Organic Chemistry

Curriculum/Content Area: Science	**Course Length:** 2 Terms
Course Title: Organic Chemistry	**Date last reviewed:** December 2024
Prerequisites: Regular or Honors Chemistry	**Board approval date:** May 2018
Primary Resource: *Organic Chemistry John McMurry 5th Edition* **Secondary Resource:** *UW Madison Organic Chemistry 343, UW Milwaukee Organic Chemistry 343, course/content progression*	

Desired Results

Course description and purpose: Organic Chemistry is a comprehensive introduction to the chemistry of carbon and its importance to biological molecules. Students will work to develop skills and understanding of current ideas of bonding and structure, major reaction mechanisms and pathways, and the analytical tool Hydrogen Nuclear Magnetic Resonance (HNMR) to determine the structure and stereochemistry of organic compounds. This course will prepare students for entrance to College Level Organic Chemistry.

Enduring Understandings:	**Essential Questions**:
1. **Patterns:** Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. 2. **Cause and Effect:** Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. 3. **Scale, Proportion, and Quantity:** In considering phenomena, it is critical to recognize what is relevant at different	1. How can hydrocarbons be classified and named using IUPAC rules. 2. How can the rules of stereochemistry be use to name and predict bonding structure and compounds' stability? 3. How can organic reaction mechanisms be created given the different possible reactants? 4. How can reading a HNMR spectra identify and propose a given compound structure? (Extension)

size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. 4. **Systems and System Models:** A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. 5. **Energy and Matter:** Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior. 6. **Structure and Function:** The way an object is shaped or structured determines many of its properties and functions. 7. **Stability and Change:** For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.	

Assessment Evidence:	
Performance Assessment Options *May include, but are not limited to the following:* ● Dry Labs ● Online Simulations	**Other assessment options** *May include, but are not limited to the following:* ● Unit problem sets ● Unit Summaries ● Unit assessments

Priority Standards
1. Make observations, collect, organize and analyze data in a safe and effective manner 2. Distinguish between various covalent bonds and their consequences 3. Acknowledge the variety of patterns in organic compounds, functional groups and

reactants, e.g. nomenclature, reaction synthesis and elimination mechanisms
4. Relate the structure of organic compounds to their unique physical and chemical properties
5. Utilize knowledge of qualitative relationships among chemicals in a chemical reaction

Unit 1: Structure and Bonding

Essential Questions:

1. How can hydrocarbons be classified and named using IUPAC rules?
2. How can the rules of stereochemistry be use to name and predict bonding structure and compounds' stability?

Standards:

Science and Engineering Practices

1. Developing and Using Models
2. Using Mathematics and Computational Thinking
3. Constructing Explanations and Designing Solutions
4. Engaging in Argument from Evidence

Cross Cutting Concepts

1. Patterns
2. System and System Models
3. Structure and Function
4. Stability and Change

Learning Targets:

1. I can identify the functional groups and draw molecules containing such functional groups
2. I can draw isomers of a given molecular compound I can name and draw alkanes and alkyl groups
3. I can identify carbons and hydrogens as being primary, secondary or tertiary
4. I can draw Newman projections of bond conformations and predict their stabilities
5. I can draw and name substituted cyclohexanes, indicating cis and trans
6. I can predict the stability of substituted cyclohexanes by estimating steric strain
7. I can locate Chirality centers, assign priorities to substituents, and assign S & R designations to the chiral centers
8. Given an stereoisomer, I can draw its enantiomer and diastereomer
9. I can manipulate a Fischer projection to see if they are identical

Digital Tools & Supplementary Resources:
Molecular Visions: Darling Molecular Models Kit

Unit 2: Organic Compounds: Alkanes and Cycloalkanes
Essential Question: 1. How can hydrocarbons be classified and named using IUPAC rules? 2. How can the rules of stereochemistry be use to name and predict bonding structure and compounds' stability?
Standards:
Science and Engineering Practices 1. Developing and Using Models 2. Using Mathematics and Computational Thinking 3. Constructing Explanations and Designing Solutions 4. Engaging in Argument from Evidence **Cross Cutting Concepts** 1. Patterns 2. System and System Models 3. Structure and Function 4. Stability and Change
Learning Targets:
1. I can determine the number of protons, neutrons, and electrons, atomic number, mass number, and identify whether it is an atom/ion/isotope 2. I can explain how the distribution of electrons in an atom can be described based on the four different kinds of orbitals and how the electrons are organized into shells 3. I can explain the Chemical Bond Theory and the Valence Bonding Theories in relation to stability 4. I can represent molecules in Lewis Structure and Line bond structures 5. I can predict and describe each elements hybridization in any compound 6. I can use electronegativity to calculate the bond type 7. I can identify whether a molecule has a dipole moment and can explain what determines the dipole moment in a molecule 8. I can calculate formal charge for atoms in a compound 9. I can identify any structure that can resonate and draw all possible structures

Digital Tools & Supplementary Resources:

Unit 3: An Overview of Organic Reactions and Alkynes
Essential Questions: 1. How can hydrocarbons be classified and named using IUPAC rules? 2. How can the rules of stereochemistry be use to name and predict bonding structure and compounds' stability?
Standards:
Science and Engineering Practices 1. Developing and Using Models 2. Constructing Explanations and Designing Solutions 3. Engaging in Argument from Evidence **Cross Cutting Concepts** 1. Patterns 2. System and System Models 3. Structure and Function 4. Energy and Matter 5. Stability and Change
Learning Targets:
1. I can identify the different kinds of Organic Reactions 2. I can recreate a reaction Mechanisms for radical and polar reactions 3. I can label an Exergonic and Endergonic Energy Diagrams: transition states and intermediates 4. Given a recant starting point and the products, I can know when to use the acid or a base to prepare the needed alkene. 5. I can create Addition reactions of alkenes using (Halogens, Halohydrin formation, Hydration, Oxymercuration, Hydroboration, Carbenes) 6. I can create the mechanisms for Reduction and oxidation of alkenes 7. Given an Alkyne structure I can name it, or given the name I can create an Alkyne structure 8. I can predict which reactants to use to prepare an Alkyne based on the reactant starting point. 9. I can create the reaction mechanisms for Reactions of Alkynes (HX, X-X, Hg(II) , Hydroboration/oxidation, reduction, Li and NH3, Oxidative cleavage 10. Given a starting point and an product end point, I can Organic synthesis

Digital Tools & Supplementary Resources:

Unit 4: (Extension Unit Option) Spectroscopy
Essential Questions: 1. How can reading a HNMR spectra identify and propose a given compound structure?
Standards:
Science and Engineering Practices: 1. Developing and Using Models 2. Analyzing and Interpreting Data 3. Constructing Explanations and Designing Solutions 4. Engaging in Argument from Evidence **Cross Cutting Concepts** 1. Patterns 2. System and System Models 3. Structure and Function 4. Stability and Change
Learning Targets:
1. I can identify non-equivalent carbons and hydrogens 2. I can predict the number of signals appearing in the HNMR spectra 3. I can propose structures for compounds given the HNMR spectra
Digital Tools & Supplementary Resources: