Honors Chemistry - Semester 1 Study Guide

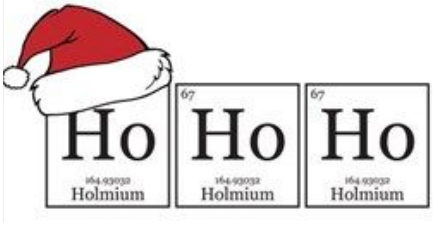
Mon, December 16 All Day	**Tues, December 17** Access 7:40-8:40 Period 1 8:50-10:15 Period 2 10:25-11:50	**Wed, December 18** Period 3 7:40-9:05 Period 5 9:15-10:40 Period 6 10:50-12:15	**Thurs, December 19** Period 7 7:40-9:05 Seminar 9:15-9:45 Period 8 9:55-11:20	**Fri, December 20** No School! Winter Break begins!

Unit 1 - Fundamentals of Chemistry:

- Know how to calculate metric conversions
    - Memorize (fractions or decimals) deci, centi, milli, nano, Mega, kilo
- Know how to properly set up and perform dimensional analysis (single unit to single unit) problems
- Know how to round to the correct number of significant figures in calculations
- Be able to tell the difference between quantitative vs. qualitative observations
- Know how to convert a number in standard notation to scientific notation and vice versa
- Know how to determine uncertainty when measuring data
- Be able to perform % yield and % error calculations
- Know the difference between an element and a compound as well as Pure Substances vs. Mixtures
    - Know the methods for separating mixtures and when you might use each method

Unit 2 - Atomic Structure and Nuclear Chemistry:

- Know the parts of an atom (P, N, E) - charge, relative size, location in the atom, etc.
- Be able to explain why a typical atom has a neutral charge
- Know how to determine the atomic number, common ion charge, average atomic mass, and mass number of an element
- Know what Isotopes are and how they affect the average atomic mass of an element
- Know how to read and write the isotopic symbol of an element
- Be able to perform average atomic mass calculations
- Know how to determine the difference between fission and fusion reactions
- Know how and why nuclear decay occurs
    - Be able to perform half life calculations
    - Be able to write and predict products in nuclear equations involving Alpha, Beta (+ and -), Gamma Decay (memorize isotopic symbol for four particles).
- Know the basic discoveries of the different atomic models (Dalton, Thomson, Rutherford, Bohr, Quantum Mechanical)
- Know how ions are formed, where the charge comes from, and the common ions for the different groups of the periodic table. (Electrons must be lost from outermost energy level)
- Be able to determine how many P, N, and E are found in an ion



Unit 3 - Electrons and Energy:

- Know how the 6 different forms of energy can transfer (3 ways)
- Know the difference between kinetic and potential energy
- Know the basic idea behind the Law of Conservation of Energy (same as Law of Conservation of Mass)
- Know the seven major types of electromagnetic radiation (radiant energy) and where they fall on the spectrum
- Know how wavelength and frequency can affect the energy of a wave

- Know how many electrons can fit in each energy level
- Know how to identify energy levels and how they are organized around an atom
- Know how electrons can emit energy from an atom when it is excited
- Be able to perform wavelength and frequency calculations (don't forget how to convert between Hz and MHz or KHz, etc.)
- Be able to calculate the energy of a photon given wavelength OR frequency
- Be able to explain how a specific element can be identified when it is excited through electricity, fire, etc.
- Know the basic shapes of each sublevel (s and p specifically) and what sublevels can be found at each energy level
- Know how many orbitals are found in each sublevel and how many electrons can fit in each orbital
- Electron Configuration - Be able to perform longhand and shorthand (noble gas) configurations for atoms and ions
    - Know why d-block ions are unique when they lose electrons (and know why Cu and Cr are EXTRA unique)
    - Know how to interpret for atoms and ions showing full and partially full orbitals and sublevels

Unit 4 - Periodic Table and Nomenclature:

