# SPRING GROVE AREA SCHOOL DISTRICT

*PLANNED COURSE OVERVIEW*

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| **Course Title:** Organic Chemistry 1 | **Length of Course:** 15 cycles |
| **Grade Level(s):** 11-12 | **Periods Per Cycle:** 6 |
| **Units of Credit:** .5 | **Length of Period:** 43 minutes |
| **Classification:** Elective | **Total Instructional Time:** 64.5 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, and nomenclature, structure, properties, and reactions of organic molecules. Labs will be an integral part of this course.

## *Instructional Strategies, Learning Practices, Activities, and Experiences*

Bell Ringers
Objectives
Agenda
Direct Instruction
Class Notes
Online Tutorials/ Videos
Teacher Demonstration
Guided Practice
Laboratory Experiments
Homework Practice
Hybrid Learning Model
Exit Tickets
Flexible Grouping
Research Articles

## *Assessments*

Paper Pencil Tests
Homework Quizzes
Lab Reports
Journal Article Critiques
Online Graded Homework

## *Materials/Resources*

Teacher Made Notes
Teacher Made Instructional Videos
Online Resources
PowerPoint Lectures
Note Packets
Laboratory Resources and Equipment
Laboratory Experiments
iPads and Apps

**Adopted:** 5/15/2017
**Revised:**

| Chemical Bonding of the Carbon Atom | |
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| CONTENT/KEY CONCEPTS | OBJECTIVES/STANDARDS |
| Review of Chemical Bonding<br>• Lewis Structures<br>• Resonance<br>• Molecular Shape<br>• Polarity<br>• Hybridization<br>• Intermolecular Forces<br>• Melting Point Determination | Objectives<br>Draw Lewis structures for organic molecules.<br>Predict the molecular shape, bond angles, polarity, and hybridization of organic molecules.<br>Predict the strength of intermolecular forces based on the shape and polarity of organic molecules.<br>Relate the intermolecular forces in organic molecules to physical properties such as melting point, boiling point, and solubility.<br>Learn and apply basic techniques used in the organic chemistry lab for identification of organic compounds.<br><br>PA Science Standards<br>3.2.10.A2<br>Compare and contrast different bond types that result in the formation of molecules and compounds.<br>Explain why compounds are composed of integer ratios of elements.<br><br>3.2.12.A5<br>Use valence shell electron pair repulsion (VSEPR) theory to predict the molecular geometry of simple molecules.<br><br>3.2.C.A1<br>Differentiate between physical properties and chemical properties.<br>Differentiate between pure substances and mixtures; differentiate between heterogeneous and homogeneous mixtures.<br>Use electronegativity to explain the difference between polar and nonpolar covalent bonds.<br><br>3.1.C.A9<br>Compare and contrast scientific theories.<br>Know that both direct and indirect observations are used by scientists to study the natural world and universe.<br>Identify questions and concepts that guide scientific investigations.<br>Formulate and revise explanations and models using logic and evidence.<br>Recognize and analyze alternative explanations and models.<br>Explain the importance of accuracy and precision in making valid measurements.<br>Examine the status of existing theories.<br>Evaluate experimental information for relevance and adherence to science processes.<br>Judge that conclusions are consistent and logical with experimental conditions.<br>Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution.<br>Communicate and defend a scientific argument. |

| Acids and Bases | |
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| CONTENT/KEY CONCEPTS | OBJECTIVES/STANDARDS |
| Acid Base Chemistry<br>• Bronsted Acid/Base Reactions<br>• Conjugate Pairs<br>• Relative Strength<br>• pH Scale<br>• Lewis Acid/Base Reactions<br>• Isolation of Chlorophyll and Thin Layer<br>• Chromatography Lab | Objectives<br>Define and identify acids, bases, conjugate acids, conjugate bases in a given reaction.<br>Mathematically calculate the potential of hydrogen (pH) and acid dissociation constant (pKa) of an acid solution.<br>Relate the pKa and the pH to the strength of the acid solution.<br>Qualitatively predict the products of an organic acid base reaction.<br>Define Lewis acid and Lewis base and compare it to the traditional definitions of acid and base.<br><br>Standards<br>3.2.C.A4<br>Predict how combinations of substances can result in physical and/or chemical changes.<br><br>3.1.C.A9<br>Compare and contrast scientific theories.<br>Know that both direct and indirect observations are used by scientists to study the natural world and universe.<br>Identify questions and concepts that guide scientific investigations.<br>Formulate and revise explanations and models using logic and evidence.<br>Recognize and analyze alternative explanations and models.<br>Explain the importance of accuracy and precision in making valid measurements.<br>Examine the status of existing theories.<br>Evaluate experimental information for relevance and adherence to science processes.<br>Judge that conclusions are consistent and logical with experimental conditions.<br>Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution.<br>Communicate and defend a scientific argument. |

