

Organic Chem Test Master

Matching - Match each item with the correct statement below.

- | | |
|-----------------------|-------------------------------|
| a. substituent | e. asymmetric carbon |
| b. structural isomers | f. <i>trans</i> configuration |
| c. geometric isomers | g. <i>cis</i> configuration |
| d. stereoisomers | |

- ___ 1. atom or group of atoms that can take the place of a hydrogen in a parent hydrocarbon molecule
___ 2. compounds that have the same molecular formula, but the atoms are joined in a different order
___ 3. arrangement in which substituted groups are on the same side of a double bond
___ 4. molecules in which atoms are joined in the same order but differ in the arrangements of their atoms in space
___ 5. arrangement in which substituted groups are on opposite sides of a double bond
___ 6. compounds that differ in the orientation of groups around a double bond
___ 7. carbon atom to which four different atoms or groups are attached

Match each item with the correct statement below.

- | | |
|---------------------------------|--------------------------------|
| a. condensed structural formula | d. saturated compound |
| b. homologous series | e. complete structural formula |
| c. unsaturated compound | |

- ___ 8. group of compounds in which there is a constant increment of change in molecular structure from one compound in the series to the next
___ 9. formula showing all the atoms and bonds in a molecule
___ 10. structural formula in which some bonds and/or atoms are left out
___ 11. organic compound that contains the maximum number of hydrogens per carbon atom
___ 12. organic compound that contains at least one double or triple carbon-carbon bond

Match each item with the correct statement below.

- | | |
|--------------------------|--------------------|
| a. aromatic compound | d. lignite |
| b. aliphatic hydrocarbon | e. bituminous coal |
| c. anthracite coal | |

- ___ 13. any straight-chain or branched-chain alkane, alkene, or alkyne
___ 14. any hydrocarbon compound in which a ring has bonding similar to benzene
___ 15. hard coal, having a carbon content of over 80%
___ 16. brown coal, having a carbon content of approximately 50%
___ 17. soft coal, having a carbon content of 70–80%

Match each item with the correct statement below.

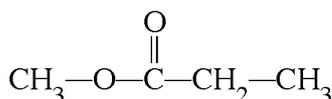
- | | |
|---------------------|----------------|
| a. functional group | f. halogen |
| b. hydroxyl group | g. fatty acids |
| c. carbonyl group | h. alcohol |
| d. carboxyl group | i. glycerol |
| e. ether | |

- ___ 18. a specific arrangement of atoms in an organic compound that is capable of characteristic chemical reactions
___ 19. reacts with an alkane by a substitution reaction
___ 20. the OH functional group in alcohols
___ 21. a main component of fats and oils
___ 22. a compound in which oxygen is bonded to two carbon atoms

