Syllabus

Franklin County High School

General Chemistry I

Mrs. Clark

**Course Description:**

This course is designed to provide an opportunity to explore the fundamental principles of chemistry. Students will investigate the atom, the periodic table, bonding, chemical equations, chemical reactions, the mole, chemical stoichiometry, solutions, behavior of gases, thermochemistry, and nuclear chemistry. Fundamental concepts of chemistry will lead to laboratory investigations/demonstrations approximately 20% of the time.

**Course Objectives:**

Upon completion of this course, the student will be able to:

* Define the fundamental properties of matter
* Classify matter, compounds, and chemical reactions
* Determine the basic nuclear and electronic structure of atoms
* Recognize that some atomic nuclei are unstable and will break down emitting radiation
* Identify trends in chemical and physical properties of the elements using the periodic table
* Describe the bonding in and the shape of simple molecules and ions
* Solve stoichiometric problems
* Write chemical formulas
* Write and balance equations
* Use the rules of nomenclature to name chemical compounds
* Define the types and characteristics of chemical reactions
* Use the gas laws and basics of the Kinetic Molecular Theory to solve gas problems
* Determine factors that affect the solubility of a substance
* Determine the role of energy in physical changes and chemical reactions
* Convert units of measure and demonstrate dimensional analysis

**Learning Sequence:**

| **Topic** | **Standards** |
| --- | --- |
| **Lab Equipment/ Intro:**  This part of the course focuses on learning basic fundamentals of chemistry like significant figures and rounding values.  Students will learn how to identify and properly use common lab equipment.  **1 week** | Review and prepare |
| **Unit 1:**  *Atomic Structure/Models* - parts of atom, history of atom, isotopes, light absorption. electron configuration, the periodic table, periodic trends  **2 weeks** | 1.11) Develop and compare historical models of the atom (from Democritus to quantum model) and construct arguments to show how scientific knowledge evolves over time, based on experimental evidence, critique, and alternative interpretations.  4.1) Using a model, explain why elements emit and absorb characteristic frequencies of light and how this information is used.  1.12) Explain the origin and organization of the Periodic Table. Predict chemical and physical properties of main group elements (reactivity, number of subatomic particles, ion charge, ionization energy, atomic radius, and electronegativity) based on location on the periodic table. Construct an argument to describe how the quantum mechanical model of the atom (e.g., patterns of valence and inner electrons) defines periodic properties. Use the periodic table to draw Lewis dot structures and show understanding of orbital notations through drawing and interpreting graphical representations (i.e., arrows representing electrons in an orbital). |
| **Unit 2:**  *Electron Arrangement*- orbital notation, electron configuration, lewis dot diagrams  **2 weeks** | 1.12) Explain the origin and organization of the Periodic Table. Predict chemical and physical properties of main group elements (reactivity, number of subatomic particles, ion charge, ionization energy, atomic radius, and electronegativity) based on location on the periodic table. Construct an argument to describe how the quantum mechanical model of the atom (e.g., patterns of valence and inner electrons) defines periodic properties. Use the periodic table to draw Lewis dot structures and show understanding of orbital notations through drawing and interpreting graphical representations (i.e., arrows representing electrons in an orbital).  1.14) Use Lewis dot structures and electronegativity differences to predict the polarities of simple molecules (linear, bent, triangular, tetrahedral). Construct an argument to explain how electronegativity affects the shape of basic chemical molecules.  1.1) Understand and be prepared to use values specific to chemical processes: the mole, molar mass, molarity, and percent composition. |
| **Unit 3:**  *Periodic Table-* Classification of the elements, group names, periodic trends  **1 week** | 1.12) Explain the origin and organization of the Periodic Table. Predict chemical and physical properties of main group elements (reactivity, number of subatomic particles, ion charge, ionization energy, atomic radius, and electronegativity) based on location on the periodic table. Construct an argument to describe how the quantum mechanical model of the atom (e.g., patterns of valence and inner electrons) defines periodic properties. Use the periodic table to draw Lewis dot structures and show understanding of orbital notations through drawing and interpreting graphical representations (i.e., arrows representing electrons in an orbital). |
| **Unit 4:**  *Solutions* - classification of matter, molarity, colligative properties  *Chemical Bonding* - properties, writing and naming formulas for ionic and covalent compounds, Lewis structures  *Acids, Bases, and Salts* - write and name formulas for acids and bases, identify properties of acids and bases, indicators, neutralization reactions  **2 weeks** | 1.7) Analyze solutions to identify solutes and solvents, quantitatively analyze concentrations (molarity, percent composition, and ppm), and perform separation methods such as evaporation, distillation, and/or chromatography and show conceptual understanding of distillation. Construct an argument to justify the use of certain separation methods under different conditions.  1.1) Understand and be prepared to use values specific to chemical processes: the mole, molar mass, molarity, and percent composition.  1.15) Investigate, describe, and mathematically determine the effect of solute concentration on vapor pressure using the solute’s van ’t Hoff factor on freezing point depression and boiling point elevation.  