

Chapter 2—Unsaturated Hydrocarbons

MULTIPLE CHOICE

1. **Name a difference between a saturated and an unsaturated hydrocarbon.**
- Saturated hydrocarbons are composed of only carbon and hydrogen, and unsaturated hydrocarbons include other atoms than just carbon and hydrogen.
 - Saturated hydrocarbons do not contain multiple bonds between carbons, but unsaturated hydrocarbons do contain multiple bonds.
 - Unsaturated hydrocarbons are flammable but saturated hydrocarbons are not.
 - Saturated hydrocarbons are essentially insoluble. Unsaturated hydrocarbons are soluble.

ANS: B PTS: 1

2. **Which characteristic relates to alkenes but not the other hydrocarbon families?**
- saturation
 - halogen substitution
 - double bonds
 - triple bonds

ANS: C PTS: 1

3. **What number would be used to indicate the double bond position in the IUPAC name for**



- 1
- 2
- 3
- 4

ANS: B PTS: 1

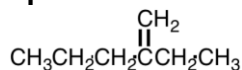
4. **In the IUPAC name for the following compound, the -Br group is located at what position of the compound shown?**



- 1
- 2
- 3
- 4

ANS: C PTS: 1

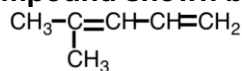
5. **What is the IUPAC name for the compound shown below?**



- 3-ethyl-1-pentene
- 2-ethyl-2-pentene
- 3-ethyl-3-pentene
- 2-ethyl-1-pentene

ANS: D PTS: 1

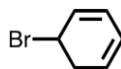
6. **What is the IUPAC name for the compound shown below?**



- 2-methyl-1,4-pentadiene
- 2-methyl-2,4-dipentene
- 4-methyl-1,3-pentadiene
- 4-methyl-2,4-pentadiene

ANS: C PTS: 1

7. **Which of the following is the correct IUPAC name for the following compound ?**



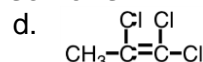
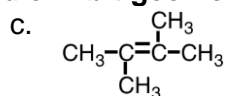
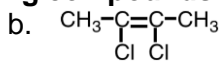
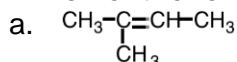
- 5-bromo-1,3-cyclohexadiene
- 2-bromo-1,4-cyclohexadiene

b. 6-bromo-1,3-cyclohexadiene

d. 3-bromo-1,5-cyclohexadiene

ANS: A PTS: 1

8. Which of the following compounds could exhibit geometric isomerism?



ANS: B PTS: 1

9. Which of the following can exhibit geometric isomerism?

a. 1-propene

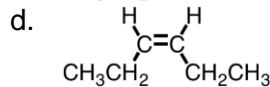
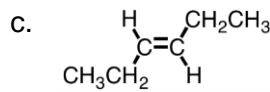
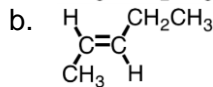
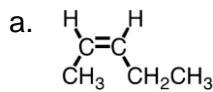
c. 2,3-dimethyl-2-butene

b. 1,2,2-tribromoethene

d. 1-bromo-1-propene

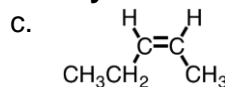
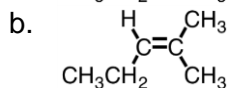
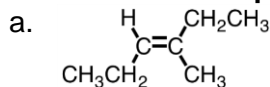
ANS: D PTS: 1

10. Which of the following compounds is *trans*-3-hexene?



ANS: C PTS: 1

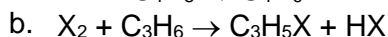
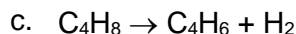
11. Which of the compounds below could correctly be called a *cis* compound?



d. None of these

ANS: C PTS: 1

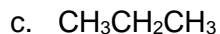
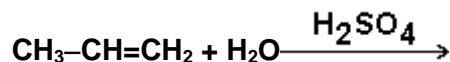
12. Which of the following represents an addition reaction?



d. more than one response is correct

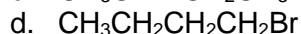
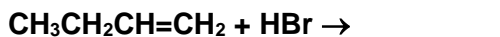
ANS: A PTS: 1

