Nomenclature of Alkanes, Alkene, and Alkynes

1. What type of molecule is it? If straight chain, go to number 2. If branched chain go to number 3. If cyclic go to number 4.

2. **Straight-chain** alkanes are named by counting the number of C atoms in the backbone and adding the family name -ane (if only single bonds). If a double bond is present add the family name -ene. If a triple bond is present add the family name -yne (Refer to Table 12.3 for the list of parent names) When naming a straight chain alkene or alkyne, you must number the carbon that the double/triple bond is on. For example 2-heptene.

3. **Branched chain** hydrocarbons can be named in the following 4 steps.

   i. **Name the main chain.** Find the longest continuous chain of carbons, and name the chain according to the number of carbon atoms it contains. The longest chain may not be immediately obvious because it is not always written on one line; you may have to “turn corners” to find it. *Always begin counting the number of carbons in the carbon backbone from an end carbon (primary carbon)*

   ![Diagram](image)
   - the longest carbon chain is 7 carbons, not 6 carbons long.
   - it is numbered from R → L because that way the branched carbon can have the smallest # possible.

   ![Diagram](image)
   - start numbering from R because it’s closer to branch point (alkane)

   ![Diagram](image)
   - start numbering from L → R because L is closer to the double bond (alkene & alkyne)

   ![Diagram](image)
   - 3-methyl-1-heptane
   - 3-methyl-hexane
   - 4-methyl-2-hexene
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III. Identify the branching substituents, and number each according to its point of attachment to the main chain. (For a list of substituents refer to Table 12.4)
-If there are two substituents on the same carbon, assign the same number to both. There must always be as many numbers in the name as there are substituents.

a. If the branched points have the different numbering from the left and the right, you want to number the chain based on the lowest number priority to the branched groups regardless of alphabetical priority. (For alkanes only)

b. If the branched points have the same number numbering from the left and the right, you want to number the chain based on alphabetical priority of the branched groups. (For alkanes only)

c. For alkenes and alkynes, the branch point does not matter as much as the location of the double/ triple bonds. Remember to start numbering the carbon backbone at the end closest to the double triple bond, and then allow the substituents to have the lowest number possible.

VI. Write the name as a single word, using hyphens to separate the numbers from the different prefixes and commas to separate numbers if necessary. If two or more different substituent groups are present, cite them in alphabetical order.
-If two or more identical substituents are present (doesn't need to be on the same carbon, the substituents can be on any carbon), use one of the prefixes di-, tri-, tetra-, and so forth, but do not use these prefixes for alphabetizing purposes.
-Remember if there are double or triple bonds, the suffix changes to -ene or -yne, and you are required to number the carbon that the double/triple bond is on.
4. **Cycloalkanes** are named by a straightforward extension of the rules for naming open-chain alkanes. In most cases, only two steps are needed.

I. **Use the cycloalkane name as the parent.** *Be sure to count only the number of carbons in the ring, not the longest chain of carbons!* If there is only one substituent on the ring, it is not even necessary to assign a number because all ring positions are identical. **If the ring contains a double bond it is called a cycloalkene, if it contains a triple bond, it is called a cycloralkyne.**

II. **Identify and number the substituents.**

   a. **For cycloalkanes with only 2 substituents.** Identify and number the substituents. Start numbering at the group that has alphabetical priority, and proceed around the ring in the direction that gives the second substituent the lower possible number.

   b. **For cycloalkanes with 3 or more substituents.** You want to number the carbons in the ring based on the lowest number priority regardless of alphabetical priority.
c. If you are naming a cycloalkene or cycloalkyne, the carbons with the double or triple bond is always numbered 1,2. You will number the carbons clockwise or counterclockwise to allow for the substituent to have the smallest number possible.