5.1: Alkenes and Alkynes

The general rules for naming alkenes and alkynes are similar to those for alkanes, using the alkyl prefixes and ending with *-ene* or *-yne* respectively.

Some alkenes and alkynes have common names.

IUPAC name	Common name
ethene	ethylene
propene	propylene
ethyne	acetylene

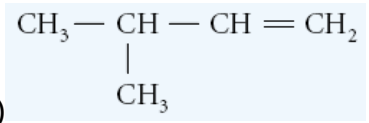
Step 1. The parent chain must be an alkene or alkyne, and thus must contain the multiple bond.

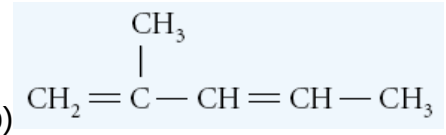
Step 2. When numbering the C atoms in the parent chain, begin with the end closest to the multiple bond.

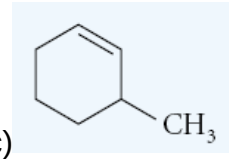
Step 3. The location of the multiple bond is indicated by the number of the C atom that begins the multiple bond; for example, if a double bond is between the second and third C atoms of a pentene, it is named 2-pentene.

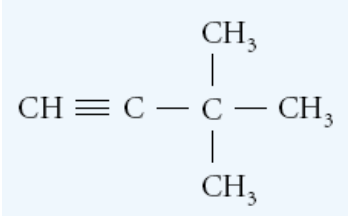
Step 4. The presence and location of multiple double bonds or triple bonds is indicated by the prefixes *di-*, *tri-*, etc.; for example, an octene with double bonds at the second, fourth, and sixth C atoms is named 2,4,6-octatriene.

Sample: Name the following molecules

a) 

b) 

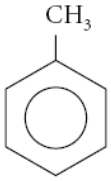
c) 

d) 

Naming Aromatic Hydrocarbons

1. If an alkyl group is attached to a benzene ring, the compound is named as an alkylbenzene. Alternatively, the benzene ring may be considered as a branch of a large molecule; in this case, the benzene ring is called a phenyl group.

2. If more than one alkyl group is attached to a benzene ring, the groups are numbered using the lowest numbers possible, starting with one of the added groups.

a) 

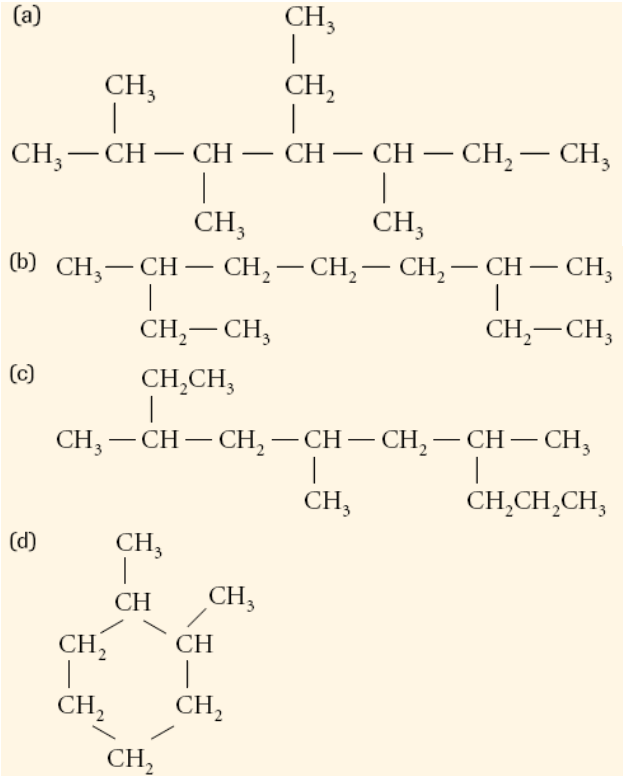
Physical Properties of Hydrocarbons

Since hydrocarbons contain only C and H atoms, two elements with very similar electronegativities, bonds between C and H are relatively nonpolar. The main intermolecular interaction in hydrocarbons is van der Waals forces: the attraction of the electrons of one molecule for the nuclei of another molecule. Since these intermolecular forces are weak, the molecules are readily separated. The low boiling points and melting points of the smaller molecules are due to the fact that small molecules have fewer electrons and weaker van der Waals forces, compared with large molecules. These differences in boiling points of the components of petroleum enable the separation of these compounds in a process called fractional distillation. Hydrocarbons, being largely nonpolar, generally have very low solubility in polar solvents such as water, which is why gasoline remains separate from water. This property of hydrocarbons makes them good solvents for other nonpolar molecules.

SCH4C: Organic Chemistry

Worksheet 5.1: Hydrocarbons

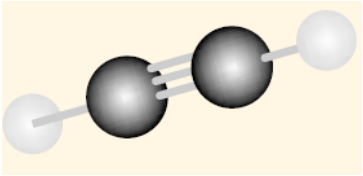
1. Write IUPAC names for the following hydrocarbons.



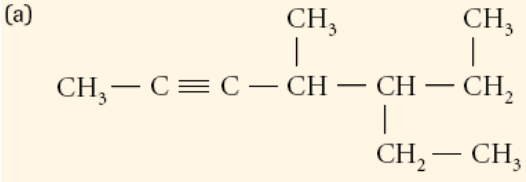
2. Draw a structural diagram for each of the following hydrocarbons:
(a) 3,3,5-trimethyloctane
(b) 3,4-dimethyl-4-ethylheptane
(c) 2-methyl-4-isopropylnonane
(d) cyclobutane
(e) 1,1-diethylcyclohexane

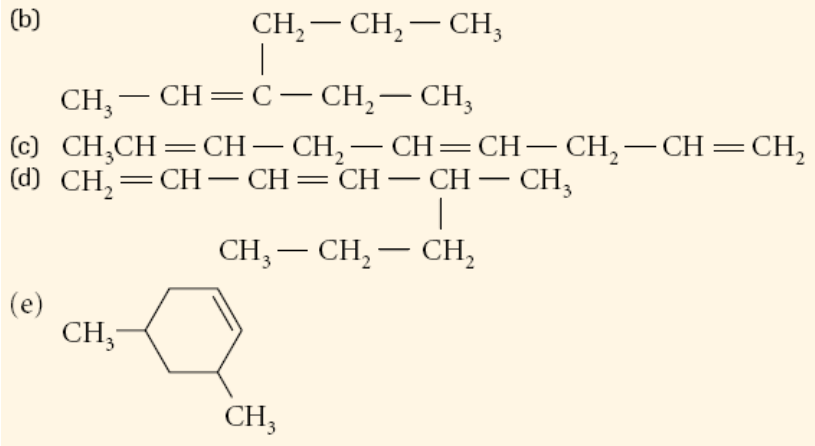
3. Explain why no number is used in the names ethene and propene.

4. Write the IUPAC name and the common name for the following compound.



5. Write IUPAC names for the compounds with the following structural diagrams:





6. Draw structural diagrams for each of the following compounds:
   (a) 2-methyl-5-ethyl-2-heptene
   (b) 1,3,5-hexatriene
   (c) 3,4-dimethylcyclohexene
   (d) 1-butyne
   (e) 4-methyl-2-pentyne

7. Write IUPAC names for the following hydrocarbon