

June 8 – 12

Isomers

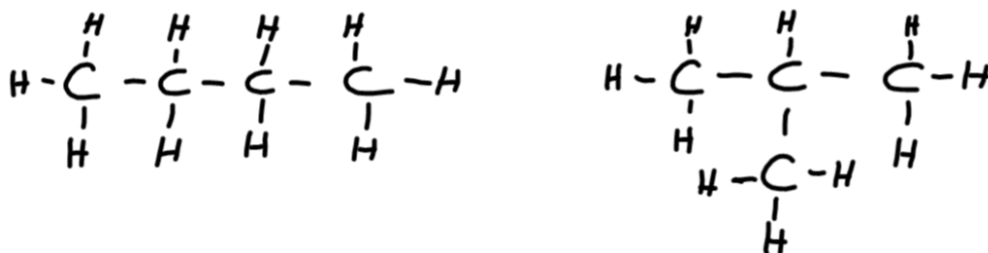
Some hydrocarbons differ only by the positions of the substituent groups or multiple bonds in their molecules. Compounds that have the same molecular formula but have different structural formulas are called isomers.

Structural Isomers

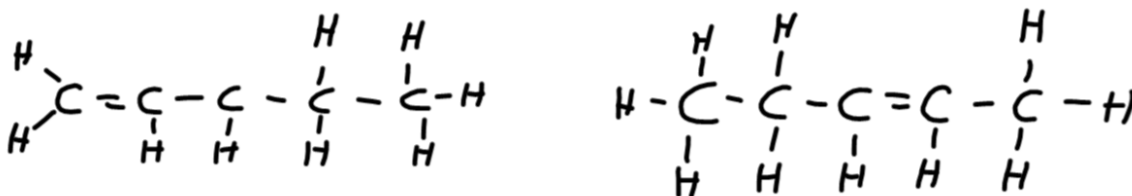
Structural isomers are compounds that have the same molecular formula, but the atoms are joined together in a different order. They differ in boiling and melting points, and they also have different chemical reactivities.

Examples:

Both of the following have the formula C_4H_{10}



Both of the following have the formula C_5H_{11}

Stereoisomers

Molecules are three-dimensional structures. Stereoisomers are molecules in which atoms are joined together in the same order, but the positions of the atoms in space are different.

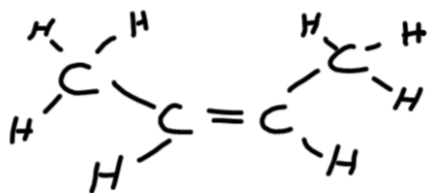
Geometric isomers are a stereoisomer that is based on the presence of a double bond in the molecule. Geometric isomers have atoms bonded together in the same order, but their orientation around the double bond differs.

There are two possible arrangements of these types of stereoisomers, and they are named using the prefixes *cis*- and *trans*-. In the *trans* configuration, groups are on the opposite side of the double bonds. In the *cis*- configuration, groups are on the same side of the double bond.

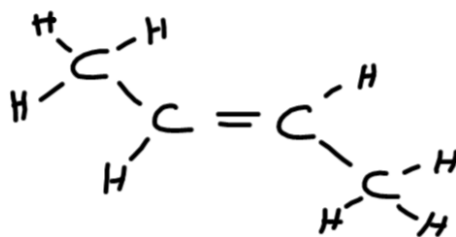
Example:

cis-2-butene

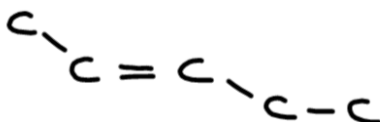
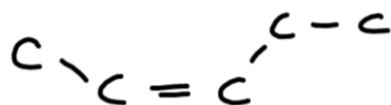
trans-2-butene



cis-2-pentene

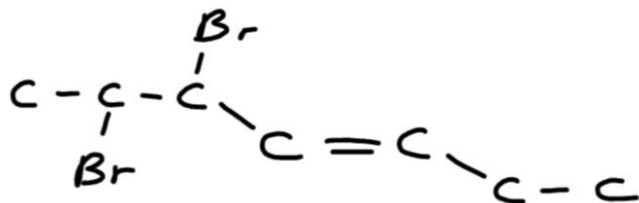
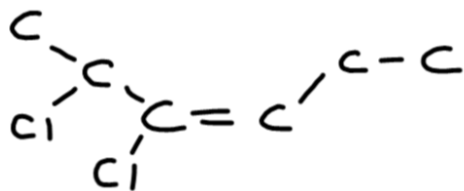


trans-2-pentene



Practice Problems

Name these structures:



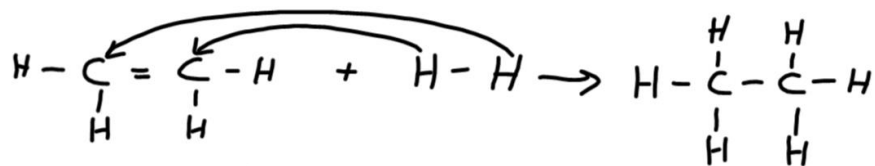
Organic reactions (addition, substitution and esterification)

Addition:

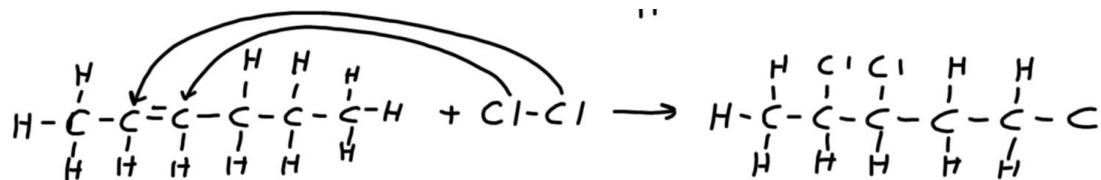
Hydrogen (H_2), halogens (Cl_2 , F_2 , Br_2 , I_2) and acids of halogens (HCl , HF , HBr , HI) can react with alkenes and alkynes in addition reactions.