2.2) Understand that intermolecular forces created by the unequal distribution of charge result in varying degrees of attraction between molecules. Compare and contrast the intermolecular forces (hydrogen bonding, dipole-dipole bonding, and London dispersion forces) within different types of simple substances (only those following the octet rule) and predict and explain their effect on chemical and physical properties of those substances using models or graphical representations.  2.3) Construct a model to explain the process by which solutes dissolve in solvents, and develop an argument to describe how intermolecular forces affect the solubility of different chemical compounds.  2.4) Conduct an investigation to determine how temperature, surface area, and stirring affect the rate of solubility. Construct an argument to explain the relationships observed in experimental data using collision theory.  1.13) Use the periodic table and electronegativity differences of elements to predict the types of bonds that are formed between atoms during chemical reactions and write the names of chemical compounds, including polyatomic ions using the IUPAC criteria.  2.1) Draw, identify, and contrast graphical representations of chemical bonds (ionic, covalent, and metallic) based on chemical formulas. Construct and communicate explanations to show that atoms combine by transferring or sharing electrons.  1.8) Identify acids and bases as a special class of compounds with a specific set of properties. |
| **Unit 5:**  *Chemical Equations/Reactions* - balancing equations, types of reactions, endothermic, exothermic  **2 weeks** | 1.2) Demonstrate that atoms, and therefore mass, are conserved during a chemical reaction by balancing chemical equations.  1.4) Use the reactants in a chemical reaction to predict the products and identify reaction classes (synthesis, decomposition, combustion, single replacement, double replacement).  3.3) Distinguish between endothermic and exothermic reactions by constructing potential energy diagrams and explain the differences between the two using chemical terms (e.g., activation energy). Recognize when energy is absorbed or given off depending on the bonds formed and bonds broken. |
| **Unit 6**  *Mole Conversions* - mole-gram, mole-particle, mole-liter  **2 weeks** | 1.3) Perform stoichiometric calculations involving the following relationships: mole-mole; mass-mass; mole-mass; mole-particle; and mass-particle. Show a qualitative understanding of the phenomenon of percent yield, limiting, and excess reagents in a chemical reaction through pictorial and conceptual examples. (states of matter liquid and solid; excluding volume of gasses) |
| **Unit 7**  *Stoichiometry*  **2 weeks** | 1.3) Perform stoichiometric calculations involving the following relationships: mole-mole; mass-mass; mole-mass; mole-particle; and mass-particle. Show a qualitative understanding of the phenomenon of percent yield, limiting, and excess reagents in a chemical reaction through pictorial and conceptual examples. (states of matter liquid and solid; excluding volume of gasses) |
| **Unit 8**  *Gas Laws* - V, P, T, n relationship, calculations  *Kinetic Molecular Theory* - *Heat* - heating curve, temperature changes, calculating heat  **2 weeks** | 1.5) Conduct investigations to explore and characterize the behavior of gases (pressure, volume, temperature), develop models to represent this behavior, and construct arguments to explain this behavior. Evaluate the relationship (qualitatively and quantitatively) at STP between pressure and volume (Boyle’s law), temperature and volume (Charles’s law), temperature and pressure (Gay-Lussac law), and moles and volume (Avogadro’s law), and evaluate and explain these relationships with respect to kinetic-molecular theory. Be able to understand, establish, and predict the relationships between volume, temperature, and pressure using combined gas law both qualitatively and quantitatively.  1.6) Use the ideal gas law, PV = nRT, to algebraically evaluate the relationship among the number of moles, volume, pressure, and temperature for ideal gases. |
| **Unit 9**  *Nuclear Chemistry* - half-life calculations, radiometric dating, nuclear decay calculations, radiation, radioactivity  **1 week** | 1.10) Compare alpha, beta, and gamma radiation in terms of mass, charge, and penetrating power. Identify examples of applications of different radiation types in everyday life (such as its applications in cancer treatment).  1.9) Draw models (qualitative models such as pictures or diagrams) to demonstrate understanding of radioactive stability and decay. Understand and differentiate between fission and fusion reactions. Use models (graphs or tables) to explain the concept of half-life and its use in determining the age of materials (such as radiometric dating). |
| **Unit 10**  *Thermochemistry* - interpret heating and cooling curves, understand phase changes, calculate enthalpy  **1 week** | 2.2) Understand that intermolecular forces created by the unequal distribution of charge result in varying degrees of attraction between molecules. Compare and contrast the intermolecular forces (hydrogen bonding, dipole-dipole bonding, and London dispersion forces) within different types of simple substances (only those following the octet rule) and predict and explain their effect on chemical and physical properties of those substances using models or graphical representations.  3.1) Contrast the concepts of temperature and heat flow in macroscopic and microscopic terms. Understand that heat is a form of energy and temperature is a measure of average kinetic energy of a molecule.  3.2) Draw and interpret heating and cooling curves and phase diagrams. Analyze the energy changes involved in calorimetry by using the law of conservation of energy quantitatively (use of q = mcΔT) and qualitatively.  3.4) Analyze energy changes to explain and defend the law of conservation of energy. |

