

# Cumberland County Schools Curriculum Guide Chemistry



## High School Level

# CHEMISTRY

Science, by nature, is an inquiry-based discipline whereby students gain knowledge through observation and experimentation. Scientific investigations involve collection of relevant evidence, use of logical reasoning, application of imagination to devise hypotheses, and explanations to make sense of collected evidence. The process skills of scientific inquiry support development of reasoning and problem-solving ability and are the core of scientific methodologies.

The high school Chemistry curriculum encompasses the following three strands: Matter: Properties and Change; Energy: Conservation and Transfer; and Interactions of Matter and Energy. Students begin with an introduction to scientific measurement and the process of scientific inquiry. In the Matter: Properties and Change strand, students will study the structure of atoms and ions, bonding, and periodic trends to gain an understanding of the specific properties of matter and chemical properties change. In the Energy: Conservation and Transfer strand, students will be able to analyze chemical reactions in terms of product formation, energy, and relationships among pressure, volume, temperature, and phase. In the Interactions of Matter and Energy strand, a study of factors that affect the rate of chemical reactions and chemical equilibrium, solutions, and the solution process will help students understand the dynamics of how matter behaves. By the end of the year, students will have developed a depth of understanding of Chemistry that will prepare them for further study at the college level.

## Matter: Properties and Change

### Analyze the structure of atoms and ions.

1. Analyze the structure of atoms, isotopes, and ions.
2. Analyze an atom in terms of the location of electrons.
3. Explain the emission of electromagnetic radiation in spectral form in terms of the Bohr model.
4. Explain the process of radioactive decay by the use of nuclear equations and half-life.

### Understand the bonding that occurs in simple compounds in terms of bond type, strength, and properties.

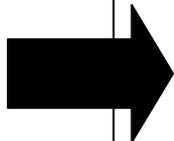
1. Compare (qualitatively) the relative strengths of ionic, covalent, and metallic bonds.
2. Infer the type of bond and chemical formula formed between atoms.
3. Compare inter- and intra-particle forces.
4. Interpret the name and formula of compounds using IUPAC convention.
5. Compare the properties of ionic, covalent, metallic, and network compounds.

### Understand the physical and chemical properties of atoms based on their position in the Periodic Table.

1. Classify the components of a periodic table (period, group, metal, metalloid, nonmetal, transition).
2. Infer the physical properties (atomic radius, metallic and nonmetallic characteristics) of an element based on its position in the Periodic Table.
3. Infer the atomic size, reactivity, electronegativity, and ionization energy of an element from its position in the Periodic Table.

## Energy: Conservation and Transfer

**Understand the relationship among pressure, temperature, volume, and phase.**



1. Explain the energetic nature of phase changes.

2. Explain heating and cooling curves (heat of fusion, heat of vaporization, heat, melting point, and boiling point).

3. Interpret the data presented in phase diagrams.

4. Infer simple calorimetric calculations based on the concepts of heat lost equals heat gained and specific heat.

5. Explain the relationships between pressure, temperature, volume, and quantity of gas both qualitative and quantitative.

**Analyze chemical reactions in terms of quantities, product formation, and energy.**



1. Explain the energy content of a chemical reaction.
2. Analyze the evidence of chemical change.
3. Analyze the Law of Conservation of Matter and how it applies to various types of chemical equations (synthesis, decomposition, single replacement, double replacement, and combustion).
4. Analyze the stoichiometric relationships inherent in a chemical reaction.
5. Analyze quantitatively the composition of a substance (empirical formula, molecular formula, percent composition, and hydrates).

## Interactions of Matter and Energy

**Understand the factors affecting rate of reaction and chemical equilibrium.**

1. Explain the factors that affect the rate of a reaction (temperature, concentration, particle size, and presence of a catalyst).
2. Explain the conditions of a system at equilibrium.
3. Infer the shift in equilibrium when a stress is applied to a chemical system (Le Chatelier's Principle).

**Understand solutions and the solution process.**

1. Classify substances using the hydronium and hydroxide ion concentrations.
2. Summarize the properties of acids and bases.
3. Infer the quantitative nature of a solution (molarity, dilution, and titration with a 1:1 molar ratio).
4. Summarize the properties of solutions.
5. Interpret solubility diagrams.
6. Explain the solution process.