13. Select the major product that would result from the reaction below.



ANS: A PTS: 1

14. Select the major product that would result from the reaction below.



ANS: C PTS: 1

15. What reagent or reagents is required for the conversion of cyclohexene to cyclohexane?

- a. HCl
b. H₂O and H₂SO₄
c. H₂ and H₂SO₄
d. H₂ and Pt

ANS: D PTS: 1

16. Which of the following is the polymer produced from CH₃-CH=CH-Cl?

- a. $\left[\begin{array}{c} \text{Cl} \\ | \\ \text{C}=\text{C} \\ | \\ \text{CH}_3 \end{array} \right]_n$
b. $\left[\begin{array}{cc} \text{H} & \text{Cl} \\ | & | \\ \text{---C} & \text{---C---} \\ | & | \\ \text{CH}_3 & \text{H} \end{array} \right]_n$
c. $\left[\begin{array}{c} \text{H}_2 & \text{Cl} \\ | & | \\ \text{C} & \text{---C---} \\ | & \\ \text{H} & \end{array} \right]_n$
d. $\left[\begin{array}{c} \text{H}_2 \\ | \\ \text{C} & \text{---C---} \\ | & | \\ \text{Cl} & \text{H} \end{array} \right]_n$

ANS: B PTS: 1

17. What is the addition polymer produced from the monomer shown below?

- a. $\left[\begin{array}{c} \text{Cl} \\ | \\ \text{C}=\text{C} \\ | \\ \text{CH}_3 \end{array} \right]_n$
b. $\left[\begin{array}{cc} \text{H} & \text{Cl} \\ | & | \\ \text{---C} & \text{---C---} \\ | & | \\ \text{CH}_3 & \text{H} \end{array} \right]_n$
c. $\left[\begin{array}{cc} \text{Cl} & \text{H}_2 \\ | & | \\ \text{---C} & \text{---C---} \\ | & \\ \text{CH}_3 & \end{array} \right]_n$
d. $\left[\begin{array}{cc} \text{H} & \text{H}_2 \\ | & | \\ \text{---C} & \text{---C---} \\ | & \\ \text{CH}_2\text{Cl} & \end{array} \right]_n$

ANS: C PTS: 1

18. A portion of the structure of Acrilan® is shown. What is the structure of the monomer?

- $\text{---CH}_2\text{---CH---CH}_2\text{---CH---CH}_2\text{---CH---CH}_2\text{---}$
 | | |
 CN CN CN
- a. $\begin{array}{c} \text{NH}_2 & \text{H} \\ | & | \\ \text{C}=\text{C} \\ | & | \\ \text{H} & \text{CH}_3 \end{array}$
b. CH₃-CH₂-CN
c. $\begin{array}{c} \text{CN} \\ | \\ \text{CH}_3\text{---CH---CH}_3 \end{array}$
d. $\begin{array}{c} \text{H} & \text{H} \\ | & | \\ \text{C}=\text{C} \\ | & | \\ \text{H} & \text{CN} \end{array}$

ANS: D PTS: 1

19. Which of the following is the monomer used to produce Teflon®?

- a. $\begin{array}{c} \text{F} & \text{H} \\ | & | \\ \text{C}=\text{C} \\ | & | \\ \text{H} & \text{H} \end{array}$
b. $\begin{array}{c} \text{F} & \text{H} \\ | & | \\ \text{C}=\text{C} \\ | & | \\ \text{H} & \text{Cl} \end{array}$
c. $\begin{array}{c} \text{F} & \text{H} \\ | & | \\ \text{C}=\text{C} \\ | & | \\ \text{Cl} & \text{Cl} \end{array}$
d. $\begin{array}{c} \text{F} & \text{F} \\ | & | \\ \text{C}=\text{C} \\ | & | \\ \text{F} & \text{F} \end{array}$

ANS: D PTS: 1

20. Which is the formula for an alkene?

- a. CH₃CHCH₂
b. CH₃CH₂CH₂
c. CH₃CH₃CH₂
d. More than one response is correct.

ANS: A PTS: 1

21. Which is the formula for an alkyne?

- a. CH₃CH₂CCH₂
b. CH₃CH₂CH₂CH₃
c. CH₃CH₂CCH
d. CH₃CH₂CCH₂

ANS: C PTS: 1

22. Which is a difference between butane and butene?

- a. butane burns and butene does not
b. the presence of a double bond
c. they are isomers
d. the presence of a triple bond

ANS: B PTS: 1

23. **Which is a difference between butene and cyclobutene?**

- a. They are isomers.
- b. Cyclobutene has 2 double bonds, butene does not.
- c. The location of the double bond is terminal in cyclobutene, but between interior carbons in butene.
- d. Cyclobutene is missing more hydrogens than is butene.

ANS: D PTS: 1

24. **Which is a difference between butyne and cyclobutyne?**

- a. Cyclobutyne does not exist.
- b. Butyne's multiple bond is interior, cyclobutyne is not between interior carbons.
- c. Cyclobutyne burns much hotter than butyne because of the greater unsaturation.
- d. Both b and c are differences between the molecules.

