Franklin Public Schools

Chemistry
Grade 10, 11 or 12
Honors

This course is for the self-motivated student interested in pursuing a career in science and/or engineering. Content is presented at an advanced level and pace. This is a traditional mathematical approach and requires well-developed math skills. Students will experience greater success in the course if they are currently enrolled in Algebra II Honors. This course is essential preparation for enrollment in AP Chemistry.

1. Properties of Matter

Broad concept: Physical and chemical properties can be used to classify and describe matter.

1.1 Identify and explain some of the physical properties that are used to classify matter (e.g. density, melting point, and boiling point).
1.2 Explain the difference between mixtures and pure substances.
1.3 Describe the three states of matter in terms of energy, particle motion, and phase transitions.
1.4 Distinguish between chemical and physical changes.

2. Atomic Structure

Broad concept: An atom is a discrete unit. The atomic model can help us to understand the interaction of elements and compounds observed on a macroscopic scale.

2.1 Trace the development of the atomic theory and the structure of the atom from the Ancient Greeks to the present (Dalton, Thompson, Rutherford, Bohr, and modern theory)
2.2 Interpret Dalton's atomic theory in terms of the Laws of Conservation of Mass, Constant Composition, and Multiple Proportions.
2.3 Identify the major components of the nuclear atom (protons, neutrons and electrons) and explain how they interact.
2.4 Using Bohr's model of the atom interpret changes (emission/absorption) in electron energies in the hydrogen atom corresponding to the emission transitions between quantum levels.
2.5 Write the electron configurations for elements.
2.6 Differentiate among alpha, beta, and gamma radiation.
2.7 Compare fission and fusion.
2.8 Recognize that some elements spontaneously break down into new elements through the process of radioactive decay. Explain this process.
2.9 Explain the process of a half-life.

3. Periodicity

Broad concept: Periodicity of the physical and chemical properties relates to atomic structure and led to the development of the periodic table. The periodic table displays the elements in order of increasing atomic number.

3.1 Explain the relationship of an element's position on the periodic table to its atomic number and mass.
3.2 Use the periodic table to identify metals, nonmetals, metalloids, families (groups), periods, valence electrons, and reactivity with other elements in the table.
3.3 Relate the position of an element on the periodic table to its electron configuration.
3.4 Identify trends on the periodic table (ionization energy, electronegativity, electron affinity, and relative size of atoms and ions).

4. Chemical Bonding

Broad concept: Atoms form bonds by the interactions of their valence electrons.

4.1 Explain how atoms combine to form compounds through both the ionic and covalent bonding.
4.2 Draw Lewis dot structures for simple molecules.
4.3 Relate electronegativity and ionization energy to the type of bonding an element is likely to undergo.
4.4 Predict the shape of simple molecules and their polarity.
4.5 Identify the types of intermolecular forces present based on molecular geometry and polarity.
4.6 Predict chemical formulas based on the number of valence electrons.
4.7 Name and write the chemical formulas for simple ionic and molecular compounds, including those that contain common polyatomic ions.

5. Chemical reactions and Stoichiometry

Broad concept: The conservation of atoms in chemical reactions leads to the ability to calculate the mass of products and reactants.

5.1 Balance chemical equations by inspection.
5.2 Recognize synthesis, decomposition, single displacement, double displacement, and neutralization reactions.
5.3 Understand the mole concept in terms of number of particles, mass and gaseous volume.
5.4 Determine molar mass, percent compositions, empirical formulas, and molecular formulas.
5.5 Calculate mass-mass, mass-volume, volume-volume, and limiting reactant problems for chemical reactions.
5.6 Calculate percent yield in a chemical reaction.

6. Gases and Kinetic Molecular Theory

Broad concept: The behavior of gases can be explained by the Kinetic Molecular Theory.

6.1 Using the Kinetic Molecular Theory, explain the relationship between pressure, volume, temperature, and number of particles in a gas sample.
6.2 Explain the relationship between temperature and average kinetic energy.
6.3 Perform calculations using the ideal gas law.
6.4 Describe the conditions under which a real gas deviates from ideal behavior.
6.5 Use the combined gas law to determine changes in pressure, volume or temperature.

7. Solutions

Broad concept: Solids, liquids, and gases dissolve to form solutions.

7.1 Describe the process by which solutes dissolve into solvents.
7.2 Identify and explain the factors that affect the rate of dissolving.
7.3 Calculate concentration in terms of molarity, molality, and percent by mass.
7.4 Write net ionic equations for precipitation reactions in aqueous solutions.

8. Acids and Bases

Broad concept: Acids and bases are important in numerous chemical processes that occur around us, from industrial processes to biological ones, from the laboratory to the environment.

8.1 Recognize acids and bases in terms of the presence of hydronium and hydroxide ions and relate their concentrations to the pH scale.

9. Equilibrium and Kinetics

Broad concept: Chemical equilibrium is a dynamic process which is significant in many systems (biological, ecological, and geological). Chemical reactions occur at different rates.

9.1 Identify the factors that affect the rate of a chemical reaction and can cause a shift in equilibrium.

10. Thermochemistry (Enthalpy)

Broad concept: The driving forces of chemical reactions are energy and entropy. This has important implications for many applications (synthesis of new compounds, meteorology, and industrial engineering.

10.1 Analyze the energy changes involved in physical and chemical processes using calorimetry.

11. Oxidation-Reduction and Electrochemistry

Broad concept: Oxidation-reduction reactions occur by electron transfer and constitute a major class of chemical reactions. Examples of redox reactions occur everywhere; their consequences are experienced daily.

11.1 Describe the chemical processes known as oxidation and reduction.
11.2 Assign oxidation numbers.
11.3 Balance oxidation-reduction equations by using half-reactions.