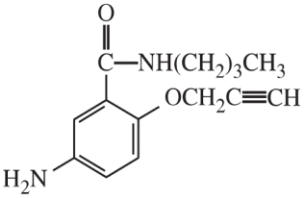
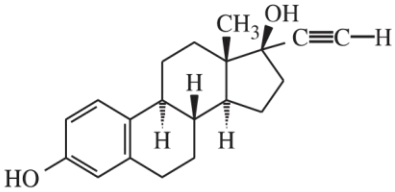
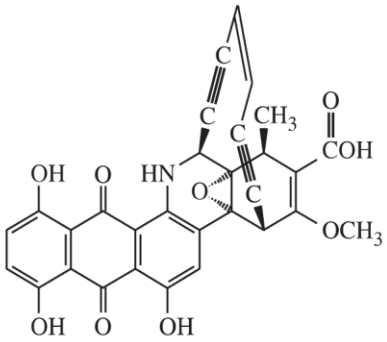


parsalmide



ethynyl estradiol



dynemicin A

PROBLEM 9-1

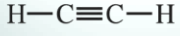
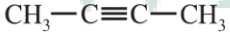
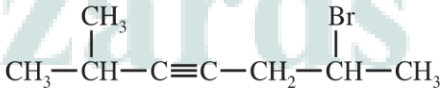
(a) Count the elements of unsaturation in the three structures shown above (parsalmide, ethynyl estradiol, and dynemicin A).

(b) Draw structural formulas of at least two alkynes of each molecular formula.

(1) C_6H_{10} **(2)** C_8H_{12} **(3)** C_7H_8

9-2 Nomenclature of Alkynes

IUPAC Names The IUPAC nomenclature for alkynes is similar to that for alkenes. We find the longest continuous chain of carbon atoms that includes the triple bond and change the *-ane* ending of the parent alkane to *–yne*. The chain is numbered from the end closest to the triple bond, and the position of the triple bond is designated by its lower-numbered carbon atom. Substituents are given numbers to indicate their locations.

				
old IUPAC name:	ethyne	propyne	2-butyne	6-bromo-2-methyl-3-heptyne
new IUPAC name:	ethyne (acetylene)	propyne	but-2-yne	6-bromo-2-methylhept-3-yne

When additional functional groups are present, the suffixes are combined to produce the compound names of the *alkenynes* (a double bond and a triple bond), *alkynols* (a triple bond and an alcohol), and so on. The new IUPAC system (placing the number right before the group) helps to clarify these names. The IUPAC rules give alcohols higher priority than alkenes or alkynes (which are given equal priority), so the numbering begins at the end closer to an alcohol. The priorities of functional groups in naming organic compounds are listed in Table 9-1. If the double bond and the triple bond are equidistant from the ends of the chain, number the chain so that the double bond receives a lower number than the triple bond (because "ene" comes before "yne" in the alphabet).

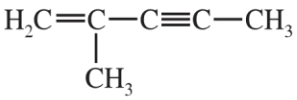
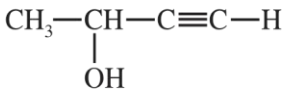
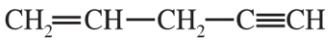
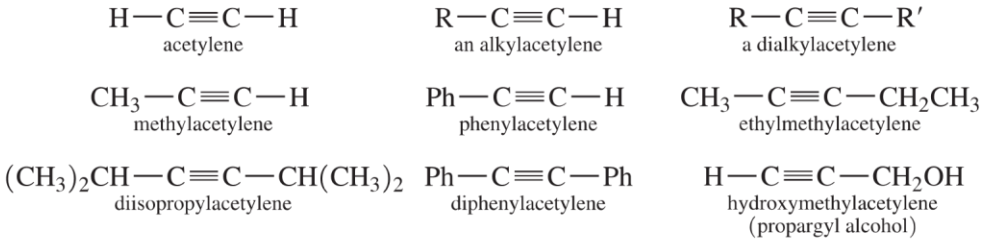
			
old IUPAC name:	2-methyl-1-penten-3-yne	3-butyn-2-ol	1-penten-4-yne
new IUPAC name:	2-methylpent-1-en-3-yne	but-3-yn-2-ol	pent-1-en-4-yne

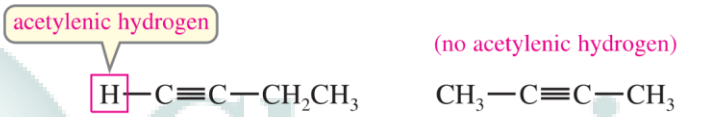
TABLE 9-1 Priority of Functional Groups in Naming Organic Compounds

acids (highest)
esters
aldehydes
ketones
alcohols
amines
alkenes, alkynes
alkanes
ethers
alkyl halides (lowest)

Common Names The common names of alkynes describe them as derivatives of acetylene. Most alkynes can be named as a molecule of acetylene with one or two alkyl substituents. This nomenclature is like the common nomenclature for ethers, where we name the two alkyl groups bonded to oxygen.



Many of an alkyne's chemical properties depend on whether there is an acetylenic hydrogen (H—C≡C), that is, whether the triple bond comes at the end of a carbon chain. Such an alkyne is called a **terminal alkyne** or a **terminal acetylene.** If the triple bond is located somewhere other than the end of the carbon chain, the alkyne is called an **internal alkyne** or an **internal acetylene.**



PROBLEM 9-2

For each molecular formula, draw all the isomeric alkynes, and give their IUPAC names. Circle the acetylenic hydrogen of each terminal alkyne.
(a) C_5H_8 (three isomers) **(b)** C_6H_{10} (seven isomers)

9-3 Physical Properties of Alkynes

The physical properties of alkynes (Table 9-2) are similar to those of alkanes and alkenes of similar molecular weights. Alkynes are relatively nonpolar and nearly insoluble in water. They are quite soluble in most organic solvents, including acetone, ether, methylene chloride, chloroform, and alcohols. Many alkynes have characteristic, mildly offensive odors. Ethyne, propyne, and the butynes are gases at room temperature, just

TABLE 9-2 Physical Properties of Selected Alkynes

Name	Structure	mp (°C)	bp (°C)	Density (g/cm^3)
ethyne (acetylene)	H—C≡C—H	−82	−84	0.62
propyne	H—C≡C—CH_3	−101	−23	0.67
but-1-yne	H—C≡C—CH_2CH_3	−126	8	0.67
but-2-yne	CH_3—C≡C—CH_3	−32	27	0.69
pent-1-yne	H—C≡C—$CH_2CH_2CH_3$	−90	40	0.70
pent-2-yne	CH_3—C≡C—CH_2CH_3	−101	55	0.71
3-methylbut-1-yne	CH_3—$CH(CH_3)$—C≡C—H		28	0.67
hex-1-yne	H—C≡C—$(CH_2)_3$—CH_3	−132	71	0.72
hex-2-yne	CH_3—C≡C—$CH_2CH_2CH_3$	−90	84	0.73
hex-3-yne	CH_3CH_2—C≡C—CH_2CH_3	−101	82	0.73
3,3-dimethylbut-1-yne	$(CH_3)_3C$—C≡C—H	−81	38	0.67
hept-1-yne	H—C≡C—$(CH_2)_4CH_3$	−81	100	0.73
oct-1-yne	H—C≡C—$(CH_2)_5CH_3$	−79	125	0.75
non-1-yne	H—C≡C—$(CH_2)_6CH_3$	−50	151	0.76
dec-1-yne	H—C≡C—$(CH_2)_7CH_3$	−36	174	0.77