

**Course Intro**

1. Follow the safety rules listed on the Laboratory Safety Agreement
2. Locate the following lab safety equipment in room 108:
  - a. Fire extinguishers
  - b. Fire blanket
  - c. Eye wash fountain
  - d. Safety shower
  - e. Fume hood
  - f. First aid kit
  - g. Spill control powders
  - h. Broken glass container
3. Describe how to use each of the items listed above.
4. Describe what can happen to a person's eyes when exposed to corrosive substances.
5. Log on to WebAssign, open my assignments, and submit answers to the questions on the assignments.
6. Use Mr. Scott's website (<http://chemistrybyscott.org>) to locate the following:
  - Weekly schedule/assignment sheet
  - Cancellation/delay information
  - Topic pages
  - Segments of notes over each topic

**Atomic Theory**

1. Explain the origin of the term "atom"
2. Describe the opposing views of continuous matter versus the atomic concept
3. List 3 objectives of the ancient alchemists
4. Recognize the relationship between atomic emission spectroscopy and atomic elements
5. Trace the sequence of discovery of the electron, nucleus, proton and neutron
6. Identify the type of experiment leading to the discovery of the electron and name its discoverer.
7. Identify the type of experiment leading to the discovery of the nucleus and name its discoverer.
8. Trace the changes in atomic theory starting with Dalton and ending with the modern quantum mechanical model.
9. Describe the basic properties of alpha, beta, and gamma radiation.
10. Explain why some atomic nuclei are unstable
11. Predict the type of nuclear decay that will occur given the composition of protons and neutrons in the nucleus.
12. Balance a nuclear equation for both charge and mass.
13. Identify the source of energy in nuclear reactions.
14. Compare and contrast nuclear fusion and nuclear fission
15. Define isotope and identify a set of isotopes when given their mass numbers and atomic numbers.

16. Generalize how the relative abundance in nature of each element's isotopes lead to the value known as atomic mass.
17. Explain the basic components of the Bohr model of the atom
18. Cite two key ideas used by Bohr to support the existence of electron energy levels
19. Associate energy changes with the transitions of the electrons
20. Describe the general contribution of deBroglie, Heisenburg, and Schrodinger to the modern quantum mechanical model of the atom.
21. Define the terms photon and quantum as they relate to atomic theory.
22. List the four quantum numbers
23. State the role of each of the four quantum numbers in describing the electron structure of the atom.
24. Produce an Aufbau Diagram of the sequence of atomic orbitals by increasing energy
25. State Hund's Rule for electron configuration
26. Write an orbital notation, electron configuration, shorthand configuration, and dot notation given a specific number of electrons or the identity of the element.
27. Identify the orbital shapes of the s and p type atomic orbitals

### **Periodicity**

1. Describe the historic importance of Mendeleev's Periodic Table.
2. List two of the problems with Mendeleev's table.
3. Identify the key contribution of Henry Moseley to the modern periodic table
4. Identify groups and periods on the Periodic Table
5. Identify key sections of the periodic table including orbital blocks, metal vs. nonmetal, alkali metals, alkaline earth metals, halogens, noble gases, lanthanide series, actinide series, transition elements, inner-transition elements, and trans-uranic elements.
6. Identify the phase (solid, liquid, gas) of each element on the Periodic Table.
7. Explain the basic periodic trends of radius and ionization energy
8. Explain the concept of Shielding
9. Explain how an ion can have a net charge
10. Determine the charge of an ion given the number of protons and electrons
11. Identify the changes in atomic radius as electrons are gained or lost by atoms.
12. Define electron affinity and electronegativity