| Organic Chemistry Notation | |
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| CONTENT/KEY CONCEPTS | OBJECTIVES/STANDARDS |
| Drawing Organic Structures<br>• Line Bond Structures<br>• Condensed Structures<br>• Skeletal Structures<br>• Perspective Drawings<br>• Molecular Models | Objectives<br>Use line bond structures, condensed notation, skeletal structures, and perspective drawings to depict the structure of an organic compound.<br>Use 3-D molecular modeling to depict the structure of organic compounds.<br><br>Standards<br>3.2.12.A5<br>Use VSEPR theory to predict the molecular geometry of simple molecules.<br><br>3.1.C.A9<br>Compare and contrast scientific theories.<br>Know that both direct and indirect observations are used by scientists to study the natural world and universe.<br>Identify questions and concepts that guide scientific investigations.<br>Formulate and revise explanations and models using logic and evidence.<br>Recognize and analyze alternative explanations and models.<br>Explain the importance of accuracy and precision in making valid measurements.<br>Examine the status of existing theories.<br>Evaluate experimental information for relevance and adherence to science processes.<br>Judge that conclusions are consistent and logical with experimental conditions.<br>Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution.<br>Communicate and defend a scientific argument. |

| Alkanes | |
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| CONTENT/KEY CONCEPTS | OBJECTIVES/STANDARDS |
| Alkanes<br>• Nomenclature<br>• Properties<br>• Conformations<br>• Structural Isomers<br>• Chirality<br>• Reactions<br>• Mechanisms<br>• Petroleum<br>• Boiling Point Determination | Objectives<br>Apply the IUPAC (International Union of Pure and Applied Chemistry) rules to systematically name alkane structures.<br>Relate eclipsed and staggered conformations to the free rotation of carbon atoms about the nuclear axis in an alkane.<br>Describe how structure influences boiling point, melting point, solubility, and chemical reactivity.<br>Use curly arrow type notation to depict substitution reaction mechanisms.<br>Study the composition of petroleum products and methods of petroleum refining.<br>Determine the boiling point of an organic substance.<br><br>Standards<br>3.2.12.A5<br>Use VSEPR theory to predict the molecular geometry of simple molecules.<br><br>3.2.C.A4<br>Predict how combinations of substances can result in physical and/or chemical changes.<br><br>3.1.C.A9<br>Compare and contrast scientific theories.<br>Know that both direct and indirect observations are used by scientists to study the natural world and universe.<br>Identify questions and concepts that guide scientific investigations.<br>Formulate and revise explanations and models using logic and evidence.<br>Recognize and analyze alternative explanations and models.<br>Explain the importance of accuracy and precision in making valid measurements.<br>Examine the status of existing theories.<br>Evaluate experimental information for relevance and adherence to science processes.<br>Judge that conclusions are consistent and logical with experimental conditions.<br>Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution.<br>Communicate and defend a scientific argument. |

| Alkenes, Alkynes, Polyenes | |
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| CONTENT/KEY CONCEPTS | OBJECTIVES/STANDARDS |
| Alkenes, Alkynes, and Polyenes<br>• Geometric Isomers<br>• Nomenclature<br>• Properties<br>• Reactions<br>• Mechanisms<br>• Formation of an Alkene by Dehydration of Secondary Alcohols | Objectives<br>Apply the International Union of Pure and Applied Chemistry (IUPAC) rules to systematically name alkene, alkyne, and polyene structures.<br>Describe how the structure of an alkene, alkyne, or polyene influences boiling point, melting point, solubility, and chemical reactivity.<br>Relate the existence of geometric isomers to the rigid, planar structure of the $sp^2$ hybridized carbon atom.<br>Predict the products of addition reactions of alkene, alkynes, and polyenes.<br>Use curly arrow notation to depict reaction mechanisms for alkene reactions.<br>Synthesize an alkene in the lab by dehydration of a secondary alcohol.<br><br>Standards<br>3.2.12.A5<br>Use VSEPR theory to predict the molecular geometry of simple molecules.<br><br>3.2.C.A4<br>Predict how combinations of substances can result in physical and/or chemical changes.<br><br>3.1.C.A9<br>Compare and contrast scientific theories.<br>Know that both direct and indirect observations are used by scientists to study the natural world and universe.<br>Identify questions and concepts that guide scientific investigations.<br>Formulate and revise explanations and models using logic and evidence.<br>Recognize and analyze alternative explanations and models.<br>Explain the importance of accuracy and precision in making valid measurements.<br>Examine the status of existing theories.<br>Evaluate experimental information for relevance and adherence to science processes.<br>Judge that conclusions are consistent and logical with experimental conditions.<br>Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution.<br>Communicate and defend a scientific argument. |

