

Chem 30B Study Guide – Exam 1

1. Be able to name any of the following types of compounds using IUPAC rules: alkanes, haloalkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, thiols, aldehydes, and ketones. (Review the different types of propyl groups and butyl groups.)
2. Be able to draw the condensed structural formula or the line structure, given the name.
3. Be able to draw the condensed structural formula, given the line structure, or vice versa.
4. Know common names of important compounds. (See your lecture notes.)
5. Know general properties of each of the types of compounds we studied.
6. Be able to explain trends in boiling point and solubility, given structures of molecules. Explain in terms of the types and strengths of intermolecular forces involved.

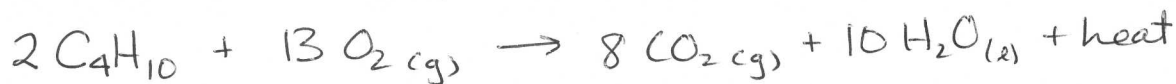
London forces: exist in all types of molecules. Higher MM, stronger London forces. If molecules have similar molar masses, look at other types of forces or at surface area. (More surface area, stronger London forces.)

Dipole-dipole forces: exist only in polar molecules. For organic molecules, a good rule of thumb is the more electronegative atoms in a molecule (F, O, N, Cl), the more polar the molecule is. (More polar, stronger dipole-dipole forces.)

Hydrogen bonding: if a molecule has H attached directly to N, O, or F, it can hydrogen bond to other like molecules. Hydrogen bonding is a stronger type of dipole-dipole force. The more hydrogen bonding groups on a molecule, the greater the extent of hydrogen bonding possible.
7. When explaining trends in solubility, discuss similarity to water. If a molecule can hydrogen bond, it will tend to be soluble in water unless the nonpolar section of the molecule is large. In general, small molecules that contain electronegative atoms are soluble in water. The longer the hydrocarbon chain, the less soluble it will be in water (unless it has lots of electronegative atoms and/or hydrogen bonding groups). Make sure to re-read the "Intermolecular Forces" handout.
8. Given the condensed structural formulas of the reactants and reaction conditions, be able to predict the products of a reaction. (And name the products.)
9. Given the name of the reactant and the name of the reaction, be able to write the reaction, including condensed structural formulas of reactants and products and any reaction conditions. Name the products.
10. Given the name or the structure of the product of a reaction, be able to deduce the structure and name of the reactant, including reaction conditions.
11. Be able to write reactions showing a conversion from one molecule to another that involves more than one step. (Usually 2 or 3 steps.)
12. Refer to your lecture notes for other miscellaneous topics:
 - Isomers, identical, or neither?
 - Organic or ionic?
 - Functional groups
 - Draw all isomers of ...
 - Saturated vs. unsaturated
 - Cis vs. trans
 - Are cis-trans isomers possible?
 - Classify the type of reaction: addition, elimination, substitution, rearrangement
 - Classify carbon atoms or alcohols as primary, secondary, or tertiary

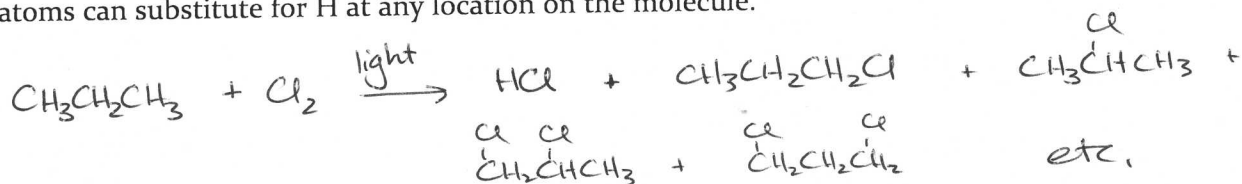
Chem 30B - Reactions - Chapters 12-15

Any organic compound will burn in O_2 . If the organic compound contains C and H or C, H, and O, the products are CO_2 and H_2O . Be able to write the balanced equation. Heat is also produced by combustion.



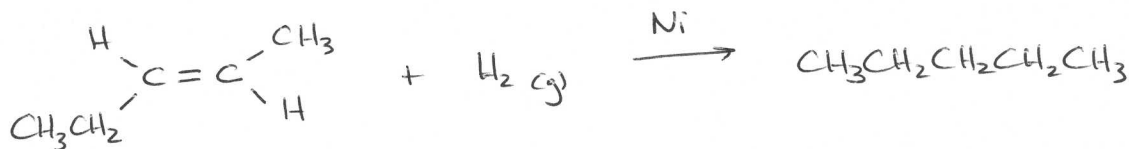
Alkanes:

Halogenation (bromination or chlorination): Substitution using Br_2 or Cl_2 . Light or heat are also needed. Products: HBr or HCl and a mixture of halogenated alkanes. Any number of halogen atoms can substitute for H at any location on the molecule.

