Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	Science	Course:	IB Chemistry 12 (H)	Unit Title:	Organic	Grade Level(s):	12
Assessed Trimester:	Trimester B	Pacing:	Trimester B	Date Created:	6/24/2014	Last Revision Date:	

Course Understandings: *Students will understand that:*

- Problems can be solved and knowledge gained in a systematic way: solutions to one problem can create new questions and problems.
- Chemistry is recognized as significant in its application to other disciplines and the world.
- Ideas are expressed symbolically, numerically, and graphically.
- Behavior and properties of materials are organized, classified, and predicted utilizing periodic trends.
- Mathematical relationships are interpreted and manipulated to model the real world.
- The basic building blocks combine and recombine in a variety of ways to make all matter from the simple to the complex.
- The laws of chemistry predict outcomes that impact and apply to daily life.

DESIRED RESULTS (Stage 1) - WHAT WE WANT STUDENT TO KNOW AND BE ABLE TO DO?

Established Goals

- Students will know that organic chemistry focuses on the chemistry of compounds containing carbon. (IB 10.1)
- Students will know that structure, bonding and chemical reactions involving functional group interconversions are key strands in organic chemistry.(IB 10.2)
- Students will know key organic reaction types include nucleophilic substitution, electrophilic addition, electrophilic substitution and redox reactions. Reaction mechanisms vary and help in understanding the different types of reaction taking place. ((IB 20.1)
- Students will know organic synthesis is the systematic preparation of a compound from a widely available starting material or the synthesis of a compound via a synthetic route that often can involve a series of different steps.(IB 20.2)
- Students will know that molecules can be made up of exactly the same atoms bonded to each other in the exact same arrangement and still be different molecules.(IB 20.3)

Transfer

Students will be able to independently use their learning to: (product, high order reasoning)

- Research an organic molecule of your choice and, using a chemist's lens, describe how it impacts your daily life both positively and negatively.

Meaning

Unit Understanding(s):	Essential Question(s):
Students will understand that: ● The structure of an organic compound is vital to understanding its chemical behavior. ● The classes of organic compounds have specific chemical and physical properties that are common to that class. ● The synthesis of an organic compound stems from a readily available starting material via a series of discrete steps. Functional group interconversions are the basis of such synthetic routes.	**Students will keep considering:** ● The label "organic chemistry" originates from a misconception that a vital force was needed to explain the chemistry of life. Can you think of examples where vocabulary has developed from similar misunderstandings? Can and should language ever be controlled to eliminate such problems? ● Kekulé claimed that the inspiration for the cyclic structure of benzene came from a dream. What role do the less analytical ways of knowledge play in the acquisition of scientific knowledge? ● What role does green and sustainable chemistry, in relation to organic chemistry, play in a global context?

Acquisition

Knowledge - Students will:

- Know a homologous series is a series of compounds of the same family, with the same general formula, which differ from each other by a common structural unit.
- Know structural formulas can be represented in full and condensed format.
- Know structural isomers are compounds with the same molecular formula but different arrangements of atoms.
- Know functional groups are the reactive parts of molecules.
- Know saturated compounds contain single bonds only and unsaturated compounds contain double or triple bonds.
- Know benzene is an aromatic, unsaturated hydrocarbon.
- Stereoisomers are subdivided into two classes—conformational isomers, which interconvert by rotation about a bond and configurational isomers that interconvert only by breaking and reforming a bond. Configurational isomers are further subdivided into *cis*-trans and E/Z isomers and optical isomers.
- A chiral carbon is a carbon joined to four different atoms or groups.
- An optically active compound can rotate the plane of polarized light as it passes through a solution of the compound. Optical isomers are enantiomers. Enantiomers are non-superimposeable mirror images of each other. Diastereomers are not mirror images of each other.
- A racemic mixture (or racemate) is a mixture of two enantiomers in equal amounts and is optically inactive.

Reasoning - Students will:

- Explain the trends in boiling points of members of a homologous series.
- Construct 3-D models (real or virtual) of organic molecules.
- Discuss the structure of benzene using physical and chemical evidence.
- Write equations for free-radical addition reactions, substitution reactions, nucleophilic substitution, oxidation of alcohols,esterification, polymerization and combustion reactions.
- Explain why hydroxide is a better nucleophile than water.
- Deduce the mechanism of the nucleophilic substitution reactions of halogenoalkanes with aqueous sodium hydroxide in terms of S_N1 and S_N2 mechanisms. Explanation of how the rate depends on the identity of the halogen (ie the leaving group), whether the halogenoalkane is primary, secondary or tertiary and the choice of solvent.
- Outline the difference between protic and aprotic solvents.
- Deduce multi-step synthetic routes given starting reagents and the product(s).

Skills - Students will:

- Distinguish between empirical, molecular and structural formulas.
- Identify different classes: alkanes, alkenes, alkynes, halogenoalkanes, alcohols, ethers, aldehydes, ketones, esters, carboxylic acids, amines, amides, nitriles and arenes.
- Identify typical functional groups in molecules eg phenyl, hydroxyl, carbonyl, carboxyl, carboxamide, aldehyde, ester, ether, amine, nitrile, alkyl, alkenyl and alkynyl.
- Apply IUPAC rules in the nomenclature of straight-chain and branched-chain isomers.
- Identify primary, secondary and tertiary carbon atoms in halogenoalkanes and alcohols and primary, secondary and tertiary nitrogen atoms in amines.

Common Misunderstandings (*The following are all incorrect understandings*)

- As long as there is C=C bond in the compound, the compound can display cis/trans isomerism.
- Two halogen atoms must be attached to double bonded carbons atoms for formation of cis/trans isomerism.
- When cycloalkenes are named, numbering is always counterclockwise.
- Only the compounds that include π bonds are capable of undergoing addition reactions.
- Only an alkene that has two carbon atoms undergoes polymerization reactions.
- Organic means better for you at the grocery store.

Essential new vocabulary

- Organic
- Hydrocarbon
- alkane
- alkene
- alkyne
- functional group
- nucleophilic substitution
- halogenoalkane
- halogen
- isomer
- enantiomer
- stereoisomer

	• cis/trans isomer (E/Z isomer) • homologous • alcohol • aldehyde • ketone • carboxylic acid • ester • amine • amide • chiral