ANS: A PTS: 1

25. **Which of the following is the correct IUPAC name for the compound**



- a. 4-bromopentyne
- b. 1-bromo-2-pentyne
- c. 1-bromo-3-pentyne
- d. 5-bromo-2-pentyne

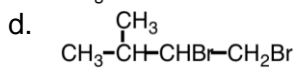
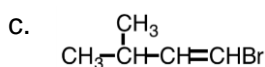
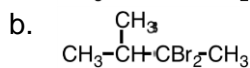
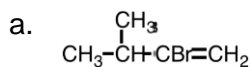
ANS: D PTS: 1

26. **The addition of two moles of hydrogen to an alkyne produces an _____ .**

- a. alkane
- b. alkene
- c. aromatic
- d. alkyl halide

ANS: B PTS: 1

27. **Select the product of the following reaction.**



ANS: B PTS: 1

28. **Acetylene is commercially useful as a fuel for torches and as**

- a. a starting material for plastics.
- b. an industrial solvent.
- c. an ingredient in pesticides.
- d. a component in paint formulations.

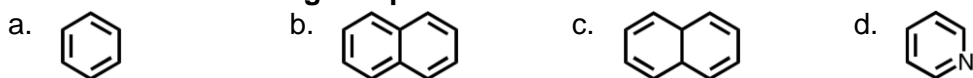
ANS: A PTS: 1

29. **What is the characteristic of aromatic compounds that is responsible for them being named aromatic compounds?**

- a. The compounds have a pleasant smell.
- b. These compounds contain a benzene ring or structural relative.
- c. A requirement is to contain a hydrocarbon chain that is either saturated or unsaturated and at least 3 carbons long.
- d. There is more than one correct response.

ANS: B PTS: 1

30. Which of the following compounds is not considered aromatic?



ANS: C

PTS: 1

31. Which of the following structures violates the octet rule?



ANS: B

PTS: 1

32. The benzene ring as a branch is called a _____ group.

- a. hexyl b. benzyl c. phenol d. phenyl

ANS: D

PTS: 1

33. Which of the following is the correct name for the compound shown?



ANS: C

PTS: 1

34. What is the correct name for  ?

- a. 3-phenyl-1-propene c. 1-phenyl-2-propene
b. 1-phenyl-1-propene d. 3-phenyl-2-propene

ANS: A

PTS: 1

35. Another acceptable name for 1-ethyl-3-methylbenzene is _____ .

- a. *m*-ethylmethyltoluene c. *p*-ethylmethyltoluene
b. *o*-ethylmethyltoluene d. *m*-ethyltoluene

ANS: D

PTS: 1

36. A major source of aromatic compounds is _____ .

- a. coal tar b. plants c. animals d. soils

ANS: A

PTS: 1

37. Which of the following is a useful organic solvent?

- a. aniline b. toluene c. naphthalene d. phenacetin

ANS: B

PTS: 1

38. Naphthalene is used as _____ .

- a. an explosive c. a pain reliever
b. moth repellent d. a solvent

ANS: B

PTS: 1

39. **Identify the statement about lycopene that is true.**
- Lycopene is known as Vitamin C.
 - Lycopene gives watermelon their red color.
 - Raw tomatoes are a better source of lycopene than cooked tomatoes.
 - Lycopene should not be eaten with fatty foods.

ANS: B PTS: 1

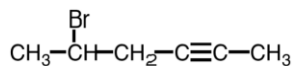
40. **Which is a characteristic of alkenes and alkynes, but not a characteristic of alkanes?**
- Alkynes are not flammable, the others are flammable.
 - Alkenes all have a scent similar to the aromatic compounds, but the alkanes and alkenes have a scent that is extremely sharp.
 - Alkanes have only single bonds between carbons.
 - There is more than one correct response.

ANS: C PTS: 1

41. **Which of the following will not reduce your cancer risk?**
- not smoking
 - being active
 - maintaining proper weight
 - cooking meats at high temperatures

ANS: D PTS: 1

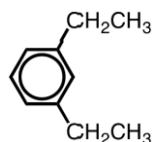
42. **Name the following compound.**



- 5-bromo-2-hexyne
- bromo-4-hexyne
- 1-bromo-1-methyl-3-pentyne
- none of these are correct

ANS: A PTS: 1

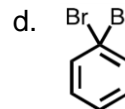
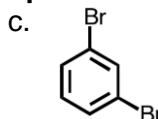
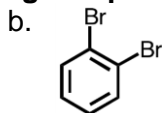
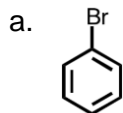
43. **Name the following aromatic compound.**