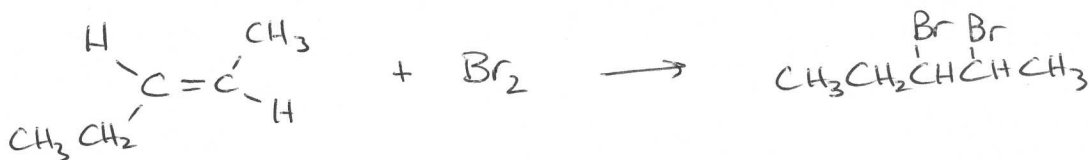


Alkenes: Addition reactions at the double bond (keep the rest of the reactant molecule's structure the same)

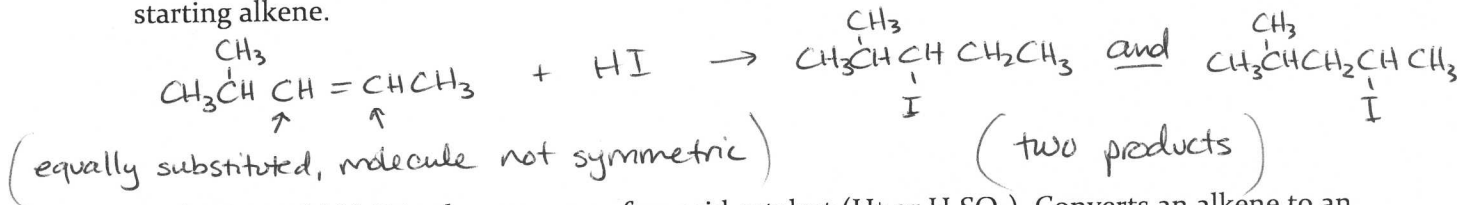
Hydrogenation: add $H_2 (g)$ in the presence of Pt or Ni catalyst. Converts an alkene to an alkane.



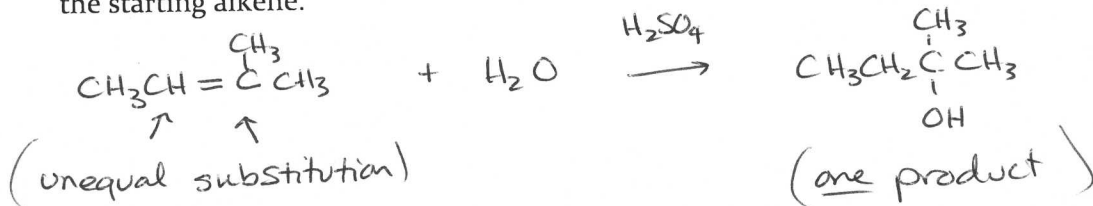
Halogenation (bromination or chlorination): add Br_2 or Cl_2 . No heat or light or any catalyst needed. Converts an alkene to a haloalkane with two halogen atoms on adjacent carbons.



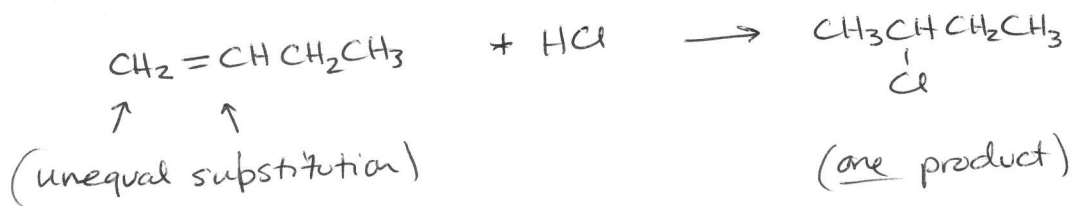
Hydrohalogenation (hydrochlorination, hydrobromination, hydroiodination): add HCl , HBr , or HI . No catalyst needed. Converts an alkene to a haloalkane with one halogen atom. Markovnikov's rule applies. You could get one product or two products, depending on the starting alkene.



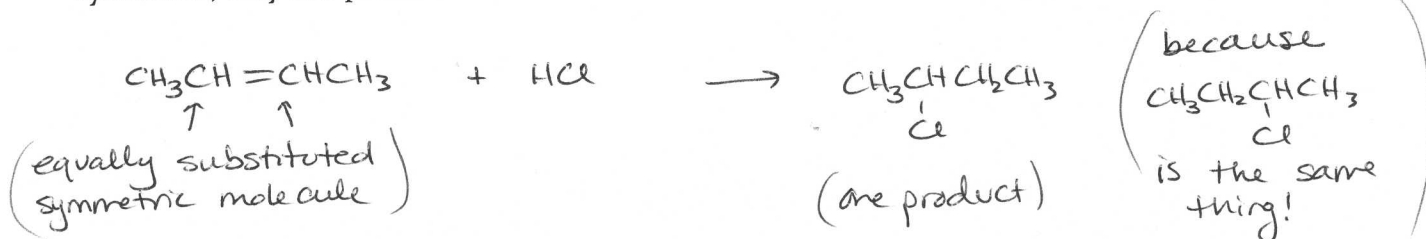
Hydration: add H_2O in the presence of an acid catalyst (H^+ or H_2SO_4). Converts an alkene to an alcohol. Markovnikov's rule applies. You could get one product or two products, depending on the starting alkene.



Markovnikov's rule: applies for hydrohalogenation and hydration of alkenes. The hydrogen atom will add to the site with more hydrogen atoms. The halogen or OH adds to the more highly substituted site.

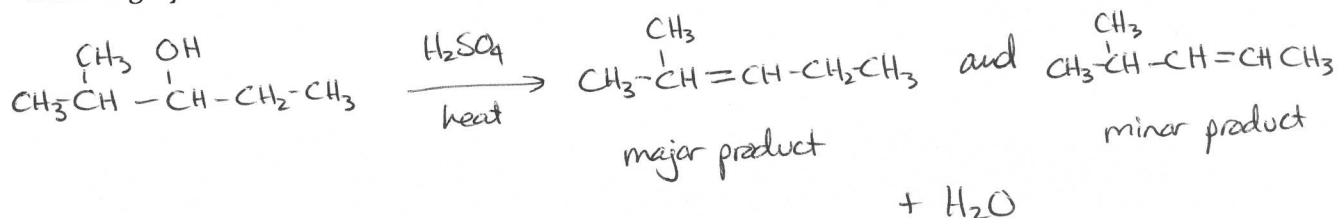


If the two sites have equal numbers of hydrogens, you could end up getting two different products. If the molecule is not symmetric, two products are formed. If the molecule is symmetric, only one product is formed.



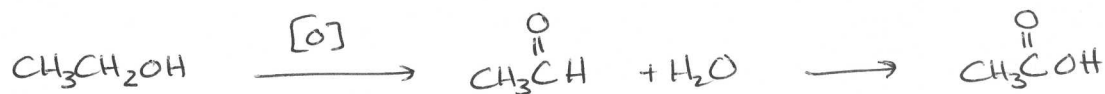
Alcohols:

Dehydration: heat an alcohol in the presence of an acid catalyst (H_2SO_4) to high temperature. Products: alkene(s) and water. The double bond could go on either side of the original position of the OH group. Could get a major and a minor product. The major product is the one with the more highly substituted double bond.

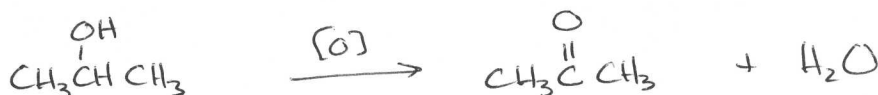


Oxidation:

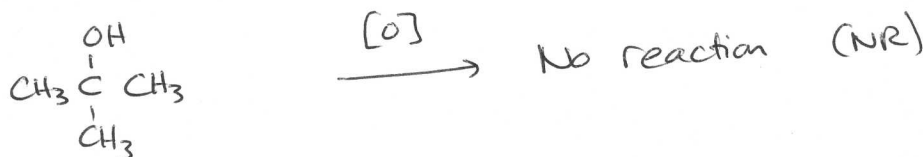
A 1° alcohol is oxidized to an aldehyde (+ H_2O) and then further to a carboxylic acid.



A 2° alcohol is oxidized to a ketone (+ H_2O) and no further.



A 3° alcohol cannot be oxidized. (Why?)



Phenols:

Reaction of phenol with water (phenol is a weak acid in water)



Thiols:

Oxidation of Thiols: In the presence of an oxidizing agent, two thiol groups can be joined to form a disulfide compound and water.



This can be reversed by reduction of the disulfide.



Aldehydes and ketones:

Oxidation:

An aldehyde is oxidized to a carboxylic acid.

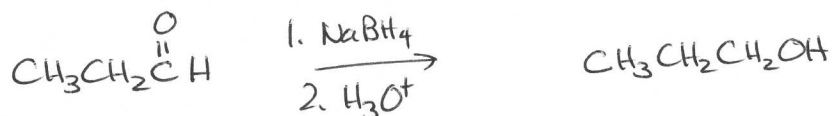


A ketone cannot be oxidized.



Reduction (reaction with a reducing agent such as NaBH_4):

An aldehyde is reduced to a 1° alcohol.



A ketone is reduced to a 2° alcohol.

