd energy level).
    - Free Radicals
  - Formal Charges
  - Resonance Structures
    - Aromatics

Bond Enthalpies
- Calculations using Hess' Law
- Determining ΔH_{rxn} from Bond Enthalpy Data
  - $\Delta H_{rxn} = \Sigma$(enthalpies of bonds broken) – Σ(enthalpies of bonds formed)

Chapter 9

Molecular Geometries
- VSEPR Theory
  - Basic Shapes
    - Linear
    - Bent (2 different potential angles)
    - Trigonal Planar
    - Trigonal Pyramidal
    - Tetrahedral
    - Trigonal Bipyramidal
    - Octahedral

Molecular Polarity
- Dipole moment cumulative or canceling

Valence Bond Theory
- Orbital overlap
- Bond Length Function of Attractive/Repulsive Balance
  - Lowest Potential Energy
- Hybrid Orbitals
  - Reconcile Valence Bond Theory & Observed Molecular Geometries

Multiple Bonds
- Sigma – single
  - Hybridization occurs in sigma bonding
- Pi – for double & triple
  - Overlap of unhybridized p orbitals
- Bond Order = Number of bonds
  - Best predicted using molecular orbital theory

Chapters 10 & 11 are still pretty fresh, so I haven't included them in the study guide.