Unit 1: Organic Compounds: Introduction to Nomenclature, Properties, and Structure of the Alkanes

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

Brief Summary of Unit

The alkanes are the most basic organic molecules composed of simply carbon and hydrogen. They make the perfect molecules to introduce nomenclature of organic molecules which differs from what they learned in general chemistry courses. The structure of these molecules directly affects their physical properties. The skills learned in this unit and knowledge of alkanes can be applied when the alkenes and alkynes are introduced.

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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.
P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
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.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.
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.
LA.RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or

	formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.
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.
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).
LA.W.11-12.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).

Essential Questions / Enduring Understandings

Essential Questions

How does the common name of organic compounds differ from the systematic (IUPAC) name?

What roles does the structure of organic molecules play in the determination of their physical properties?

Enduring Understandings

The IUPAC nomenclature system is a set of rules which, when applied, determine a unique name for a particular structure.

Structure of a molecule is a determining factor in micro- and macroscopic properties due to the affect the structure has on the distribution of charge (intermolecular forces).

Trends in names and properties can extend from smaller molecules to larger ones.

Objectives

Students will be skilled at using IUPAC nomenclature to name and identify molecules.

Students will know the role structure plays on the properties of that compound.

Students will be skilled at identifying functional groups in a structure.

Students will know how functional groups can be identified in the name of a molecule.

Students will know the difference between primary, secondary, and tertiary carbons.

Students will know that molecules tend to take the structure that results in the lowest potential energy.

Students will know that the IUPAC system results in one and only one name for a structure.

Students will know that substituents/functional groups are treated differently when naming.

Students will be skilled at drawing molecules when given the name.

Learning Plan

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

Introduce the IUPAC naming system and apply the rules to alkanes and alkanes with alkyl substituents.

Compare and contrast the naming of chain-carbon compounds with ring-carbon structures.

Name compounds with non-alkyl substituents (halides and ethers) as well as functional groups (alcohols and amines).

Investigate the role that structure has on the physical properties (boiling/melting point, solubility) of organic compounds.

Complete the Properties of Ethanol v Propan-1-ol Experiment (virtual, http://www.nuffieldfoundation.org/practical-chemistry/properties-alcohols).

Modeling Activities (order at teacher's discretion)

1 – Substituency Constituency: a 3D look at alkyl substituents and the key's for differentiating them

2 – Alkane Nomenclature: after all rules/substituents/functional groups have been covered this activity includes building molecules from names which will be helpful in understanding the properties

3 – Structures v Properties: students will build molecules and be given a property (or properties) and they will try to identify the reason for the change in property from one molecule to another.

Unit Quizzes (at teacher's discretion)

Unit Assessment (at conclusion)

Assessment

Formative Assessment

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

Apply IUPAC rules when developing the names of molecules.

Correctly identify and name parent chains and/or substituents on molecules.

Determine ranks for physical properties based on a list of potential molecules.

Benchmark Assessment

Build the correct structure from a given name (or the reverse).

MidTerm Exam

Alternative Assessment

Research ethanol and propan-1-ol to determine results for the virtual experiment.

Complete molecular modeling activity (options in Learning Plan).

Summative Assessment

Unit Quizzes

Unit Tests

Materials

Guided notes or teacher handouts

Organic Chemistry (Bruice, 2007) – electronic textbook

Activity/Lab Handouts (Includes materials specific to each activity: Ethanol v Propan-1-ol (http://www.nuffieldfoundation.org/practical-chemistry/properties-alcohols); Substituency-Constituency; Alkane Nomenclature; Structures v Properties)

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/