

## 3.2: Conjugated Dienes

### Objective

- Determine whether or not a molecule contains a conjugated system, given its Kekulé, condensed or shorthand formula.

### Key Terms

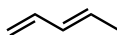
Make certain that you can define, and use in context, the key terms below.

- conjugated diene
- conjugated double bonds
- diene
- enone
- polyene

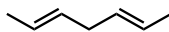
A diene is a hydrocarbon chain that has two double bonds that may or may not be adjacent to each other. The arrangements of these double bonds can have varying affects on the compounds reactivity and stability. This section focuses on the delocalization of pi systems by comparing two neighboring double bonds, specifically conjugated molecules. A molecule is defined as conjugated when there is a system of connected p orbitals where electron density can be shared across the system. The arrangement of bonds alternates between single and multiple bonds in conjugated molecules.

### Conjugated vs. Nonconjugated vs. Cumulated Dienes

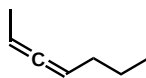
Conjugated dienes are two double bonds separated by a single bond. An example of this is penta-1,3-diene.



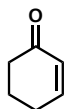
Nonconjugated dienes are two double bonds separated by more than one single bond. The double bonds are considered isolated from each other. An example of this is 2,5-heptadiene.



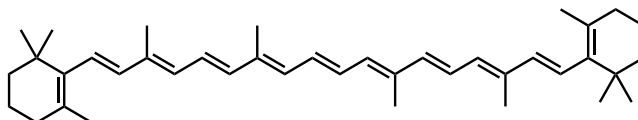
Cumulated dienes are two double bond connected to a similar atom. These are also known as allenes. An example of this is 2,3-heptadiene.



Another conjugated diene is an enone, which is a compound containing both a double bond and a carbonyl where the double bond is conjugated to the carbonyl. An example of this is cyclohex-2-en-1-one.

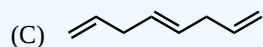
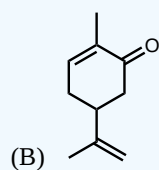
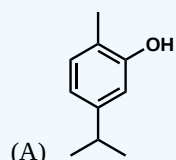


There are many compounds that have more than two double bonds present in the molecule. The term given to describe these molecules is polyene. An example of a polyene is beta-carotene (below). Beta-carotene is a red-orange pigment found in plants and fruits like carrots, which is converted to vitamin A in the human body.



### ? Exercise \(\PageIndex{1}\)

Are the following structures conjugated?



**Answer**

- (A) Yes - conjugated
- (B) Yes - conjugated
- (C) No - not conjugated

### Contributors and Attributions

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