Examples

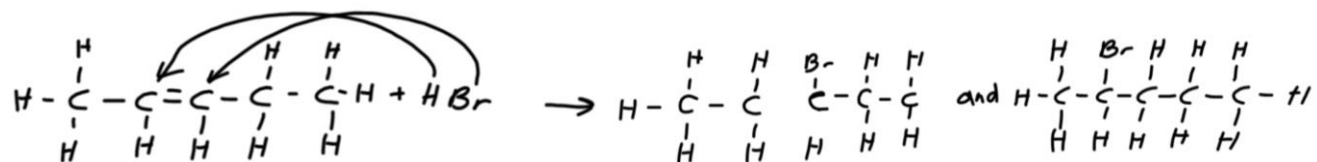
Ethene + H_2



2-hexene + Cl_2



2-pentene + HBr



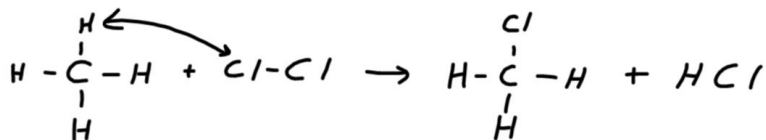
Substitution:

A substitution reaction is when an atom, or a group of atoms, replaces another atom or group of atoms.

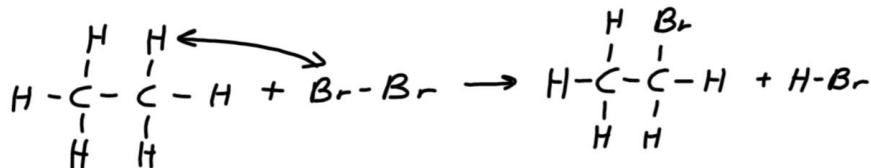
A halogen can replace a hydrogen atom on an alkane to produce an organic halide.

Example

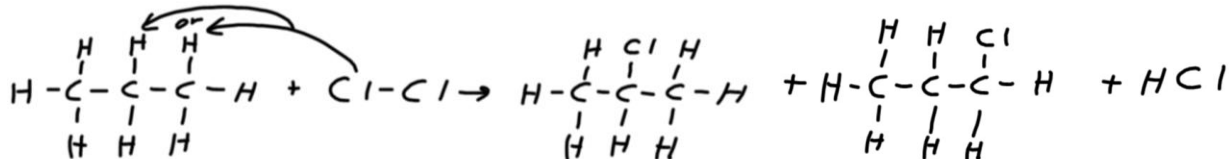
Methane + Cl₂



Ethane + Br₂



Propane + Cl₂

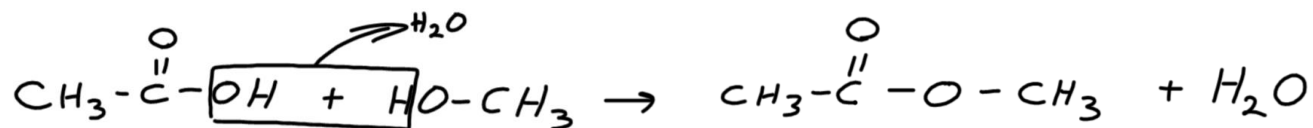


Esterification:

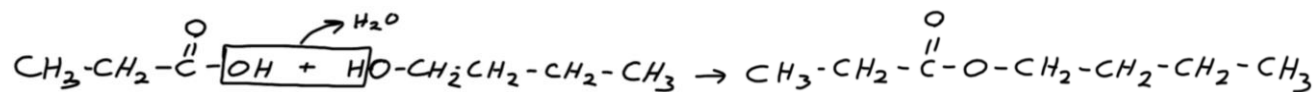
In a condensation reaction, a carboxylic acid and another reactant form an organic compound and water. Esterification is a more specific type of condensation reaction in which a carboxylic acid and alcohol produce an ester and water.

Example

Ethanoic acid + methanol



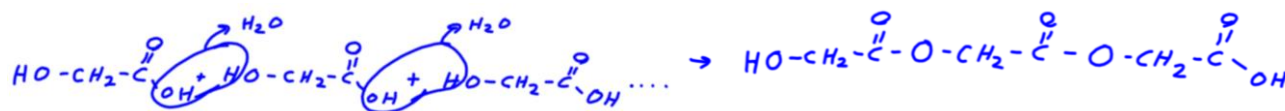
Propanoic acid + butanol



Polymers

Polymerization is the formation of very large molecules from smaller units called monomers to form polymers. Polymers can be formed through addition reactions or condensation reactions.

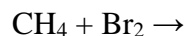
Example (The molecules have a carboxylic acid group on one end and an alcohol group on the other. They can join through repeated esterification reactions to make a polyester.)



Practice Problems

1. Draw the products for each of the following reactions:

a) Substitution reaction



b) Addition reaction



c) Esterification reaction