| Functional Groups | |
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| CONTENT/KEY CONCEPTS | OBJECTIVES/STANDARDS |
| Functional Groups<br>• Alcohols<br>• Aldehydes<br>• Carboxylic Acids<br>• Ketones<br>• Esters<br>• Amides<br>• Amines<br>• Nomenclature<br>• Properties<br>• Reactions<br>• Saponification Reaction – Making Soap<br>• Formation of an Ester | Objectives<br>Apply IUPAC rules to systematically name functional group containing structures.<br>Describe how the structure of a functional group influences boiling point, melting point, solubility, and chemical reactivity.<br>Predict the products of reactions containing functional groups.<br>Determine the boiling point of an organic substance.<br>Synthesize and ester by dehydration of a carboxylic acid and an alcohol.<br><br>Standards<br>3.2.C.A4<br>Predict how combinations of substances can result in physical and/or chemical changes.<br><br>3.1.C.A9<br>Compare and contrast scientific theories.<br>Know that both direct and indirect observations are used by scientists to study the natural world and universe.<br>Identify questions and concepts that guide scientific investigations.<br>Formulate and revise explanations and models using logic and evidence.<br>Recognize and analyze alternative explanations and models.<br>Explain the importance of accuracy and precision in making valid measurements.<br>Examine the status of existing theories.<br>Evaluate experimental information for relevance and adherence to science processes.<br>Judge that conclusions are consistent and logical with experimental conditions.<br>Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution.<br>Communicate and defend a scientific argument. |

| Aromatic Compounds | |
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| CONTENT/KEY CONCEPTS | OBJECTIVES/STANDARDS |
| Aromatic Compounds<br>• Nomenclature<br>• Properties<br>• Reactions<br>• Mechanisms<br>• Isolation of Cinnamaldehyde from Cinnamon Sticks | Objectives<br>Apply the IUPAC rules to systematically name aromatic structures.<br>Describe how the structure influences boiling point, melting point, solubility, and chemical reactivity.<br>Use curly arrow type notation to depict the reaction mechanism for electrophilic aromatic substitution reactions.<br>Isolate an aromatic aldehyde from a common substance.<br><br>Standards<br>3.2.C.A4<br>Predict how combinations of substances can result in physical and/or chemical changes.<br><br>3.1.C.A9<br>Compare and contrast scientific theories.<br>Know that both direct and indirect observations are used by scientists to study the natural world and universe.<br>Identify questions and concepts that guide scientific investigations.<br>Formulate and revise explanations and models using logic and evidence.<br>Recognize and analyze alternative explanations and models.<br>Explain the importance of accuracy and precision in making valid measurements.<br>Examine the status of existing theories.<br>Evaluate experimental information for relevance and adherence to science processes.<br>Judge that conclusions are consistent and logical with experimental conditions.<br>Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution.<br>Communicate and defend a scientific argument. |

| Polymers | |
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| CONTENT/KEY CONCEPTS | OBJECTIVES/STANDARDS |
| Polymers<br>• Addition Polymers<br>• Condensation Polymers<br>• Elastomers<br>• Recycling<br>• Forensic Lab<br>• Formation of a Polymer | Objectives<br>Apply the IUPAC rules to systematically name polymers.<br>Describe how the structure of a polymer influences boiling point, melting point, solubility, and chemical reactivity.<br>Describe the structure of an elastomer and relate its elastic property to its structure.<br>Investigate the uses of various polymers, and relate these uses to the structural properties of the polymer.<br>Identify polymers associated with recycled plastic resin codes.<br>Use plastics evidence to solve a forensic crime scene.<br>Conduct an addition polymerization to form a polymer<br><br>Standards<br>3.2.C.A4<br>Predict how combinations of substances can result in physical and/or chemical changes.<br><br>3.1.C.A9<br>Compare and contrast scientific theories.<br>Know that both direct and indirect observations are used by scientists to study the natural world and universe.<br>Identify questions and concepts that guide scientific investigations.<br>Formulate and revise explanations and models using logic and evidence.<br>Recognize and analyze alternative explanations and models.<br>Explain the importance of accuracy and precision in making valid measurements.<br>Examine the status of existing theories.<br>Evaluate experimental information for relevance and adherence to science processes.<br>Judge that conclusions are consistent and logical with experimental conditions.<br>Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution.<br>Communicate and defend a scientific argument. |

| Biomacromolecules | |
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| CONTENT/KEY CONCEPTS | OBJECTIVES/STANDARDS |
| Biomolecules<br>• Lipids<br>• Carbohydrates<br>• Amino Acids and Proteins<br>• Nucleic Acids<br>• Hydrolysis of Starch | Objectives<br>Identify the functional groups within each type of biomolecule.<br>Relate the structure of the molecule to its function.<br><br>Standards<br>3.1.C.A7<br>Illustrate the formation of carbohydrates, lipids, proteins, and nucleic acids.<br><br>3.1.10.B5<br>Use models to demonstrate patterns in bio macromolecules.<br><br>3.1.C.A9<br>Compare and contrast scientific theories.<br>Know that both direct and indirect observations are used by scientists to study the natural world and universe.<br>Identify questions and concepts that guide scientific investigations.<br>Formulate and revise explanations and models using logic and evidence.<br>Recognize and analyze alternative explanations and models.<br>Explain the importance of accuracy and precision in making valid measurements.<br>Examine the status of existing theories.<br>Evaluate experimental information for relevance and adherence to science processes.<br>Judge that conclusions are consistent and logical with experimental conditions.<br>Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution.<br>Communicate and defend a scientific argument. |