

CHEMISTRY DAILY PLAN

Class:

Date:

Subject: *Physical Properties and Preparations of Alkenes*

Time:

Physical Properties of Alkenes

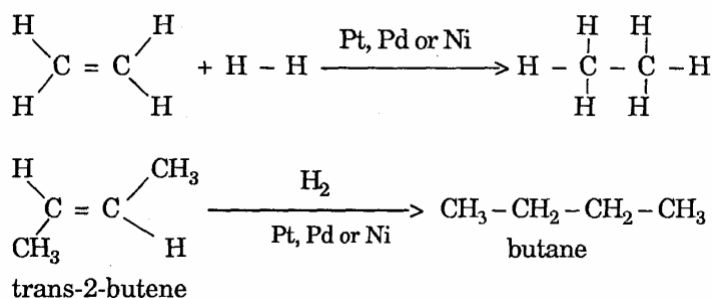
The first three alkene ethene, propene and butene are colorless gases. The pentene and higher homologous are liquids. They are insoluble in water but soluble in organic solvents.

Reactions of Alkenes

Alkenes react with a wide variety of chemical reagents. The characteristic reaction of alkenes is addition to the double bond.

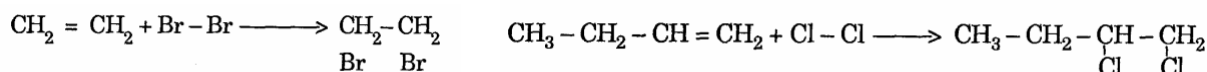
a) Hydrogenation

Alkenes react with hydrogen in the presence of catalysts to form alkanes. Addition of hydrogen to a double bond is called **hydrogenation**.



b) Addition of Halogens

Chlorine and bromine add readily to alkenes.



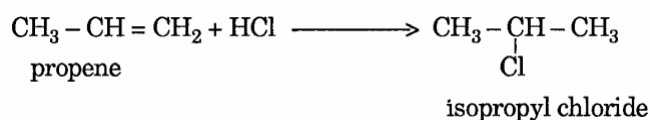
c) Addition of Hydrogen Halides and Markovnikov's Rule

The hydrogen halides HCl, HBr, and HI add to alkenes



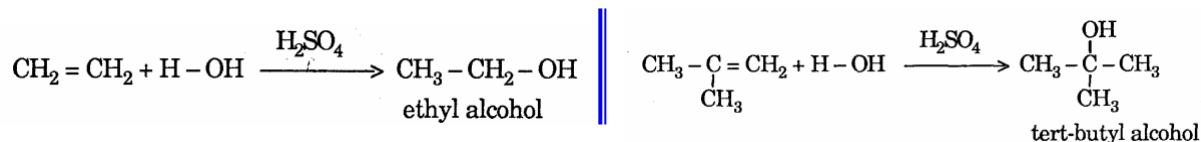
In the addition of an unsymmetrical reagent (HX, HOH, HCN, HOSO₃H) to an unsymmetrical alkene (olefin), such as CH₃CH=CH₂, the more positive fragment of the reagent (usually hydrogen) adds to the carbon atom with the greater number of attached hydrogen atoms. This rule was proposed by Markovnikov in 1871.

The applications of Markovnikov's rule are illustrated in following examples:



d) Addition of Water

Water adds to alkenes in the presence of an acidic catalyst. The reaction is often carried out by adding the alkene to a solution of sulfuric acid in water. Markovnikov's rule is followed. The -OH group is called a hydroxyl group.



Exercise: Write an equation for each of the following reactions.

- hydrogenation of 2-methyl propene
- addition of bromine to 1-butene
- acid-catalyzed addition of water to 2-butene
- addition of HBr to 2-butene

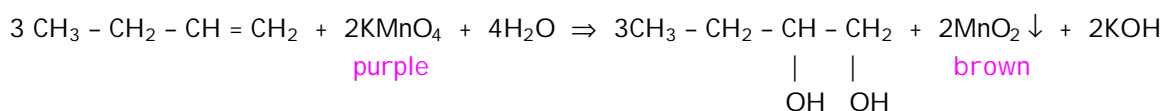
Exercise: If 7.2 g of water is added to an alkene, 24 g of an alcohol is obtained. What is the formula of the alkene?

Exercise: If 32 g of bromine (Br₂) can be added to a 10 gram mixture of ethylene (C₂H₄) and ethane (C₂H₆), what is the percentage by mass of C₂H₆ in the mixture?

Exercise: 11.2 liters of hydrogen gas at STP are required to saturate a 14.6 g mixture of ethylene (C₂H₄) and propene (C₃H₆). What is the mass of each gas in the mixture?

d) Oxidation

As do alkanes, alkenes burn in air to form CO₂ and H₂O. Alkenes also react with a variety of oxidizing agents. The reaction of an alkene with alkaline potassium permanganate is used as a test for the presence of a double bond in organic compounds. (It is called **Baeyer's Test**)



Exercise: The density of an alkene at STP is 3.125 g/L. If 0.1 mol of the alkene is burned and the CO₂ produced is passed into a solution of calcium hydroxide (Ca(OH)₂), what mass of calcium carbonate (CaCO₃) precipitates?

Exercise: How many grams of KMnO₄ which is 40% pure is required to oxidize ethylene (ethene) obtained from 9.2 g of ethyl alcohol?