- Know how to differentiate between physical and chemical properties and changes
- Know the different major categories of the periodic table (metals, nonmetals, metalloids)
- Know the properties of main group elements including predicted ion charges, number of valence electrons, properties, and examples of each group.
- Know how to explain reactivity as a trend for metals vs. nonmetals in terms of shielding
- Know how to define each major parent trend and explain how that trend works (Nuclear Charge, Effective Nuclear Charge (with Z_{eff} calculations), and Shielding)
- Know the trends for Atomic and Ionic (cations AND anions) Radii and why they occur
- Know how to name Type 1 Metal Compounds, Type 2 Metal Compounds, Compounds containing Polyatomic Ions, and Covalent Compounds
- Know how to conjugate polyatomic ions based on # of oxygens

Unit 5 - Chemical Bonding:

- Know the types of elements that undergo metallic, ionic, and covalent bonding
- Know what makes metallic bonding (metals + metals) different from crystal lattice structures of ionic compounds and how that affects their conductivity, malleability, and ductility
- Know the basics of how and why ionic bonds form
- Ionic Dot Diagrams
    - Know how to draw dot diagrams for individual elements
    - Know how to show transfer of electrons
    - Know what a formula unit is
- Know the chemical and physical properties of ionic compounds AND be able to explain and draw diagrams of how each property works
    - Solubility, Conductivity as a solid and aqueous, Melting Point, Boiling Point,
    - Know the ion effect and how it relates to conductivity
- Know how and why ionic compounds form crystal lattice structures
- Know how to compare and contrast ionic compounds from covalent compounds in terms of method of naming, properties, etc.
- Be able to draw covalent dot diagrams in 3-D in the correct shape

Unit 6 - Molecular Geometry and IMFs -

- Know how to determine a compound's molecular geometry
    - Sketch/Structural (with wedges and dashes)
    - Shape name and approximate Bond Angles using VSEPR
        - Bent/V-shape (smallest angle), trigonal planar, trigonal pyramidal (3D), tetrahedral (3D), linear
            - Memorize bond angle for Linear (2 bonds), Trigonal Planar (3 bonds), and Tetrahedral (4 bonds) and be able to predict bond angles for others
            - Know that lone pairs repel 2 degrees more
- Know how and why covalent compounds share electrons and what happens when they don't share evenly
- Know how to calculate polarity of a bond
- Know what it means when two atoms form a double or triple bond vs. a single bond
- Be able to draw or identify resonance structures for NO_3, CO_3, or SO_3
- Know how to determine molecular polarity and what it means about the properties of the molecule
    - Know how to draw dipole vectors and net dipoles with positive and negative charges
- Know how to explain that solubility is based on polarity of solvents ("like dissolves like") and how soap works
- Know how to explain the role of IMFs in phase changes
- Know how to rank the intermolecular forces in terms of strength
    - Know the different factors that affect strength of IMF's:
        - Be able to calculate the molecular mass of a compound
    - Know how IMF's affect melting and boiling point trends
    - Know how differences in IMF's can be used to separate mixtures (distillation)
- Know the properties of water and why they exist in the way that they do
    - Adhesion, Cohesion, Surface Tension

Unit 7 - Chemical Reactions:

- Be able to visually identify if a reaction has occurred
- Know how to write word equations from chemical equations and vice versa.
- Know the seven (7) diatomic elements (BrINClHOF) and when they get a 2 behind them
- Know how to balance a chemical equation
- Know how to identify states of matter in equations for compounds and elements
- Know how to predict products for all types of reactions
    - Single Replacement
    - Double Replacement (Precipitation Reaction)
    - Combustion
    - Synthesis (Know special types)
    - Decomposition (Know special types)
- DR: Write Complete Molecular (normal), Complete Ionic (separated Ions), Net Ionic (Which Ions React) equations
    - Be able to identify spectator Ions
- SR: Use the Activity Series to predict products of SR reactions and determine if they will occur


Happy
Holidays