

Topic: Introduction	Days: days
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**Key Learning:** Understanding the importance of organic chemistry to everyday life.

**Unit Essential Question:**

**Unit Essential Question:** What is Organic Chemistry?



<b>Concept: Applications</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Techniques and Reactions</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	
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<b>Lesson Essential Questions:</b> How is organic chemistry defined today?  What is meant by organically grown?  How many different types of useful organic molecules are found in my home's medicine cabinet?  How important is organic chemistry if I want to pursue a career in medicine or agriculture?	<b>Lesson Essential Questions:</b> What is a saponification reaction?  Can I separate components of an ink mixture?  How is column chromatography used to separate pigments in a spinach leaf?  Can I synthesize aspirin (acetylsalicylic acid)?  What is the structural formula of caffeine?	<b>Lesson Essential Questions:</b>
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<b>Vocabulary: Organic Chemistry</b>	<b>Vocabulary: structural formula, column chromatography</b>	<b>Vocabulary:</b>
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Additional info:

Topic: Structure and Bonding	Days: days
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**Key Learning:** Recognizing the relationship between the structure and behavior of atoms and molecules.

**Unit Essential Question:**

**Unit Essential Question:** How does the structure of an atom affect how it will bond?



<b>Concept: Structure</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Bonding</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Acid/Base definitions</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1
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<b>Lesson Essential Questions:</b>  Am I familiar with atomic structure? (orbital, shell, ground-state electron configuration)  How is a Kekule structure used to represent the tetravalent nature of the carbon atom?  Can I draw Lewis structures showing covalent bonds and lone pair of electrons?	<b>Lesson Essential Questions:</b>  Why do atoms bond together?  What types of hybridization are used by the carbon atom in molecules?  What is a sigma bond? A pi bond?  Can I identify bond angles in an organic molecule?  How is electronegativity used to determine the polarity of a bond?	<b>Lesson Essential Questions:</b>  Can I use the Bronsted-Lowry model to identify an acid or a base?  Can I use the Lewis model to identify an acid or a base?
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<b>Vocabulary:</b> orbital, shell, electron configuration, Kekule structure, tetravalent, lone pair, covalent bonding	<b>Vocabulary:</b> hybridization, sigma bond, pi bond, electronegativity, polar, nonpolar	<b>Vocabulary:</b> Bronsted-Lowry Acid/Base, Lewis Acid/Base
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Additional info:

Topic: Introduction to Matter

Days: days

**Key Learning:** Alkanes are the simplest organic structures and are a vital introduction to the nature of organic molecules.

**Unit Essential Question:**

Unit Essential Question: How are organic molecules identified and named?



<b>Concept: Functional Groups</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Nomenclature</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Organic Structures</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1
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<b>Lesson Essential Questions:</b>  How are functional groups used to classify organic structures?  What are alkanes, alkenes, and alkynes?  How does a saturated hydrocarbon differ from an unsaturated hydrocarbon?  What is a cycloalkane?  What are some properties of alkanes?	<b>Lesson Essential Questions:</b>  What prefixes are used to represent the number of carbon atoms in a hydrocarbon?  How is the IUPAC system of nomenclature used to name organic structures?	<b>Lesson Essential Questions:</b>  Can I draw straight-chain and branched-chain isomers for a given molecular formula?  Can I use sawhorse and Newman projections to represent organic structures?  Can I distinguish between cis-trans isomerism for organic structures?  Can I draw chair structures for organic molecules to illustrate various conformations?  How do organic structures determine how crude oil is refined?
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<b>Vocabulary:</b> alkanes, alkenes, alkynes, cycloalkane, saturated, unsaturated	<b>Vocabulary:</b> IUPAC	<b>Vocabulary:</b> isomers, chair structure, sawhorse projection, Newman projection, cis-trans structures
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Additional info:

Topic: Alkenes	Days: days
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**Key Learning:** The structure of alkenes determines how they behave.