- a. isomer
b. substituted alkane
- c. principle alkane
d. parent alkane
- ___ 43. The name for an alkyl group that contains two carbon atoms is ____.
- a. diphenyl
b. ethyl
c. dimethyl
d. propyl
- ___ 44. What is the physical state of the smallest alkanes at room temperature?
- a. gas
b. liquid
c. solid
d. gas or liquid
- ___ 45. What is the general formula for a straight-chain alkane?
- a. C_nH_n
b. C_nH_{n+2}
c. C_nH_{2n}
d. C_nH_{2n+2}
- ___ 46. What is the increment of change in a series of straight-chain alkanes?
- a. CH
b. CH_2
c. CH_3
d. CH_2
- ___ 47. What is the condensed structural formula for 2,2-dimethylbutane?
- a. $CH_3(CH_2)_2CH_3$
b. $CH_3CH_2CH_2CH_2CH_3$
c. $(CH_3)_3CCH_2CH_3$
d. $C_6H_{14}(CH_3)_2$
- ___ 48. What is the name of the compound $CH_3CH(CH_3)C(CH_3)_3$?
- a. 2,2,3-trimethylbutane
b. tetramethylpropane
c. 1,1,1,2-tetramethylpropane
d. isoheptane
- ___ 49. The condensed structural formula for 2,2,3-trimethylbutane is ____.
- a. $CH_3CH_2(CH_3)CH(CH_3)_2$
b. $CH_3C(CH_3)_2C(CH_3)_3$
c. $CH_3C(CH_3)_2CH(CH_3)_2$
d. $CH_3CH_2CH(CH_3)C(CH_3)_3$
- ___ 50. In which of the following liquids is hexane most likely to dissolve?
- a. aqueous ammonium hydroxide
b. vinegar
c. rubbing alcohol
d. octane
- ___ 51. Why are the molecules of hydrocarbons nonpolar?
- a. The intermolecular attractions are strong.
b. All the bonds are single covalent bonds.
c. The electron pair is shared almost equally in all the bonds.
d. Van der Waals forces overcome polarity.
- ___ 52. Which of the following compounds is an unsaturated hydrocarbon?
- a. methane
b. propyne
c. nonane
d. methyl
- ___ 53. In which of the following compounds does rotation occur around all covalent bonds between carbons?
- a. octene
b. octyne
c. octane
d. all of the above
- ___ 54. A saturated straight-chain hydrocarbon with two carbons is ____.
- a. ethene
b. decane
c. propane
d. ethane
- ___ 55. The general name for hydrocarbons with at least one triple covalent bond is ____.
- a. alkenes
b. alkyls
c. alkanes
d. alkynes
- ___ 56. Which of these compounds is an alkene?
- a. methane
b. nonene
c. butyne
d. propanone
- ___ 57. What is the name of the smallest alkyne?
- a. butyne
c. methyne

- b. ethyne
d. propyne
- ___ 58. An organic compound that contains only carbon and hydrogen and at least one carbon-carbon triple bond is classified as an ____.
- a. alkane
b. alkene
c. alkyne
d. arene
- ___ 59. How are hydrogen atoms arranged in ethene?
- a. in the same plane, separated by angles of 120°
b. in different planes, separated by angles of 120°
c. in the same plane, separated by angles of 180°
d. in different planes, separated by angles of 180°
- ___ 60. Which of the following compounds is a structural isomer of butane?
- a. 2-methylbutane
b. 2,2-dimethylbutane
c. 2-methylpropane
d. 2,2-diethylpropane
- ___ 61. Which of the following is true about structural isomers?
- a. Structural isomers have the same molecular formula.
b. Structural isomers have different physical and chemical properties.
c. Structural isomers have the same elemental composition.
d. all of the above
- ___ 62. A structural isomer of hexane is ____.
- a. 2,2-dimethylbutane
b. cyclohexane
c. benzene
d. 2-methylpentene
- ___ 63. In the *cis* configuration, the methyl groups are placed ____.
- a. in between the double bonds
b. on opposite sides of the double bond
c. to the left of the double bond
d. on the same side of the double bond
- ___ 64. Alkanes do not have geometric isomers because the carbon atoms in their carbon-carbon bonds are ____.
- a. double bonds
b. quite polar
c. free to rotate
d. asymmetric
- ___ 65. How many different atoms or groups are attached to an asymmetric carbon?
- a. 2
b. 4
c. 6
d. 8
- ___ 66. Hydrocarbons containing a saturated carbon ring are called ____.
- a. cyclic hydrocarbons
b. aromatic hydrocarbons
c. aliphatic hydrocarbons
d. alkylated hydrocarbons
- ___ 67. Which hydrocarbon rings are most common in nature?
- a. rings with 3 or 4 carbon atoms
b. rings with 4 or 5 carbon atoms
c. rings with 5 or 6 carbon atoms
d. rings with 6 or 7 carbon atoms
- ___ 68. In a cyclic hydrocarbon with only carbon-carbon single bonds and n number of carbon atoms, how many hydrogen atoms are there in terms of n ?
- a. $2 - n$
b. 2_n
c. $2 + n$
d. $2n$
- ___ 69. What compound is the simplest aromatic compound?
- a. methane
b. ethene
c. ethyne
d. benzene
- ___ 70. Which of the following molecules does NOT display resonance?
- a. benzene
b. phenylethane
c. *m*-xylene
d. cyclohexane
- ___ 71. Which of the following is NOT an important fossil fuel?
- a. petroleum
b. hydrogen
c. natural gas
d. coal
- ___ 72. What is the first stage in the formation of coal?

