NFC ACADEMY

COURSE OVERVIEW

Chemistry is intended to expose students to the designs and patterns in the world that God has created. In preceding years, students should have developed an understanding for the macroscopic properties of substances and been introduced to the microstructure of substances. This chemistry course will expand upon that knowledge, further develop the microstructure of substances, and teach the symbolic and mathematical world of formulas, equations, and symbols. The major concepts covered are measurement, atomic structure, chemical formulas and bonding, chemical reactions, stoichiometry, gases, chemical equilibrium, and organic chemistry.

Students at this level should show development in their ability and understanding of scientific inquiry. The units contain experiments and projects that seek to develop a deeper conceptual meaning for the student and actively engage the student. The continued exposure of science concepts and scientific inquiry will serve to improve the student's skill and understanding.

Chemistry should be preceded by an Algebra I course and preceded or accompanied by an Algebra II course.

OBJECTIVES

- **MEASUREMENT AND ANALYSIS:** Students will explore different types of laboratory measurements.

- **STARTING THE INVESTIGATION:** How to Identify Elements, Compounds, and Mixtures: Students will explore the chemical and physical properties of elements, compounds, and mixtures.
- **EXPLORING LAWS FOR GASES AND CONSERVATION OF MASS:** Students will explore the kinetic molecular theory, the gas laws and the conservation of mass.
- **THE DISCOVERY OF ATOMS:** Nature's Building Blocks: Students will describe the history and current atomic theory.
- **MOLECULAR STRUCTURE:** Students will explore stoichiometry, chemical bonding, and polar properties.
- **CHEMICAL REACTIONS, RATES AND EQUILIBRIUM:** Students will observe chemical changes, reaction rates, and factors that affect equilibrium.
- **EQUILIBRIUM SYSTEMS:** Students will explore solutions and equilibrium systems.
- **CARBON CHEMISTRY: HYDROCARBONS:** Students will describe organic compounds and saturated and unsaturated hydrocarbons.
- **CARBON CHEMISTRY: FUNCTIONAL GROUPS:** Students will explore and describe the functional groups in hydrocarbons.

CURRICULUM CONTENT & SKILL FOCUS

UNIT 1: MEASUREMENT AND ANALYSIS

- Convert between English and metric units utilizing dimensional analysis
- Do mathematical operations with numbers in scientific notation while maintaining significant figure rules
- Describe the relationship between mass, volume, and density
- Differentiate between hypotheses, theories, and laws
- Differentiate between graphs depicting direct and inverse relationships between variables
- Demonstrate an awareness of the many opportunities in the career fields relating to chemistry

UNIT 2: STARTING THE INVESTIGATION: HOW TO IDENTIFY ELEMENTS, COMPOUNDS, AND MIXTURES

- Differentiate between physical and chemical properties
- Use density measurements to help identify an unknown substance
- Distinguish between chemical and physical properties and changes in compounds
- Relate differences between colloids, suspensions, and solutions, and give examples of each

UNIT 3: EXPLORING LAWS FOR GASES AND CONSERVATION OF MASS

- Explain that the random motion of molecules causes the diffusion of gases
- Describe the relationship between average kinetic energy and particle temperature, mass, and speed.
- Solve problems using Boyle's Law
- Solve problems using Charles's Law
- Describe how Charles's Law and Boyle's Law were combined to form the Combined Gas Law
- Calculate the molecular or atomic mass and number of particles in a given mass of a substance and its chemical formula

UNIT 4: THE DISCOVERY OF ATOMS: NATURE'S BUILDING BLOCKS

- Discuss the history of the atomic theory
- Relate the position of an element in the periodic table to its atomic number and its atomic mass
- Compare and contrast two different atomic models
- Explain, based on properties of atoms, why periodic trends in ionization energy exist
- Realize that the release of energy in a nuclear reaction (fission or fusion) is much larger than in a chemical reaction

UNIT 5: MOLECULAR STRUCTURE

- Evaluate a balanced chemical reaction to determine the yield of a certain product given appropriate information (mass, number moles, number atoms) about the reactants

- Determine now a particular atom will gain stability by gaining or losing valence electrons to obtain the noble gas (octet) structure
- Determine ionic charges based on valence electron structure
- Define ionization energy and electronegativity and relate their trends on the periodic table
- Relate the difference between ionic, covalent, and metallic bonds based on atomic valence electron structure
- Determine if a compound is polar based on symmetry

UNIT 7: CHEMICAL REACTIONS, RATES AND EQUILIBRIUM

- Distinguish between exothermic and endothermic processes given appropriate information in the balanced equation
- Determine if a reaction is exothermic or endothermic based on its enthalpy of reaction
- Use the Gibbs free energy equation to determine if a reaction will be spontaneous
- Determine mole fraction, molarity, molality, and percent solute of a solution
- Determine from the value of an equilibrium constant, whether reactants or products are favored
- Apply LeChatelier's Principle in cases where equilibrium is stressed by concentration, temperature, pressure or volume

UNIT 8: EQUILIBRIUM SYSTEMS

- Solve problems concerning moles, gram formula weights, and balanced equations
- Calculate the concentration of the solute in terms of molarity
- List factors that influence the solubility of a solute in a solvent
- Understand that strong acids/bases fully dissociate while weak acids only partially dissociate
- Do calculations using the method of titration in determining the concentration of an unknown acid/base
- Determine the oxidized and reduced species and oxidizing and reducing agents in a reaction

UNIT 9: CARBON CHEMISTRY: HYDROCARBONS

- Relate the historical and modern meaning of "organic compound"
- Describe the valence structure of carbon and how this influences it's tendency to enter into covalent bonds
- Determine if a bond is likely to be ionic or covalent based on electronegativity differences or valence electron structure
- Explain that saturated hydrocarbons have all carbons bonded to 4 other atoms
- Relate that alkanes are chemically fairly unreactive
- Explain that unsaturated hydrocarbons are very reactive with the major reaction being an addition process which occurs at the site of the double or triple bond

UNIT 10: CARBON CHEMISTRY: FUNCTIONAL GROUPS

- Relate that substitution by halides is the most common reaction of saturated hydrocarbons other than combustion
- Recognize the hydroxyl functional group and explain the basic process by which alcohols are manufactured
- State the functional groups contained in aldehydes, carboxylic acids, ketones, and esters
- State that the functional group of amides and explain that amides provide the structural link in proteins
- Explain that proteins are made by the polymerization of amino acids

ADDITIONAL RESOURCES

All of the activities in this course can be completed with online resources. All labs in Chemistry are completed online with our virtual lab partner. Chemistry also includes extra alternate assignments, experiment/projects and tests for use in enhancing instruction or addressing individual needs based upon the instructor's decision.

GRADING INFORMATION

GRADING COMPONENTS

Lessons	35%	
Quizzes	25%	
Projects	10%	*(includes science labs)*
Tests	30%	

GRADING SCALE

100-90	A
89-80	B
79-70	C
69-60	D
Below 60	F