

Exercise 1. What is the geometry around an sp-hybridized carbon?

- a) Tetrahedral
 - b) Trigonal planar
 - c) Bent
 - d) Linear
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Exercise 2. How many unhybridized p orbitals remain in an sp²-hybridized carbon?

- a) 0
 - b) 1
 - c) 2
 - d) 3
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Exercise 3. Which hybridization is found in the carbons of a typical alkene?

- a) sp
 - b) sp²
 - c) sp³
 - d) Depends on substituents
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Exercise 4. Isomers are molecules that:

- a) Have different molecular formulas
 - b) Have the same molecular formula but different structures
 - c) Are mirror images only
 - d) Must have double bonds
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Exercise 5. Hydrocarbons (containing only C and H) are generally:

- a) Strongly polar
 - b) Slightly polar
 - c) Nonpolar
 - d) Ionic
-

Exercise 6. For each of the statements below, write if it is TRUE or FALSE:

- a) The boiling point of alkanes increases as the carbon chain becomes longer.
- b) Branched alkanes are more reactive than straight-chain alkanes because they have weaker C–H bonds.
- c) Alkanes can undergo addition reactions readily.
- d) Cycloalkanes have the general formula C_nH_{2n}.
- e) Geometric isomerism is possible in alkenes when each carbon of the C=C bond has two different substituents.

- f) All carbons in benzene are sp^2 -hybridized.
g) Aromatic compounds typically undergo substitution reactions rather than addition reactions.
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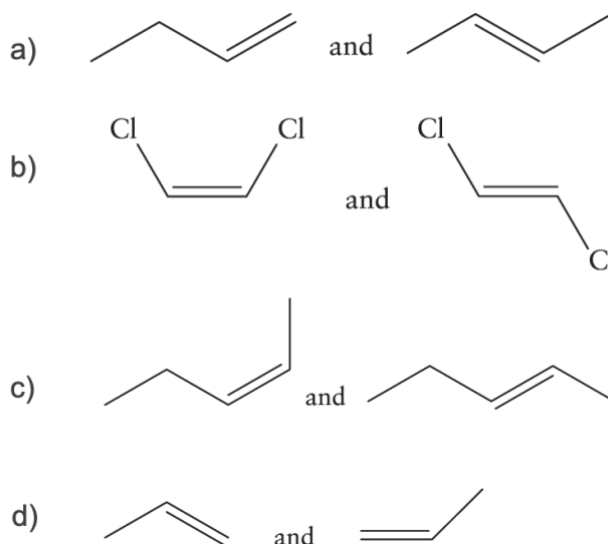
Exercise 7. For each of the statements below, write if it is TRUE or FALSE:

- a) Oxidation of an alcohol typically increases the number of C–O bonds in a molecule.
b) Reduction reactions in organic chemistry usually involve adding hydrogen or removing oxygen.
c) Ethers and esters have two carbon atoms bonded to the same oxygen atom.
d) Halogenoalkanes (alkyl halides) cannot undergo substitution reactions.
e) Oxygen-containing functional groups generally make a molecule more hydrophobic.
f) C–O bond is generally more polar than C–X (halogen).
g) Aldehydes and ketones have the same functional group (C=O) located at the terminal carbon or non-terminal carbon, respectively.
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Exercise 8. Draw line structures of the following molecules and identify each as an alkane, alkene or alkyne

- a) CH_3CCCH_3
b) $CH_3CH_2CH_2CH_3$
c) $CH_2CHCH_2CH_3$
d) $CH_3CHCHCH_2CCCH_3$
e) $CH_2CHCH_2CHCH_2$
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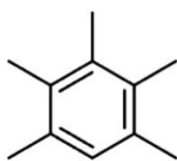
Exercise 9. Identify each of the following pairs as structural isomers, geometric isomers, or not isomers:



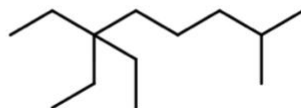
Exercise 10. How many different products containing 2 carbon atoms are possible in substitution reactions of chlorine and ethane? Do any of the products exist as geometric or optical stereoisomers?