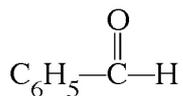
- a. lignite
 b. anthracite coal
 c. peat
 d. bituminous coal
- ___ 73. What is the main hydrocarbon component of natural gas?
 a. benzene
 b. ethane
 c. ethene
 d. methane
- ___ 74. Which type of coal has the highest carbon content?
 a. anthracite
 b. bituminous
 c. lignite
 d. peat
- ___ 75. The controlled process by which hydrocarbons are broken down or rearranged into smaller, more useful molecules is called _____.
 a. vaporizing
 b. cracking
 c. distillation
 d. fractionating
- ___ 76. What is the first step in the refining of petroleum?
 a. cracking
 b. drilling
 c. cooling
 d. distillation
- ___ 77. Which of the following is NOT a fraction obtained from crude oil?
 a. ammonia
 b. natural gas
 c. gasoline
 d. kerosene
- ___ 78. Which of the following is NOT a product obtained from the distillation of coal tar?
 a. benzene
 b. phenol
 c. coke
 d. toluene
- ___ 79. What is the name of the functional group in the following compound?



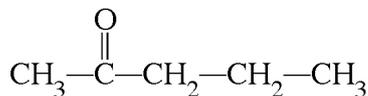
- a. halogen
 b. ester
 c. carbonyl
 d. carboxylic acid
- ___ 80. The most important way to classify organic compounds is by _____.
 a. the number of carbon atoms in the longest chain
 b. functional group
 c. the type of carbon—carbon bonds
 d. reactivity
- ___ 81. What is the common name of the following compound?
- $$\begin{array}{c} \text{CH}_3 \\ | \\ \text{CH}_3\text{—C—Br} \\ | \\ \text{CH}_3 \end{array}$$
- a. isopropyl bromide
 b. *tert*-butyl bromide
 c. isobutyl bromide
 d. *sec*-butyl bromide
- ___ 82. Which halocarbon has the highest boiling point?
 a. 1-chloropropane
 b. 2-chloropropane
 c. 1,2,3-trichloropropane
 d. 2-dichloropropane
- ___ 83. What is the carbon skeleton of the product formed in the following reaction?
 $\text{C}_3\text{H}_6 + \text{HBr} \rightarrow$
- a. $\text{C—C}=\text{C—Br}$
 b. C—C—C—Br
 c. $\text{C—C—Br}=\text{C}$
 d. $\text{C}=\text{C—C—Br}$