**Unit Essential Question:**

**Unit Essential Question:** How does the structure of alkenes determine their behavior?



<b>Concept: Naming and Structure</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Alkene Reactions and Mechanisms</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	
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<b>Lesson Essential Questions:</b>  What is an olefin?  How is the IUPAC system used to name alkenes?  What type of hybridization is used in alkenes?  Can I identify the cis-trans isomers for alkenes?  How is the E,Z system of sequence rules used for naming trisubstituted and tetrasubstituted structures?	<b>Lesson Essential Questions:</b>  Can I recognize addition, elimination, substitution, and rearrangement reactions for alkenes?  Can I identify electrophiles and nucleophiles?  What is a carbocation?  How is an energy diagram used to describe an organic reaction?  How does a catalyst affect a reaction mechanism?	
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<b>Vocabulary:</b> olefin, E,Z system	<b>Vocabulary:</b> addition reactions, elimination reactions, substitution reactions, rearrangement reactions, electrophiles, nucleophiles, catalyst, carbocation, energy diagram	<b>Vocabulary:</b>
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Additional info:

Topic: Reactions of Alkenes and Alkynes

Days: days

**Key Learning:** The structures of alkenes and alkynes determine how they will react.

**Unit Essential Question:**

**Unit Essential Question:** How can I predict the products of reactions involving alkenes and alkynes?



<b>Concept: Structural Classifications</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Reactions Involving Alkenes and Alkynes</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	
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<b>Lesson Essential Questions:</b> Can I use Markonikov's rule used with alkene addition reactions? What factors affect the stability of a substituted carbocation? What is a polymer? How are polymers formed from monomers? What is a conjugated diene? How is resonance used with alkenes and alkynes?	<b>Lesson Essential Questions:</b> Can I determine the products of an addition of water reaction for alkenes? Alkynes? Can I determine the products of a halogenation reaction for alkenes? Alkynes? Can I predict the product obtained from a catalytic hydrogenation reaction of an alkene? Can I predict the product obtained from the oxidation of an alkene?	
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<b>Vocabulary:</b> Markonikov's rule, polymer, monomer, diene	<b>Vocabulary:</b> halogenation, hydrogenation	<b>Vocabulary:</b>
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Additional info:

Topic: Aromatic Compounds

Days:        days

**Key Learning:** The structure of aromatic compounds affects their properties and behavior.

**Unit Essential Question:**

**Unit Essential Question:** How does the structure of aromatic compounds affect their behavior?

<b>Concept: Aromatic Structure</b> 3.2.12.A5   3.2.C.A2   3.2.C.A1	<b>Concept: Nomenclature and Reactions</b> 3.2.12.A5   3.2.C.A2   3.2.C.A1	
<b>Lesson Essential Questions:</b>  What is an aromatic compound?  Can I represent the structure of benzene several different ways?  Why are some of the bonds in a benzene molecule described as being delocalized?  How do I determine if a polycyclic compound is aromatic?	<b>Lesson Essential Questions:</b>  How is the IUPAC system of nomenclature used to name benzene structures?  Can I predict products formed from an electrophilic substitution reaction?  What is a Friedl-Crafts reaction?  Can I interpret and explain substituent effects in electrophilic aromatic substitution?  How is working backward from product to reagents useful with organic synthesis?	
<b>Vocabulary:</b> aromatic, benzene, polycyclic	<b>Vocabulary:</b> electrophilic substitution, Friedel-Crafts, electrophilic aromatic substitution	<b>Vocabulary:</b>

Additional info:

Topic: Stereochemistry

Days: days

**Key Learning:** The spatial orientation of a molecule affects its interactions with other molecules.

**Unit Essential Question:**

**Unit Essential Question:** How can the spatial orientation of a molecule be determined?



<b>Concept: Chirality</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Applications of Chirality</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept:</b>
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<b>Lesson Essential Questions:</b>  What is stereochemistry?  Can I determine if a molecule is chiral?  What is an enantiomer?  What makes an organic molecule optically active?	<b>Lesson Essential Questions:</b>  Can I distinguish between molecules that levorotatory or dextrorotatory?  How is specific rotation calculated?  What are the sequence rules for specifying configuration?  What are diastereomers? Meso compounds?	
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<b>Vocabulary:</b> stereochemistry, chiral, enantiomer	<b>Vocabulary:</b> levorotatory, dextrorotatory, diastereomers, meso	<b>Vocabulary:</b>
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Curriculum: Chambersburg Area School District  
Course: Organic Chemistry

Date: Fall 2012

Topic: Alkyl Halides	Days: days
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<b>Key Learning:</b> Alkyl halides are synthesized through unique reaction mechanisms.
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Unit Essential Question:

**Unit Essential Question:** How are alkyl halides named and synthesized?

<b>Concept: Nomenclature</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Reactions and Mechanisms</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept:</b>
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<b>Lesson Essential Questions:</b>  How is the IUPAC system of nomenclature used to name alkyl halides?  How is an alkyl halide prepared?	<b>Lesson Essential Questions:</b>  Can I show how to use a Grignard reagent to prepare an alkyl halide?  How are S <sub>N</sub> 1 and S <sub>N</sub> 2 reaction mechanisms used in organic synthesis?  How are E1 and E2 reaction mechanisms used in organic synthesis?	<b>Lesson Essential Questions:</b>
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<b>Vocabulary:</b> alkyl halides	<b>Vocabulary:</b> Grignard reagent, S <sub>N</sub> 1 and S <sub>N</sub> 2 reaction mechanisms, E1 and E2 reaction mechanisms	<b>Vocabulary:</b>
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Additional info:



Topic: Alcohols, Phenols, and Ethers

Days: days

**Key Learning:** Alcohols, phenols, and ethers have unique properties that determine how they react and interact with other molecules.

**Unit Essential Question:**

**Unit Essential Question:** How are alcohols, phenols, and ethers named and how do they react with other substances?



<b>Concept: Structure and Nomenclature</b>  3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Mechanisms and Reactions</b>  3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Applications</b>  3.2.12.A5 3.2.C.A2 3.2.C.A1
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<b>Lesson Essential Questions:</b>  How do I recognize a molecule as being an alcohol, phenol, or ether?  What is the IUPAC method of naming alcohols, ethers, and phenols?  What effects does hydrogen bonding have on the properties of alcohols, phenols, and ethers?  Can I determine the acidity of alcohols, phenol, and ethers?	<b>Lesson Essential Questions:</b>  How is the reduction of aldehydes, ketones, esters, and carboxylic acids used in the synthesis of alcohols?  Can I show how alcohols undergo dehydration?  Can I show oxidation of alcohols?  How does the Williamson synthesis convert alcohols into ethers?	<b>Lesson Essential Questions:</b>  How can phenols be converted into ethers?  Can I show how to cleave ethers using a strong acid?  What is an epoxide?  How are thiols and sulfides used in organic synthesis?
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<b>Vocabulary:</b> alcohol, phenol, ether	<b>Vocabulary:</b> aldehydes, ketones, esters, carboxylic acids, dehydration, oxidation, Williamson synthesis	<b>Vocabulary:</b> cleave, epoxide, thiols, sulfides
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Topic: Aldehydes and Ketones

Days: days

**Key Learning:** Aldehydes and ketones have unique properties that determine how they react and interact with other molecules.

**Unit Essential Question:**

**Unit Essential Question:** How are aldehydes and ketones named and how do they react with other substances?



<b>Concept: Structure and Naming</b>	<b>Concept: Mechanisms and Reactions</b>	<b>Concept: Applications</b>
3.2.12.A5 3.2.C.A2 3.2.C.A1	3.2.12.A5 3.2.C.A2 3.2.C.A1	3.2.12.A5 3.2.C.A2 3.2.C.A1



<b>Lesson Essential Questions:</b>  What is a carbonyl group?  What is an aldehyde? A ketone?  What is the IUPAC method of naming aldehydes and ketones?	<b>Lesson Essential Questions:</b>  Can I show synthesis reactions for aldehydes and ketones?  How do amines form imines?  Can I show how to use a Grignard reagent to form an alcohol?	<b>Lesson Essential Questions:</b>  How is a silver test tube produced by oxidizing an aldehyde with the Tollens' reagent?  What are the importance of hemiacetals and acetals in nature and the laboratory?
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<b>Vocabulary:</b> carbonyl, aldehyde, ketone	<b>Vocabulary:</b> amines, imines, Grignard reagent	<b>Vocabulary:</b> Tollens' reagent, acetals, hemiacetals
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Additional info:

Topic: Carboxylic Acids and Derivatives

Days: days

**Key Learning:** Carboxylic acids have unique properties that determine how they react and interact with other molecules.