### **Bonding**

1. Differentiate between ionic and covalent bonding
2. Describe the key steps in the formation of an ionic bond and a covalent bond
3. Demonstrate the use of electronegativity in predicting bond type
4. Predict the type of bonding (ionic, polar covalent, non-polar covalent, metallic) given any combination of two elements
5. Describe the essential aspects of metallic bonding
6. Apply the Octet Rule to the behavior of atoms during bonding
7. Describe the general properties of ionic and molecular substances
8. Relate the general properties of salts and molecules to their bonding characteristics
9. Define the term molecule
10. List the primary types of intermolecular forces
11. Illustrate how dipole-dipole, hydrogen-bonding, and London Dispersion Forces work

12. Describe how intermolecular forces (IMFs) relate to the material phases of solid, liquid, and gas; and describe how the IMFs relate to mixtures of substances.
13. Interpret the relationship between melting point and boiling point and the types and strengths of the IMF's found in the substance
14. Generalize about the relationship of bond energy and bond length in covalent bonding.

### **Formulas & Nomenclature**

1. Correctly name a chemical compound when given a chemical formula from the following categories: binary & ternary ionic, binary & ternary acids, and binary non-organic molecules.
2. Correctly write the chemical formula when given the name of the chemical from the following categories: binary & ternary ionic, binary & ternary acids, and binary non-organic molecules.

### **Quantities**

1. Define molar mass
2. Know the value of 1 mole
3. Calculate molar mass for a compound given the name or formula of that compound
4. Apply significant figures to molar mass values
5. Convert from mass in grams to moles and the reverse (one step conversions).
6. Convert from mass in grams to number of atoms/molecules/ions and the reverse (two step conversions).
7. Demonstrate the conversion of the units in gram  $\rightarrow$  mole  $\rightarrow$  atom and atom  $\rightarrow$  mole  $\rightarrow$  gram calculations.
8. Calculate the % composition of a compound given either the chemical formula or the name
9. Calculate the empirical formula of a compound given either the % composition or the relative mass composition of the constituent elements.
10. Calculate the molecular formula of a compound given the empirical formula and the molecular mass.
11. Summarize how the gas variables of P, V, n, And T relate to each other in common situations such as the air in a car tire or the air in a hot air balloon.
12. Identify STP conditions including the units
13. State the standard molar volume of a gas at STP conditions.
14. Calculate the moles of gas particles contained given the gas volume at STP and the reverse.
15. Define the terms temperature and pressure in terms of gaseous matter.
16. Interpret the relative velocity of gas particles in two separate gas volumes given their molar mass and relative temperatures.
17. Explain how gas density is affected by changing either V or n at STP.
18. Calculate the density of a gas at STP given the molar mass of the gas
19. Calculate the molar mass of a gas at STP given the density of the gas.

## Chemical Reactions

1. Given a set of reactants, classify the reaction into the following categories:
  - Synthesis
  - decomposition
  - single replacement
  - double replacement
  - combustion.
2. Given the reactants as shown below, predict the products of the reaction.
  - ACID + HYDROXIDE BASE
  - ACID + SULFITE SALT
  - ACID + SULFIDE SALT
  - ACID + SALT
  - ACID + METAL CARBONATE
  - ACID + METAL
  - ACTIVE METAL + SALT
  - ACTIVE METAL + WATER
  - ACTIVE METAL OXIDE + WATER
  - BINARY COMPOUND HEATED OR ELECTROLYZED
  - COMPLETE COMBUSTION OF HYDROCARBON
  - HALOGEN + HALOGEN SALT
  - METAL + OXYGEN
  - METALCARBONATE heated
  - METAL CHLORATE heated
  - METAL ELEMENT + NONMETAL ELEMENT
  - METAL HYDROXIDE heated
  - METAL NITRATE heated
  - METAL OXIDE + HYDROGEN
  - NONMETAL ELEMENT + NONMETAL ELEMENT
  - OXYACID heated
  - TWO AQUEOUS SALTS mixed
  - WATER + NONMETAL OXIDE
3. Write a balanced chemical equation for any of the above types of reactions.
4. Write a balanced net ionic equation for a double replacement salt reaction.