SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: Organic Chemistry	**Length of Course:** Half Year
Grade Level(s): 11 - 12	**Periods Per Cycle:** 6
Units of Credit: .5	**Length of Period:** 40 Minutes
Classification: Elective	**Total Instructional Time:** 60 Hours

Course Description

This introductory course in organic chemistry is meant to supplement the chemistry knowledge of students who will take organic chemistry in college. It will be particularly valuable to students who plan for careers in the health sciences. This course will introduce skills and concepts that will establish a foundation to understand advanced content in college organic chemistry. Course topics will include chemical bonding of the carbon atom, acid base behavior, nomenclature, structure, properties, and reactions of organic molecules. Labs will be an integral part of this course. Prerequisite: Successful completion of Biology or Honors Biology and Chemistry or Honors Chemistry is required.

Instructional Strategies, Learning Practices, Activities, and Experiences

- Inquiry Based Wet or Dry Lab Activities
- Direct Instruction
- Guided Notes from Instructional Videos, Readings, or PowerPoints
- Remedial Videos, Examples, and Practice
- Analogies
- Summarization
- Problem Solving
- Guided Practice
- Homework Assignments
- Graphic Organizers
- Cooperative Learning Activities
- Discovery Learning Activities
- Teacher Demonstration
- Models and Manipulatives
- Review Games

Assessments

Formative Assessments: Student Created Summaries, Homework Problems, Teacher Questioning, Post Lab Questions, Lesson/Topic Quizzes
Summative Assessments: Written Unit Exams, Lab Reports, Project Reports, Final Exam (Or Midterm/Final Exam Combo).

Materials/Resources

Teacher Constructed Handouts, Chemistry Laboratory Equipment and Chemicals (determined by staff as needed), Safety Equipment, Technology Equipment and Software

Adopted: 5/15/17
Revised: 5/22/23

Unit 1: Chemical Bonding of Carbon	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Review of Chemical Bonding • Lewis Structures • Resonance • Molecular Shape • Polarity • Hybridization • Intermolecular Forces Melting Point Determination	Objectives 1) I can draw Lewis structures for organic molecules. 2) I can predict the molecular shape, bond angles, polarity, and hybridization of organic molecules. 3) I can predict the strength of intermolecular forces based on the shape and polarity of organic molecules. 4) I can relate the intermolecular forces in organic molecules to physical properties such as melting point, boiling point, and solubility. 5) I can apply basic techniques used in the organic chemistry lab for identification of organic compounds. Standards MS-PS1-1 Matter and its Interactions: Develop models to describe the atomic composition of simple molecules and extended structures. HS-PS1-1 Matter and its Interactions: Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. HS-PS1-3 Matter and its Interactions: Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