**Unit Essential Question:**

**Unit Essential Question:** How are carboxylic acids named and how do they react with other substances?



<b>Concept: Nomenclature and Structure</b>	<b>Concept: Mechanisms and Reactions</b>	<b>Concept: Application</b>
3.2.12.A5 3.2.C.A2 3.2.C.A1	3.2.12.A5 3.2.C.A2 3.2.C.A1	3.2.12.A5 3.2.C.A2 3.2.C.A1



<b>Lesson Essential Questions:</b>  What is a carboxylic acid?  What is the IUPAC method for naming carboxylic acids?  How is acid strength for carboxylic acids determined?	<b>Lesson Essential Questions:</b>  Can I show the synthesis of carboxylic acids?  What is a Fischer esterification reaction?  Can I show different types of carboxylic acid reactions?  Can I show how to prepare acid anhydrides?	<b>Lesson Essential Questions:</b>  Am I able to explain the chemistry of esters? Amides? Nitriles?  What polymers are most useful in today's society?  How are enzymes important in organic synthesis?
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<b>Vocabulary:</b> carboxylic acid	<b>Vocabulary:</b> Fischer esterification, acid anhydrides	<b>Vocabulary:</b> esters, amides, nitriles, enzymes
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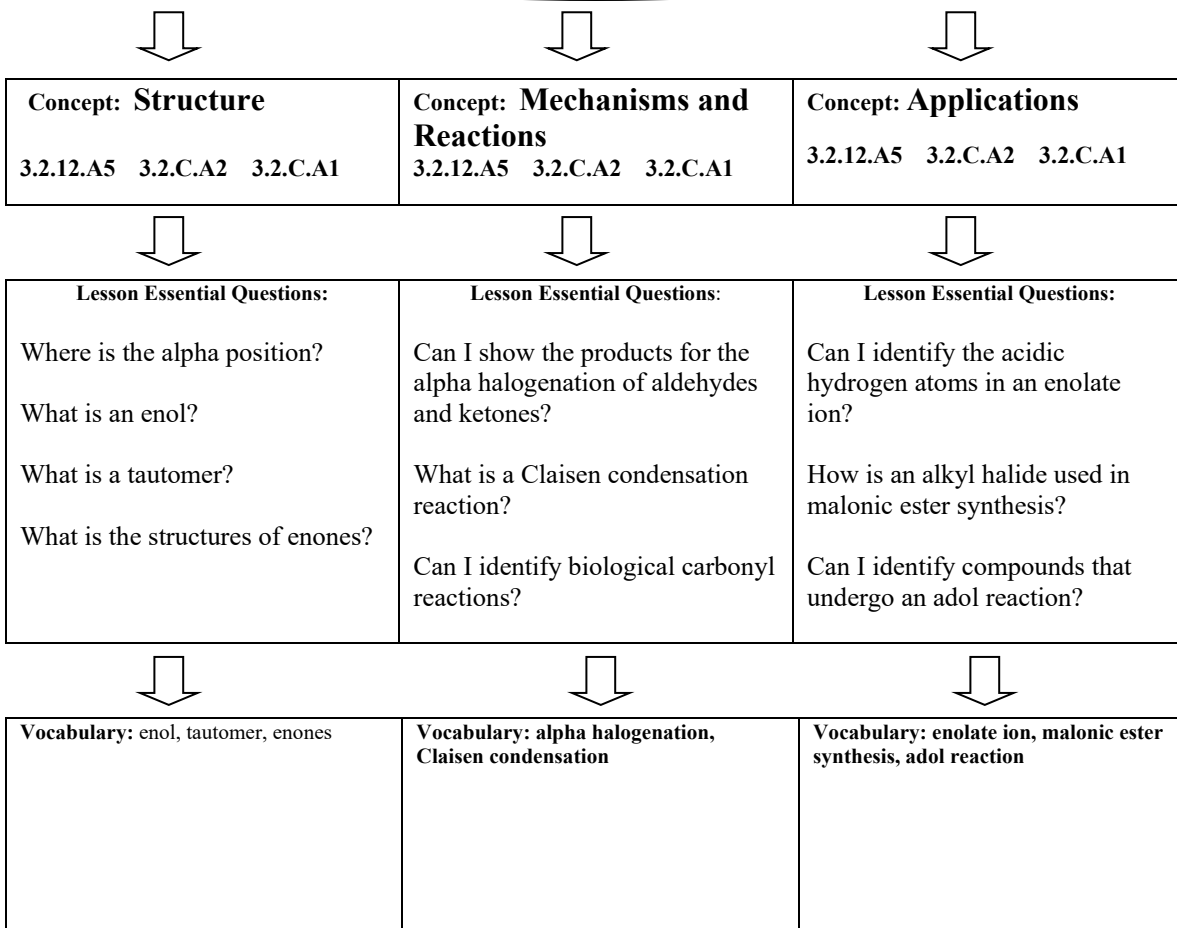
Additional info:

Topic: Carbonyl Alpha-Substituted Reactions and Condensation Reactions  
 Days:            days

**Key Learning:** Carbonyl alpha-substituted hydrocarbons participate in unique reaction due to their structure.

**Unit Essential Question:**

**Unit Essential Question:** How does the structure of carbonyl alpha-substituted hydrocarbons affect their interaction with other molecules?



