



Conceptual Chemistry - Unit 3 - Polymers

Unit Focus

Polymers are the focus of the third unit in Conceptual Chemistry. Students will understand the basic structure of hydrocarbons (including alkanes, alkenes and alkynes) and they will explore how common functional groups impact the properties of hydrocarbons. Students will name and write formulas for various hydrocarbons. Students will differentiate between natural and synthetic polymers and will explore the chemical reactions used to synthesize polymers. Students will engage in a lab experiment where they will create bioplastics from various plant starches and will collect quantitative data on tensile strength. Students will analyze their data and will propose novel applications for the materials they have created. Students will have laboratory experiences that will support their understanding in Chemistry 2 if they choose to enroll in that class the following year.

Stage 1: Desired Results - Key Understandings

Standard(s)	Transfer	
Next Generation Science Standards (DCI) <i>Science: 10</i> <ul style="list-style-type: none"> Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. <i>ETS1.9.A2</i> The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. <i>PS1.9.A2</i> Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. <i>PS1.9.B1</i> 	T1 Use the scientific process to generate evidence that addresses the original questions. T2 Analyze qualitative and quantitative data to interpret patterns, draw conclusions, and/or make predictions.	
	Meaning	
	Understanding(s)	Essential Question(s)
	U1 The properties of many chemical compounds are determined by the molecular interactions. U2 Chemical reactions can synthesize polymers from monomers as well as break down polymers into monomers. U3 Scientists can make synthetic polymers to mimic natural polymers and/or to provide a functional need for humans. U4 Proper experimental design and data collection is important in order to accurately understand and communicate results. U5 The structure and interactions of matter are determined by electrical forces within and between atoms.	Q1 How do the fundamental forces of the universe explain the behavior and interactions of objects? (e.g. particles, people, stars, planets) Q2 How do different substances interact? Q3 Based on current information, how do I develop a testable design? 3-12 Q4 How do I explain my results? What questions do I wonder about now? Q5 Based on what I am seeing, how does it shape my thinking?
	Acquisition of Knowledge and Skill	
	Knowledge	Skill(s)
NGSS/NSTA Science & Engineering Practices <i>NGSS Science & Engineering Practices: 9-12</i> <ul style="list-style-type: none"> Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising 	K1 Hydrocarbons are organic molecules composed of only carbon and hydrogen. Alkanes are saturated	S1 Conduct an experiment using proper scientific design and protocols.

Stage 1: Desired Results - Key Understandings

models, supporting explanations for phenomena, or testing solutions to problems. Consider possible variables or effects and evaluate the confounding investigation's design to ensure variables are controlled. *SE.9-12.3.1*

Madison Public Schools Profile of a Graduate

Critical Thinking

- Analyzing: Examining information/data/evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)

hydrocarbons that contain only single bonds. Alkenes contain one or more carbon-carbon double bonds.

Alkynes contain one or more carbon-carbon triple bonds

K2 A functional group is an atom or group of atoms within a molecule that has similar chemical properties whenever it appears in various compounds. Common functional groups include: alcohols, amines, carboxylic acids and esters.

K3 Natural polymers occur in nature and can be extracted. They are often water-based. Examples of naturally occurring polymers are starches, cellulose, nucleic acids and proteins.

K4 Synthetic polymers are derived from petroleum oil, and made by scientists and engineers. Examples of synthetic polymers include nylon, polyethylene, polyester, Teflon, and epoxy.

S2 Gather and analyze data to draw conclusions and communicate results.

S3 Identify how the use of bioplastics can impact the environment and cite evidence to justify claims.