1.4: Alkenes and Alkynes

Learning Objective

- How to name alkenes and alkynes.

An **alkane** is a **saturated** hydrocarbon, meaning that the molecule contains all the possible hydrogen atoms because all the carbon-carbon bonds are single bonds. If one of those carbon-carbon bonds is a double bond, the resulting hydrocarbon is **unsaturated** and called an **alkene**.

This alkene is named propene.

Figure 1.4.1: propene

If one of the carbon-carbon bonds is a triple bond, the resulting hydrocarbon is called an **alkyne**.

Practice Question

1. This alkyne is named ethyne.

Figure 1.4.2: ethyne

What is the name of Molecule A?

Figure 1.4.3: Molecule A

The double or triple bond is called a **functional group,** and is often the site where chemical reactions occur. Like a substituent, it is specified in the molecular name. When naming molecules according to the IUPAC system of nomenclature, remember **prefix-parent-suffix** (like un-believe-able).

prefix: what are the substituents?

parent: how many carbons? If there is a double or triple carbon-carbon bond in the molecule, both carbons in that bond must belong to the parent carbon chain, even if that chain does not have the greatest number of carbons.

suffix: what is the family of compounds?

Practice Questions

1. This molecule is named 2-pentene.

Figure 1.4.4: 2-pentene

What is the name of Molecule B?

Figure 1.4.5: Molecule B

What is the name of Molecule C?

Figure 1.4.6: Molecule C

2. This molecule is named 4-methyl-2-pentene.

Figure 1.4.7: 4-methyl-2-pentene

What is the name of Molecule D?

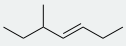

Figure 1.4.8: Molecule D

3. This molecule is named 3-isobutyl-1-octyne.

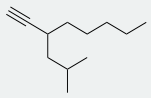

Figure 1.4.9: 3-isobutyl-1-octyne

What is the name of Molecule E?

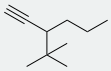

Figure 1.4.10: Molecule E

4. This molecule is named cyclohexene.

Figure 1.4.11: cyclohexene

What is the name of Molecule F?

Figure 1.4.12: Molecule F

5. This molecule is named 4-methylcyclohexene. Number the carbons.

Figure 1.4.13: 4-methylcyclohexene

What is the name of Molecule G?

Figure 1.4.14: Molecule G

6. This molecule is named 1,3-pentadiene.

Figure 1.4.15: 1,3-pentadiene

What is the name of Molecule H?

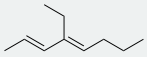

Figure 1.4.16: Molecule H

7. The location of substituents relative to the double bonds can lead to a type of constitutional isomer known as a **positional isomer**.

The name of this molecule is 5-methyl-1,3-cyclohexadiene.

Figure 1.4.17: 5-methyl-1,3-cyclohexadiene

What is the name of Molecule I?

Figure 1.4.18: Molecule I

Double or triple carbon-carbon bonds are rigid and planar. Since the carbons cannot rotate freely around the bond, **cis/trans isomers** are common, and the orientation may be important for chemical reactions.

Figure 1.4.19: cis-2-butene and trans-2-butene

Practice Questions

1. Write the steps that you use to name an alkene and an alkyne, in order, as instructions for a student who doesn't know how to do it.
2. Draw any alkene or alkyne and go through the steps in naming your molecule.
