



# STAFFORD COUNTY PUBLIC SCHOOLS

## Curriculum Overview Chemistry

### **Course Description:**

This course is designed to introduce the student to the basic theory of chemistry. Topics include formula balancing, dimensional analysis, reactions, electron theory, atomic theory, molar concept, gas laws, and basic organic chemistry. Lab work is an integral part of this course. If a science verified credit is needed, students can take the Standards of Learning test at the end of this course.

### **Essential Skills/Processes:**

The goals of the course are to educate the student in the material content of Chemistry, to increase science inquiry skills and logical thinking, and foster positive attitudes for further science study. There will be preparation for the Chemistry Standards of Learning Test.

- The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated produce observations and verifiable data
- The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure
- The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations
- The student will investigate and understand that quantities in a chemical reaction are based on molar relationships
- The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between

### **Essential Knowledge:**

Essential knowledge and skills is categorized into six strands.

### **Science as Process:**

- Designated laboratory techniques.
- Accurate recording, organizing, and analysis of data.
- Mathematical manipulations including SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, and dimensional analysis.
- Use of appropriate technology including computers, graphing calculators, and probeware for gathering data and communicating results.
- Multiple variables manipulated with repeated trials.
- Mathematical and procedural error analysis.
- Construction and defense of a scientific viewpoint.
- An emphasis on laboratory safety.

**Atomic Structure and Periodic Table:**

- Placement of elements on the periodic table as a function of their atomic structure including average atomic mass/ mass number, and atomic number.
- Isotopes, half-lives, and radioactive decay.
- Characteristics of subatomic particles as to mass and charge.
- Families/groups, series/periods, trends/patterns, and chemical and physical properties.
- Electron configurations, valence electrons, and oxidation numbers.
- Historical and quantum models.

**Conservation of Matter and Energy:**

- Conservation of matter and energy expressed in chemical formulas and balanced equations.
- Nomenclature, bonding types- ionic and covalent.
- Chemical formulas including molecular, structural, empirical, and Lewis diagrams.
- Balancing chemical equations.
- Physical and chemical equilibrium.
- Reaction types including synthesis, decomposition, single and double replacement, oxidation/reduction, neutralization, exothermic and endothermic, spontaneous/nonspontaneous, and dissociation/ionization.
- Reaction rates and kinetics including activation energy, catalysis, and degree of randomness.

**Mole Relationships:**

- Mole concept including conversions, Avogadro's principle, relative masses, and empirical formulas.
- Stoichiometric relationships including mass-mass, mass-volume, volume-volume, and limiting reactions.
- Per cent yield, limiting reactant.
- Chemical equilibrium
- Acid/base theory: strong electrolytes, weak electrolytes, and nonelectrolytes; dissociation and ionization.
- pH and pOH; the titration process.
- Solution concentration including molarity, molality, and dilution.
- Gas laws.

**Kinetic Molecular Theory:**

- Pressure, temperature, and volume, and vapor pressure.
- Phases of matter and phase changes.
- Colligative properties, freezing point depression and boiling point elevation.
- Energy changes including heat of fusion, heat of vaporization, and specific heat.
- Solutions including solubility, equilibrium, and the dissolving process.