Exercise 11. Name the following hydrocarbon molecules:

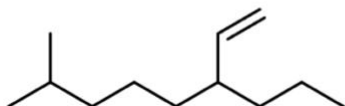
a)



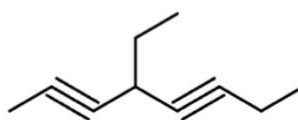
b)



c)

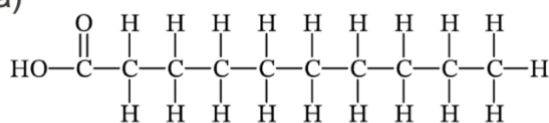


d)

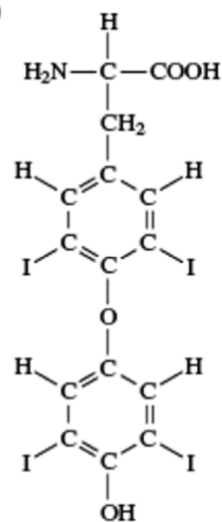


Exercise 12. Below are 4 important biomolecules found in human body: (a) capric acid, (b) lysine, (c) glucose, and (d) thyroxine. Identify and name all the heteroatom-containing functional groups:

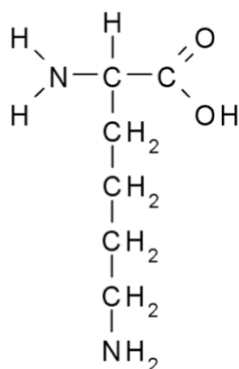
a)



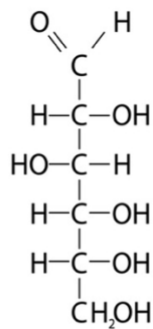
d)



b)



c)



Exercise 13. Draw the line structures of the following molecules:

a) Hexan-3-one

b) Butanal

c) Butan-2-ol

d) Pentan-3-amine

e) 2-chloro-3-methylpentanoic acid

Quick Answers:

1. d)

2. b)

3. b)

4. b)

5. c)

6.

a) TRUE

b) FALSE

c) FALSE

d) TRUE

e) TRUE

f) TRUE

g) TRUE

7.

a) TRUE

b) TRUE

c) TRUE

d) FALSE

e) FALSE

f) FALSE

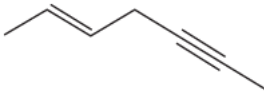
g) TRUE


8.

a) Alkyne: 

b) Alkane: 

c) Alkene: 

d) Alkene and Alkyne: 

e) Alkene: 

9.

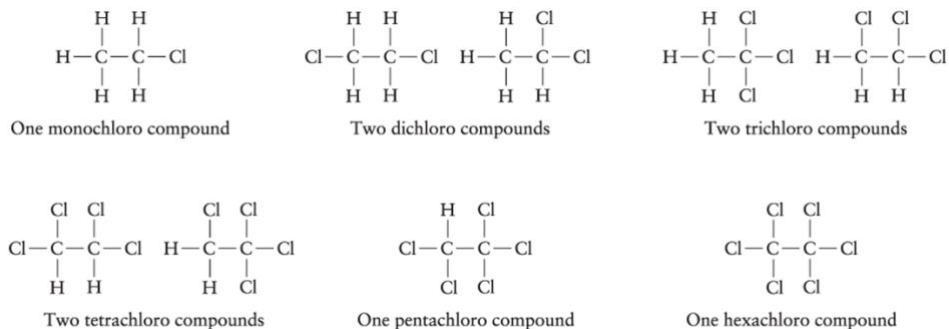
a) Structural isomers

b) Geometric isomers

c) Geometric isomers

d) Not isomers.

10.



No isomers among these compounds.

11.

- a) 1,2,3,4,5-pentamethylbenzene
- b) 6,6-Diethyl-2-methyloctane
- c) 7-methyl-3-propyloct-1-ene (or 7-methyl-3-propyl-1-octene)
- d) 4-ethylocta-2,5-diyne (or 4-ethyl-2,5-octadiyne)

12.

- a) Carboxylic acid (-COOH)
- b) Primary amines (-NH₂) on 2 opposite ends; Carboxylic acid (-COOH)
- c) Aldehyde (-CHO); Multiple alcohols (-OH) on carbons 2, 3, 4, 5, and 6
- d) Alcohol OH groups (two of them); Ether linkage (Ar-O-Ar); Primary amine (-NH₂); Carboxylic acid (-COOH); Iodo substituents on the aromatic rings (four iodine atoms)

13.