- 1,5-diethylbenzene
- p*-diethylbenzene
- o*-diethylbenzene
- 1,3-diethylbenzene

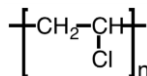
ANS: D PTS: 1

44. **Which of the following compounds is not possible?**



ANS: D PTS: 1

45. **Poly (vinyl chloride), PVC, is used for water pipes and synthetic leather. What is the monomer of the PVC polymer shown below?**



- $\text{CH}_2=\text{CHCl}$
- $\text{CH}\equiv\text{CCI}$
- $\text{CH}_3-\text{CH}_2\text{Cl}$
- $\text{CH}_2\text{Cl}-\text{CH}_2\text{Cl}$

ANS: A PTS: 1

46. Lycopene has been shown to prevent certain types of cancer. Which of the following is not a good source of lycopene?

- a. tomatoes
- b. pink grapefruit
- c. guava
- d. green beans

ANS: D PTS: 1

47. Color is a property associated with which type of hydrocarbon?

- a. alkanes
- b. alkenes
- c. alkynes
- d. cycloalkanes

ANS: B PTS: 1

48. What would the reaction of hydrogen fluoride with ethene be an example of?

- a. hydration
- b. halogenation
- c. hydrohalogenation
- d. fluorination

ANS: C PTS: 1

49. Which of the following could exhibit *cis/trans* isomerism?

- a. propene
- b. 1,2-dichloropropene
- c. 1-butene
- d. 2-butene

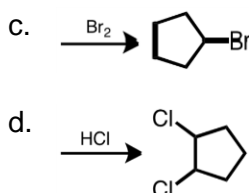
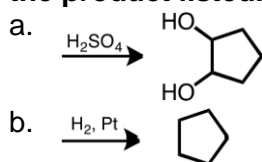
ANS: D PTS: 1

50. What type of hybridization is associated with alkyne bonding?

- a. sp
- b. sp^2
- c. sp^3
- d. sp^4

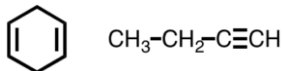
ANS: A PTS: 1

51. Starting with cyclopentene, indicate which of the following reactants would produce the product listed.



ANS: B PTS: 1

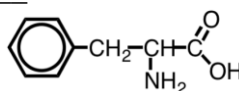
52. How many pi bonds are in the following two molecules, respectively from left to right?



- a. 2, 1
- b. 1, 2
- c. 2, 2
- d. 4, 3

ANS: C PTS: 1

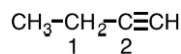
53. The following compound is a(n) _____.



- a. vitamin
- b. industrial solvent
- c. amino acid
- d. monomer for polystyrene

ANS: C PTS: 1

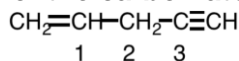
54. Indicate the hybridization on each of the carbon atoms designated by a number in the following molecule.



- a. 1 - sp , 2 - sp^2 c. 1 - sp^2 , 2 - sp^3
b. 1 - sp^3 , 2 - sp^2 d. 1 - sp^3 , 2 - sp

ANS: D PTS: 1

55. Indicate the geometry around each of the carbon atoms in the following molecule.



- a. 1 - triangular, 2- tetrahedral, 3 - linear
b. 1 - linear, 2- tetrahedral, 3 - triangular
c. 1 - tetrahedral, 2- tetrahedral, 3 - linear
d. 1 - triangular, 2- linear, 3 - tetrahedral

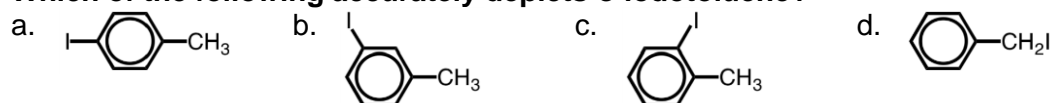
ANS: A PTS: 1

56. What type of hybridization is associated with the carbons in ethene?

- a. sp b. sp^2 c. sp^3 d. sp^4

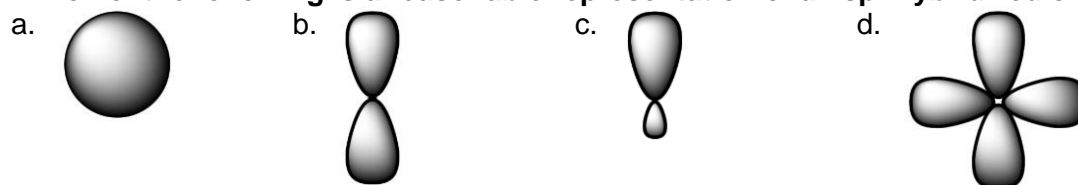
ANS: B PTS: 1

57. Which of the following accurately depicts *o*-iodotoluene?



ANS: C PTS: 1

58. Which of the following is a reasonable representation of an sp^2 hybridized orbital?



ANS: C PTS: 1

59. According to Markovnikov's rule, when 3-methyl-1-butene undergoes an addition reaction with HCl, the chlorine will end up on which main chain carbon?