Unit 2: Acids and Bases	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Acid Base Chemistry • Bronsted Acid/Base Reactions • Conjugate Pairs • Relative Strength • pH Scale • Lewis Acid/Base Reactions	Objectives 1) I can define and identify acids, bases, conjugate acids, conjugate bases in a given reaction. 2) I can mathematically calculate the potential of hydrogen (pH) and acid dissociation constant (pKa) of an acid solution. Relate the pKa and the pH to the strength of the acid solution. 3) I can qualitatively predict the products of an organic acid base reaction. 4) I can define Lewis acid and Lewis base and compare it to the traditional definitions of acid and base. Standards HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS2-6 Motion and Stability: Forces and Interactions: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Unit 3: Organic Chemistry Notation	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Drawing Organic Structures • Line Bond Structures • Condensed Structures • Skeletal Structures • Perspective Drawings • Molecular Models	Objectives 1) I can use line bond structures, condensed notation, skeletal structures, and perspective drawings to depict the structure of an organic compound. 2) I can use 3-D molecular modeling to depict the structure of organic compounds. Standards MS-PS1-1 Matter and its Interactions: Develop models to describe the atomic composition of simple molecules and extended structures. HS-PS2-6 Motion and Stability: Forces and Interactions: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Unit 4: Alkanes	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Alkanes • Nomenclature • Properties • Conformations • Structural Isomers • Chirality • Reactions • Mechanisms • Petroleum • Boiling Point Determination	Objectives 1) I can apply the IUPAC (International Union of Pure and Applied Chemistry) rules to systematically name alkane structures. 2) I can relate eclipsed and staggered conformations to the free rotation of carbon atoms about the nuclear axis in an alkane. 3) I can describe how structure influences boiling point, melting point, solubility, and chemical reactivity. 4) I can use curly arrow type notation to depict substitution reaction mechanisms. 5) I can describe the composition of petroleum products and methods of petroleum refining. 6) I can determine the boiling point of an organic substance. Standards HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS2-6 Motion and Stability: Forces and Interactions: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. HS-LS2-7 Ecosystems: Interactions, Energy, Dynamics: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Unit 5: Alkenes, Alkynes, Polyenes	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Alkenes, Alkynes, and Polyenes • Geometric Isomers • Nomenclature • Properties • Reactions • Mechanisms • Formation of an Alkene by Dehydration of Secondary Alcohols	Objectives 1) I can apply the International Union of Pure and Applied Chemistry (IUPAC) rules to systematically name alkene, alkyne, and polyene structures. 2) I can describe how the structure of an alkene, alkyne, or polyene influences boiling point, melting point, solubility, and chemical reactivity. 3) I can relate the existence of geometric isomers to the rigid, planar structure of the sp2 hybridized carbon atom. 4) I can predict the products of addition reactions of alkene, alkynes, and polyenes. 5) I can use curly arrow notation to depict reaction mechanisms for alkene reactions. 6) I can synthesize an alkene in the lab by dehydration of a secondary alcohol. Standards HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS2-6 Motion and Stability: Forces and Interactions: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Unit 6: Functional Groups	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Functional Groups • Alcohols • Aldehydes • Carboxylic Acids • Ketones • Esters • Amides • Amines • Nomenclature • Properties • Reactions • Saponification Reaction – Making Soap • Formation of an Ester	Objectives 1) I can apply IUPAC rules to systematically name functional group containing structures. 2) I can describe how the structure of a functional group influences boiling point, melting point, solubility, and chemical reactivity. 3) I can predict the products of reactions containing functional groups. 4) I can synthesize and ester by dehydration of a carboxylic acid and an alcohol. Standards HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS2-6 Motion and Stability: Forces and Interactions: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Unit 7: Aromatic Compounds	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Aromatic Compounds • Nomenclature • Properties • Reactions • Mechanisms	Objectives 1) I can apply the IUPAC rules to systematically name aromatic structures. 2) I can describe how the structure of aromatic compounds influences boiling point, melting point, solubility, and chemical reactivity. 3) I can use curly arrow type notation to depict the reaction mechanism for electrophilic aromatic substitution reactions. 4) I can isolate an aromatic aldehyde from a common substance. Standards HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS2-6 Motion and Stability: Forces and Interactions: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

Unit 8: Polymers	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Polymers • Addition Polymers • Condensation Polymers • Elastomers • Recycling • Formation of a Polymer	Objectives 1) I can apply the IUPAC rules to systematically name polymers. 2) I can describe how the structure of a polymer influences boiling point, melting point, solubility, and chemical reactivity. 3) I can describe the structure of an elastomer and relate its elastic property to its structure. 4) I can investigate the uses of various polymers, and relate these uses to the structural properties of the polymer. 5) I can identify polymers associated with recycled plastic resin codes. 6) I can conduct an addition polymerization to form a polymer. Standards HS-PS1-2 Matter and its Interactions: Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. HS-PS2-6 Motion and Stability: Forces and Interactions: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. HS-LS2-7 Ecosystems: Interactions, Energy, Dynamics: Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Unit 9: Biomacromolecules	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
Biomolecules • Lipids • Carbohydrates • Amino Acids and Proteins • Nucleic Acids • Hydrolysis of Starch	Objectives 1) I can identify the functional groups within each type of biomolecule. 2) I can relate the structure of the molecule to its function. Standards MS-PS1-1 Matter and its Interactions: Develop models to describe the atomic composition of simple molecules and extended structures. HS-LS1-6 From Molecules to Organisms: Structures and Processes: Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.