Unit 3: Alkenes Structure and Properties

Content Area: **Science**
Course(s):
Time Period: **Marking Period 1**
Length: **3 Weeks**
Status: **Published**

Brief Summary of Unit

Carbon is at the center of organic chemistry because of the way it bonds. In alkanes, carbon only makes single bonds but in alkenes we find carbon making at least one double bond. This seemingly small change has a major effect on the structure which in turn alters the physical and chemical properties. The IUPAC naming system will be altered to account for the new class of compound and the changes to structure, properties, and reactivity will be investigated before the in-depth look at the alkene reactions in Unit 4.

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Standards

MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
P.3	Consider the environmental, social and economic impacts of decisions.
P.4	Demonstrate creativity and innovation.
TECH.K-12.1.1.c	use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways.
P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
MA.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
MA.N-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
MA.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
HS-PS1-2	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.
TECH.K-12.1.3.b	evaluate the accuracy, perspective, credibility and relevance of information, media, data or other resources.
HS-PS1-3	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.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.

TECH.K-12.1.6.a	choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.
LA.W.11-12.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
HS-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
HS-PS1-5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
LA.W.11-12.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.W.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (MLA or APA Style Manuals).
HS-PS1-6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
LA.W.11-12.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
HS-PS1-7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Essential Questions

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How do alkenes differ from alkanes in name, structure, and chemical/physical properties?

What are the major underlying principles behind organic reactions?

Enduring Understandings

An alkene is considered a functional group and naming these molecules must prioritize the location of the double bond itself.

Electron rich atoms or molecules (nucleophiles) are attracted to electron deficient atoms or molecules (electrophiles) – this attraction is the basis of the chemical reaction.

Objectives

Students will know the alkenes contain a double bond somewhere along the carbon chain.

Students will know the location of the double bond along the chain determines the numerical locations of other groups on the molecule when naming.

Students will know that isomerism occurs when substituents are arranged differently about the double bond.

Students will be skilled at identify cis and trans isomers when analyzing a molecule or structure.

Students will know that isomers can also be classified as E or Z in the IUPAC naming system but that they have no link to cis and trans.

Students will be skilled at identifying nucleophiles or electrophiles.

Students will know that thermodynamics can be used to predict whether a reaction is favorable or not.

Students will be skilled at using thermodynamic values (H and S, enthalpy and entropy) to calculate free energy (G) and interpret the value with respect to what will happen in the reaction.

Students will know that activation energy is needed for a reaction to occur.

Students will be skilled at interpreting an activation energy diagram to identify enthalpy change (H), activation energy requirements, rate-limiting steps, and the locations of transition states and intermediates.

Learning Plan

Preview essential questions and connect them to the concepts we will cover in the unit.

Model the nomenclature of an alkene in order to identify the differences from alkanes.

Demonstrate isomers of alkenes with molecular models and how the cis/trans and E/Z naming system is applied.

Complete the Alkene Modeling activity where students use molecular models to build structures according to the IUPAC name or name the structure itself.

Introduce general alkene reactions (specifics are Unit 4) with respect to modeling the location on the alkene where the reaction occurs.

Complete the Alkene Reaction Modeling Activity (a step up from the introduction).

Discuss the role that thermodynamics and kinetics has on simple alkene reactions.

Complete the thermodynamics activity and analyze reaction coordinates, calculate free energy, enthalpy, and reaction rates.

Investigate the dehydration of ethanol. (http://www.nuffieldfoundation.org/practical-chemistry/dehydration-ethanol-form-ethene; can be a ‘paper’ lab)

Unit Quizzes (at teacher discretion)

Unit Test

Assessment

Formative Assessment

Completion of practice problems assigned by teacher (textbook or otherwise).

Develop appropriate alkene names using IUPAC nomenclature (includes isomers).

Determine the structure of an alkene given its name (includes isomers).

Determine the outcome of a basic alkene reaction.

Analyze reaction coordinate diagrams.

Benchmark Assessment

Correctly build structures from names and names from structures (modeling activity 1).

Complete the Alkene Reaction Modeling Activity.

MidTerm Exam

Alternative Assessment

Predict results of "Dehydration of ethanol" experiment (paper lab); research and compare with literature.

Summative Assessment

Unit Quizzes

Unit Test

Materials

Guided notes or teacher handouts

Organic Chemistry (Bruice, 2007) – electronic textbook

Activity/Lab Handouts (Includes materials specific to each activity: Dehydration of Ethanol [http://www.nuffieldfoundation.org/practical-chemistry/dehydration-ethanol-form-ethene])

Molecular Modeling Kits (teacher provided)

Molecular Modeling Websites (an example: https:\\molview.org)

Safety Supplies (specifics to when they are required included in lab handouts)

Integrated Accommodations and Modifications Spec Ed., ELL, At-Risk, G&T, Career Education, 504s

https://docs.google.com/spreadsheets/d/1WPR9w7-UpEeDhl7-1U_EjbNwTuqMkUj8KIJdNwAS0Es/edit?usp=sharing