- a. #1 b. #2 c. #3 d. #4

ANS: B PTS: 1

60. The ability to detect light is based, in part, to a change of one form of retinal to another. Specifically, what is this change?

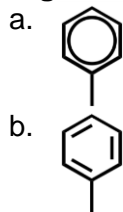
- a. a *cis* to *trans* conversion c. A hydrogenation reaction
b. a *trans* to *cis* conversion d. A dehydrogenation reaction

ANS: A PTS: 1

61. **The reaction of bromine with an alkene can be detected by which of the following?**
- formation of hydrogen gas
 - loss of bromine solution color
 - precipitate formation
 - color change from red to green

ANS: B PTS: 1

62. **Which of the following can be used to represent a phenyl branch when drawing an organic structure?**



d. More than one answer is correct.

ANS: D PTS: 1

TRUE/FALSE

1. **$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2$ is the formula for a saturated hydrocarbon.**

ANS: F PTS: 1

2. **The general formula for an alkene is C_nH_{2n} .**

ANS: T PTS: 1

3. **Alkenes must have at least two carbon atoms.**

ANS: T PTS: 1

4. **Alkenes can only have one double bond.**

ANS: F PTS: 1

5. **The addition of bromine to an alkene results in an alkane because one bond of the multiple bond is broken.**

ANS: T PTS: 1

6. **A characteristic of alkynes is a region of strong polarity caused by the multiple bond.**

ANS: F PTS: 1

7. **One of the halogenation reactions occurs when a halogen, a member of group VIIA, reacts with alkene.**

ANS: T PTS: 1

8. **Cyclic compounds do not undergo halogenation reactions.**

ANS: F PTS: 1

9. **The general formula for an alkyne is C_nH_{2n} .**
- ANS: F PTS: 1
10. **Markovnikov's rule indicates that in the addition of H-X to an alkene, the hydrogen becomes attached to the carbon atom that is already bonded to more hydrogens.**
- ANS: T PTS: 1
11. **An alkene with one multiple bond can be converted to an alkane by hydration.**
- ANS: T PTS: 1
12. **Polymers are compounds that are composed of repeating units chemically bound to each other.**
- ANS: T PTS: 1
13. **The physical properties of alkynes are very different from those of alkenes.**
- ANS: F PTS: 1
14. **2-butyne can exist as *cis*- and *trans*- isomers.**
- ANS: F PTS: 1
15. **The same substances which add to double bonds can add to triple bonds.**
- ANS: T PTS: 1
16. **Two moles of hydrogen gas would be required to convert one mole of 2-butyne into butane.**
- ANS: T PTS: 1
17. **Benzene is an alkene with more than one multiple bond.**
- ANS: F PTS: 1
18. **Phenyl is the name given to the ion produced when benzene loses one hydrogen, making it a substituent.**
- ANS: T PTS: 1
19. **Aromatic compounds dissolve well in a nonpolar solvent.**
- ANS: T PTS: 1
20. **The alkynes belong to an extensive family of compounds that have a large biological significance, especially when discussing digestion.**
- ANS: F PTS: 1

21. Benzene is an aromatic hydrocarbon while cyclohexane and cyclohexene are aliphatic hydrocarbons.

ANS: T PTS: 1

22. Another name for 1,2-dimethylbenzene is *m*-dimethylbenzene.

ANS: F PTS: 1

23. Anthracene has the structure given below and is an example of a polycyclic aromatic compound.

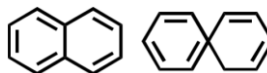


ANS: T PTS: 1

24. As the number of double bonds increases in a alkene compound, the color shifts from a higher to lower energy range.

ANS: T PTS: 1

25. Consider the diagram below. Both materials would be considered polycyclic aromatic compounds.

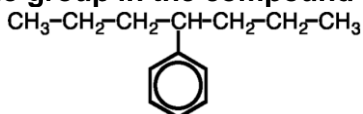


ANS: F PTS: 1

26. Comparing unbranched alkanes and alkenes of the same length, alkenes have higher melting and boiling points.

ANS: F PTS: 1

27. The branch name for a benzene group in the compound below is phenyl.



ANS: T PTS: 1