- _____ 84. Which of the following compounds is trichloromethane?
- a.
$$\begin{array}{c} \text{Cl} \\ | \\ \text{Cl}-\text{C}-\text{Cl} \\ | \\ \text{H} \end{array}$$
- b.
$$\begin{array}{c} \text{Cl} \\ | \\ \text{Cl}-\text{C}-\text{Cl} \\ | \\ \text{CH}_3 \end{array}$$
- c.
$$\begin{array}{c} \text{Cl} \\ | \\ \text{Cl}-\text{C}-\text{Cl} \\ | \\ \text{Cl} \end{array}$$
- d.
$$\begin{array}{c} \text{Cl} \\ | \\ \text{Cl}-\text{C}-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- _____ 85. An example of a secondary alcohol is shown by the structure _____.
- a. $\text{CH}_3\text{CH}_2\text{OH}$
- b.
$$\begin{array}{c} \text{CH}_3\text{CH}_2\text{CHCH}_3 \\ | \\ \text{OH} \end{array}$$
- c. $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- d.
$$\begin{array}{c} \text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_2 \\ | \\ \text{OH} \end{array}$$
- _____ 86. Which of the following compounds is a secondary alcohol?
- a. $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2\text{OH}$
- b.
$$\begin{array}{c} \text{OH} \\ | \\ \text{CH}_3-\text{CH}_2-\text{C}-\text{CH}_3 \\ | \\ \text{H} \end{array}$$
- c.
$$\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{CH}-\text{CH}_3 \\ | \\ \text{CH}_3 \end{array}$$
- d. none of the above
- _____ 87. Phenols are characterized by _____.
- a. their behavior as gases
- b. ether linkages
- c. an —OH group on a benzene ring
- d. their use as flavoring agents
- _____ 88. What is the common name of the following alcohol?
- $$\begin{array}{c} \text{OH} \\ | \\ \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}-\text{CH}_3 \end{array}$$
- a. *sec*-hexyl alcohol
- b. *tert*-hexyl alcohol
- c. isohexyl alcohol
- d. hexyl alcohol
- _____ 89. Which of the following compounds is a glycol?
- a. $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2\text{OH}$
- b. $\text{CH}_3-\text{CH}_2-\text{O}-\text{CH}_2-\text{CH}_3$
- c. $\text{HOH}_2\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2\text{OH}$
- d. $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CHO}$
- _____ 90. Which pair of formulas represents the same compound?
- a. $\text{C}_2\text{H}_5\text{OH}$; CH_3OCH_3
- b. $\text{CH}_3\text{CH}_2\text{CHO}$; $\text{CH}_3\text{CH}_2\text{COOH}$
- c. $(\text{CH}_3)_2\text{CO}$; CH_3OCH_3
- d. $\text{CH}_3\text{COH}(\text{CH}_3)_2$; $(\text{CH}_3)_3\text{COH}$

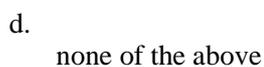
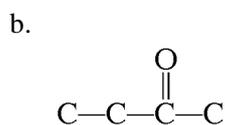
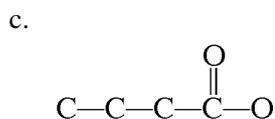
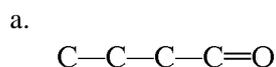
- ___ 91. Which of the following is true about isopropyl alcohol?
- It has a relatively high boiling point.
 - It is insoluble in water.
 - It is completely odorless.
 - It is white.
- ___ 92. Which of the following alcohols is used in antifreeze?
- ethanol
 - isopropyl alcohol
 - ethylene glycol
 - glycerol
- ___ 93. What substance is added to an organic molecule to test for the degree of saturation?
- water
 - hydrogen gas
 - bromine
 - hydrogen bromide
- ___ 94. In an addition reaction, which bond of the reactant is broken?
- carbon—carbon single bond
 - carbon—hydrogen single bond
 - carbon—carbon double bond
 - carbon—hydrogen double bond
- ___ 95. What type of compound is $\text{CH}_3\text{—O—CH}_2\text{—CH}_2\text{—CH}_3$?
- alcohol
 - aldehyde
 - ether
 - ketone
- ___ 96. Which of the following compounds has the lowest boiling point?
- diethyl ether
 - 2-butanol
 - diphenyl ether
 - 4-octanol
- ___ 97. The functional group in $\text{CH}_3\text{—O—CH}_2\text{—CH}_2\text{—CH}_2\text{—CH}_3$ is a(n) ____.
- ester
 - ether
 - carbonyl
 - carboxyl
- ___ 98. Name the following compound.
- $$\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—CH}_2\text{—O—C}_6\text{H}_5$$
- cyclohexylbutyl ether
 - butylcyclohexyl ether
 - phenylbutyl ether
 - butylphenyl ether
- ___ 99. Name the compound $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_2\text{CH}_3$.
- diethyl ether
 - dipropyl ether
 - ethylpropyl ether
 - pentane oxide
- ___ 100. Which of these compounds would you expect to be most soluble in water?
- $\text{CH}_3\text{CH}_2\text{Cl}$
 - $\text{CH}_3\text{CH}_2\text{CH}_2\text{F}$
 - $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
 - $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- ___ 101. Which carbon skeleton represents an ether?
- $$\text{C—C—C—O—C—C—C}$$
 - $$\text{C—C—C—C—C—C=O}$$
 - $$\text{C—C—C—C—C—C}$$
 - $$\text{C—C—C—C—C—C=O}$$
- ___ 102. What type of compound is the following?
- $$\text{CH}_3\text{—}\overset{\text{O}}{\parallel}\text{C—CH}_2\text{—CH}_3$$
- alcohol
 - aldehyde
 - ether
 - ketone
- ___ 103. What is the name of the following compound?



