Midterm Exam Checklist—Chem Honors ***Name*** _____
Period _____

What to bring: **#2 pencil**, **calculator and folder of tests**.

EXAM OVERVIEW: 10% of your final year average
Part I: **50 multiple choice--** *All basic information is included-- no long calculations required*. (~40 mins)
Part II: **3 pages of short answer and problem solving questions**-- Showing all work. (~40 mins)
Part III: **4 Explanation questions** (~40 mins)
The explanation questions will be similar to the explanation questions I have asked all year. Look back at all notes, homeworks, labs, review sheets and tests to thoroughly prepare. You need to impress me with your understanding of chemistry.

Units 1-2: Matter, Measurement **LABS:** $CuCl_2$ lab, Candle Lab, Density Lab,

- matter-- substances vs mixtures, elements vs. compounds, atoms and molecules
- change-- physical change vs. chemical change
- Law of conservation of mass during chemical reactions *(atoms only rearrange, not lost or created)*
- scientific notation *(with and without a calculator)*
- accuracy vs. precision
- significant digits *(counting # of sig figs and properly rounding answers to proper # of sig figs)*
- density-- concept and problem solving *(rearranging equation, plugging in numbers, writing units)*
- factor label conversions *(using method properly to convert any type of units)*
- metric unit conversions-- use factor label method to convert metric units

Unit 3: Moles and Stoichiometry **LABS**: $MgO/NaHCO_3$ Lab, $Ca_3(PO_4)_2$ Lab, Mole Rockets

- History of moles: Law of conservation of mass, Law of Definite proportions and Law of multiple proportions; theories of Democritus, Dalton, Gay-Lussac, and Avogadro
- Avogadro's Hypothesis: Use it to balance eqs (& determine formulas) and relative masses of gases
- Mole Conversions: Conversions between grams or liters ↔ moles ↔ particles (mc's or separate atoms)
- Percent composition, empirical formulas and molecular formulas
- Balancing equations
- Stoichiometry problems: Conversions between amounts of one substance to amounts of another in a rxn
- Limiting reactants, theoretical yield and percent yield
- Lab type questions-- general lab separation techniques, concepts and calculations

Unit 4: Basics of Atoms and History of atom Mass Spectrometry Demo

- protons, neutrons, electrons, atomic number, mass number, symbols
- Calculations of average atomic mass of an element given % abundance data.
- Evidence for structure of atom-- Democritus, Aristotle, Dalton, Mendeleev, Thomson, Millikan, Rutherford, Chadwick, mass spectrometer (mass of atoms, isotopes)
  *(*No long explanation questions will be asked for any of the people.)*

Unit 5: Nuclear Chemistry and Specific Heat of Metal (Lab)

- Specific heat of a metal-- concepts and calculations of specific heat of different substances (See Lab)
- electromagnetic spectrum—high and low energy radiation, ionizing vs. non-ionizing, dangers of radiation.
- alpha, beta and gamma radiation-- symbol? How penetrable?
- Know typical sources of radiation (rocks, radon gas, cosmic, x-rays, etc.)
- radioactive decay equations (alpha, beta, positron, electron capture), half-life problems
- Reasons for instability of nuclei (properties and importance of both the electromagnetic & strong force)

- Fission, fusion-- equations, definitions and examples of each. Why are both fission and fusion favorable?
- nuclear power plants-- fuel, control rods, moderator, meltdowns, Chernobyl(what went wrong)
- $E= mc^2$ calculations. Concept that energy-mass is always conserved, but mass is lost in nuclear reactions
- Star Born Article--how were elements besides hydrogen formed? (gravity vs. expanding radiation)
- Nuclear Chem articles (C-14, Alchemist Dream) Know basic concepts

Unit 6: **Modern Atomic Structure, Periodic Table** **LABS:** Color Lab (incl. emission spectra), Elements Lab

- Relationships between energy, frequency & wavelength.
- Calculations using $c = \lambda\nu$ and $E=h\nu$ *(Formulas and the needed constants are given on reference chart!!)*
- Bohr's Model of the hydrogen atom states that electrons have quantized energies. Explain how emission lines give evidence for this model. (Explain by discussing absorption, jumps of electrons, and emission.)
- Color Lab: flame tests, fluorescence, phosphorescence, color of objects as absorption/reflection of visible light
- Wave-particle duality of light and electrons: Particle properties--photoelectric effect and line emission spectra; wave properties—diffraction & interference; wave packets; Heisenberg uncertainty principle.
- Electron Configurations: types of orbitals (s, p, d), arrow diagrams, writing electron configurations with periodic table (*Orbitals as e^- probability not orbits. Rules: Auf Bau, Pauli Exclusion Principle and Hund's Rule)*
- Determining # of valence electrons, charge of ions in compounds, size of ions vs. size of their atom
- Labeling families in periodic table and properties of metals, nonmetals and metalloids. (periods,groups)
- Element Lab type questions, Periodic System Article

Unit 7-8: **Trends, Bonding (Ionic, covalent, metallic), Reactivity** **LABS**: Empirical Formula of a Hydrate, Reactivity Demo, Molecular Models, Synthesis of Aspirin

- **Periodic Trends**: Know definitions and trend reasons for effective nuclear charge, radius, IE, EN
- **Types of Substances** --ionic, covalent and metallic.
  - What combination of metal and nonmetal elements makes up each type of substance? Are electrons given and taken? shared? just given away? Why (electronegativity differences)?
  - Names and formulas of compounds
  - Why do metals conduct electricity? Why don't nonmetals conduct electricity?
- **Lewis Dot diagrams**:
  a) ionic compounds: Dot diagrams showing the electrons moving. Determining how many atoms of each element you need. Determining charges of ions produced and final formula.
  b) covalent compounds: determining correct Lewis Dot structures --correct # of valence electrons, all full octets (duets for H), no single electrons.
  c) Showing all significant partial charges/dipoles in covalent molecules. (EN values significant?)
- **Shapes of covalent molecules**
  a) VSEPR Theory-- definition: drawing 3D drawings, determining overall and specific shapes, refinement of theory due to lone pairs (lone pairs take up more room)
    - Hybridization Model: sp3, sp2, sp
    - Understand & explain the differences between sigma (σ) and pi (π) bonds
    - labeling the hybridization of atoms in a Lewis structure (what shape do the atoms have?)
    - what types of bonds make up a single, double or triple bond (sigma and/or pi bonds?)
    - labeling a drawing of a molecule which shows orbitals (label with sp, sp^2, sp^3 , p, s, and p bonds)
- **Reactivity—Reactivity of metals and non-metals (relating radius to reactivity): Reactivity Demo**