Additional info:

Curriculum: Chambersburg Area School District

Course: Organic Chemistry

Date: Fall 2012

Topic: Amines

Days: days

**Key Learning:** The structure of amines determines their interactions with other molecules.

**Unit Essential Question:**

**Unit Essential Question:** How does the structure of amines determine how they will react and interact with other molecules?



<b>Concept: Nomenclature and Structure</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Mechanisms and Reactions</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept:</b>
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<b>Lesson Essential Questions:</b>  What is an amine?  Can I distinguish between primary, secondary, and tertiary amines?  Can I use the IUPAC system of nomenclature to name amine compounds?  What is an amide?  What is a heterocyclic amine?  What are alkaloids?	<b>Lesson Essential Questions:</b>  Can I determine which amine in a pair of amines is more basic?  Can I show the synthesis of amines using reduction of nitriles, amides, and nitrobenzenes?	<b>Lesson Essential Questions:</b>
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<b>Vocabulary:</b> amine, primary, secondary, tertiary, amide, heterocyclic amine, alkaloid	<b>Vocabulary:</b> nitriles, nitrobenzenes	<b>Vocabulary:</b>
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Additional info:

Curriculum: Chambersburg Area School District

Course: Organic Chemistry

Date: Fall 2012

Topic: Determination of Structure

Days:        days

**Key Learning:** Using advanced instrumentation can provide evidence for the structure of organic molecules.

**Unit Essential Question:**

**Unit Essential Question:** How can laboratory instruments be used to determine the structure of organic molecules?



<b>Concept: Instrumentation</b> 3.2.12.A5   3.2.C.A2   3.2.C.A1	<b>Concept: Applications of Instrumentation</b> 3.2.12.A5   3.2.C.A2   3.2.C.A1	<b>Concept:</b>
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<b>Lesson Essential Questions:</b>  How can structure be determined by using instruments such as: x-ray crystallography, mass spectrometry, NMR spectroscopy, IR spectroscopy, and UV spectroscopy?  Can I explain how properties of electromagnetic radiation are used to probe organic structures?	<b>Lesson Essential Questions:</b>  Can I identify functional groups when examining IR data at Shippensburg University or Wilson College?  Can I determine the carbon-hydrogen framework for an organic molecule when examining NMR data at Shippensburg University or Wilson College?	<b>Lesson Essential Questions:</b>
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<b>Vocabulary:</b> X-Ray crystallography, IR spectroscopy, UV spectroscopy, NMR spectroscopy	<b>Vocabulary:</b>	<b>Vocabulary:</b>
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Additional info:

Curriculum: Chambersburg Area School District

Course: Organic Chemistry

Date: Fall 2012

Topic: Biomolecules

Days: days

**Key Learning:** Biomolecules are essential to energy production on a micro and macro scale.

**Unit Essential Question:**

**Unit Essential Question:** How and why are biomolecules essential to energy production?



<b>Concept: Structure</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept: Applications and Reactions</b> 3.2.12.A5 3.2.C.A2 3.2.C.A1	<b>Concept:</b>
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<b>Lesson Essential Questions:</b>  What is the structure of a carbohydrate?  Can I distinguish between a monosaccharide, disaccharide, and polysaccharide?  What is the structure of an amino acid?  Can I recognize the structure of a protein molecule?  Can I draw the structure of a typical fat molecule?  Can I recognize the structure of a nucleic acid?  What is a lipid?	<b>Lesson Essential Questions:</b>  How are plants a possible alternative to petroleum?  How is electrophoresis used to separate a mixture of amino acids?  Can I show peptide synthesis?	<b>Lesson Essential Questions:</b>
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<b>Vocabulary:</b> carbohydrate, monosaccharide, disaccharide, polysaccharide, amino acid, protein, fat, lipid, nucleic acid	<b>Vocabulary:</b> peptides, electrophoresis	<b>Vocabulary:</b>
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Additional info: