

DIENES

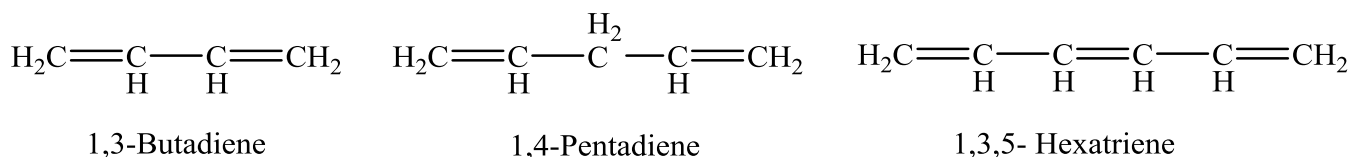
1. Structure and Nomenclature of dienes

Dienes are simply alkenes that contain two carbon – carbon double bonds. Therefore they have essentially the same properties as in the alkenes. And we shall say applied equally well to compounds with more than two double bonds.

2. Nomenclature of dienes

Dienes are named by the IUPAC system in the same way as alkenes, except at the ending diene is used, with two numbers to indicate the positions of the two double bonds. This system is easily extended to compounds containing any number of double bonds.

Example :-

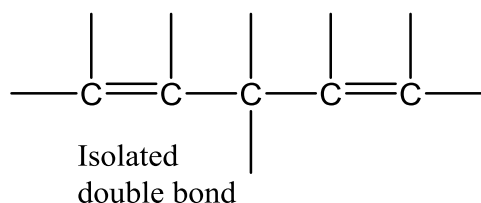
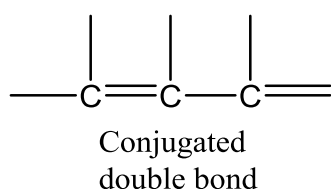


- Dienes are divided into three classes :-

The two important classes according to the arrangement of the double bonds are as follows :-

a- Double bonds that alternate with single bonds are said to be **Conjugated**.

b- Double bonds that are separated by more than one single bond are said to be **Isolated**.

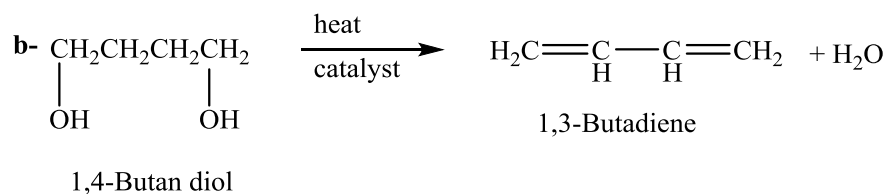
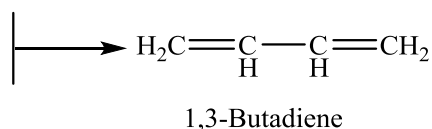
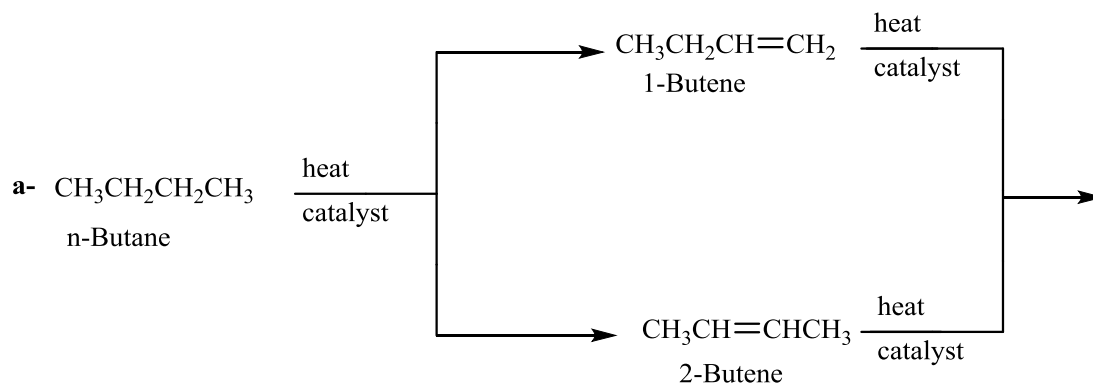


c- The third class of dienes of increasing interest to organic chemists, contain cumulated double bonds. These compounds are known as **allenes**.



3- Preparation and properties of dienes

Dienes are usually prepared by the same methods used to make simple alkenes, for example the most important diene ; 1,3-Butadiene : has been made by cracking process ; or by dehydration of an alcohol containing two OH group as below :-



- The chemical properties of a diene depend upon the arrangement of its double bonds. Isolated double bonds exert little effect on each other; and hence each reacts as though it were the only double bond in molecules. Except for the consumption of larger amounts of reagents , then the chemical properties of the non- conjugated dienes are identical with those of the simple alkenes .
- Conjugated dienes differ from simple alkenes in three ways:-
 - (a) They are more stable
 - (b) They undergo 1,4-addition
 - (c) Toward free radical addition , they are more reactive.

4- Stability of conjugated dienes

We find that the heats of hydrogenation of alkenes having similar structures are remarkably constant. For mono substituted alkenes $\text{R}-\underset{\text{H}}{\text{C}}=\text{CH}_2$

The values are very close to 30 kcal/ mole. for di substituted alkenes $\text{R}-\overset{\text{R}}{\text{C}}=\text{CH}_2$

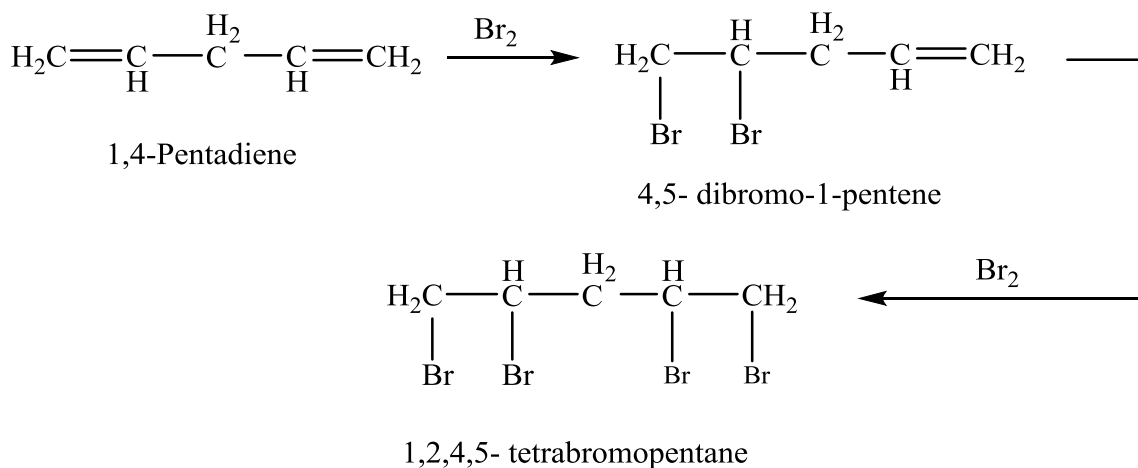
Is 28kcal/mole. and for tri substituted alkenes $\text{R}-\underset{\text{H}}{\text{C}}=\overset{\text{R}}{\text{C}}-\text{R}$

Is 27kcal/mole. For a compounds containing more than one double bond we might expect a heats of hydrogenation that is the sum of the heats of hydrogenation of the individual double bonds.

- For non-conjugated dienes this additives relationship is found to hold. As shown in 1,4-pentadiene and 1,5-Hexadiene. For example, have heats of hydrogenation very close to 2×30 kcal/mole or 60kcal/mole.

5- Electrophilic addition to conjugated dienes 1,4 addition

When 1,4-Pentadiene is treated with bromine under special condition the favor formation is the di halide, there is obtained the expected product, 4,5- dibromo-1-Pentene. Addition of more bromine yields the 1,2,4,5- tetra bromo pentane.



- This is typical of the behavior of dienes containing isolated double bonds; the double bonds react as though as they were is different molecules.
- When 1,3- Butadiene is treated with bromine under similar conditions, there are obtained not only the expected 3,4- dibromo-1-butene; But also 1,4-dibromo-2-Butene. Treatment with HCl yields not only 3-chloro-1-butene, But also 1- chloro-2-Butene. Hydrogenation yields not only 1-butene, But also 2-Butene as the equation below :-