**Textbook:**

This course is described as an open source course, meaning there is no textbook for this course. This course is supplemented by educational videos which are a better supplement than a textbook.

**Major Assignments:**

Comprehensive Final Exam

Lab Final

**Important Links:**

For grades and assignments: [www.fcstn.net](http://www.fcstn.net) (see Skyward at bottom of page)

To access teacher webpage: <http://fchs.fcstn.net> (tap “School Staff” in left column and select teacher’s name)

**Class Attendance:**

Chemistry is a comprehensive science and each day’s topic is built upon the previous day’s information. Because of this, it is imperative that you attend class on a regular basis. If you are absent, you can check Google classroom for any missing assignments. It is YOUR responsibility to complete and turn in your missing work. You will have as many days as you are absent to turn in your missed assignments. If you are absent on a test day and you had prior knowledge of the test, you are expected to make the test up when you return to school. Class time is not the best time for make-up work since we will be continuing in our learning experience so it is preferred that you stay after school for make-up tests. If you are aware of an upcoming absence, please let me know so we can work together on what you will need to do.

**Laboratory Information:**

Chemistry is a laboratory science. We will spend at least 20% of our time in a lab environment. You will be given a lab safety contract to read and sign along with your parent/guardian acknowledging you understand the lab safety rules. A copy can also be found on my webpage under the link “Syllabus and Handouts”. You are expected to read over all lab procedures and listen carefully to any added instructions before beginning ANY experiment. If you neglect to observe the lab safety rules, you will be removed from the lab and receive a zero for the lab that day. A lab final will be given at the end of the semester; therefore it is suggested you be in attendance for each lab. A LAB FEE of $20 is required to be paid by all students to cover the cost of equipment and chemicals. You may apply for a fee waiver that will cover your fees for you. Please see me for a fee waiver.