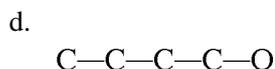
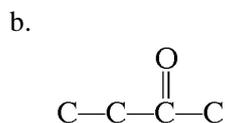
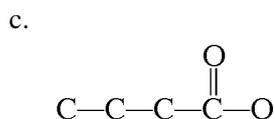
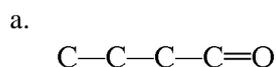
104. What is the name of the following compound?
- | | |
|-------------------|--------------------|
| a. phenylhyde | c. benzaldehyde |
| b. cyclohexylhyde | d. phenol aldehyde |



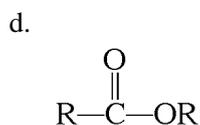
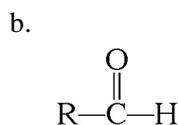
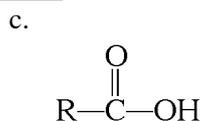
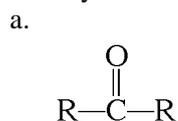
105. Which carbon skeleton represents an aldehyde?
- | | |
|----------------|----------------|
| a. 2-butanone | c. 4-butanone |
| b. 2-pentanone | d. 4-pentanone |



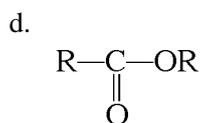
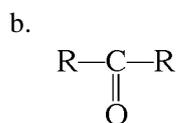
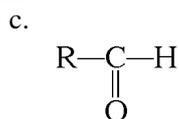
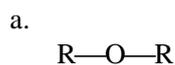
106. Which carbon skeleton represents a ketone?



107. Aldehydes have the general structure _____.



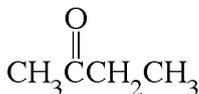
108. A ketone has the general structure _____.



___ 109. Based on your knowledge of intermolecular forces, which of the following would you expect to have the highest boiling point?

- a. hexanol
b. hexane
c. hexanal
d. hexanone

___ 110. What is the name of the following compound?



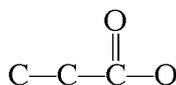
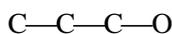
- a. butane
b. butanal
c. butanol
d. butanone

___ 111. Which of the following compounds has the highest boiling point?

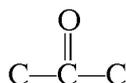
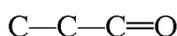
- a. 2-pentanone
b. pentane
c. pentene
d. chloropentane

___ 112. Which carbon skeleton contains a carboxyl group?

- a. c.

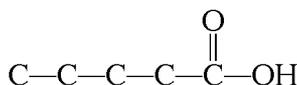


- b. d.

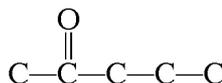
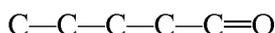


___ 113. Which of the following carbon skeletons represents a carboxylic acid?

- a. c.

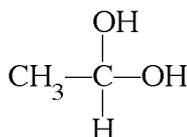
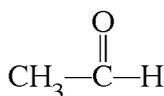


- b. d.

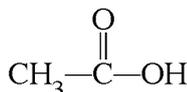
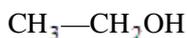


___ 114. Which of the following compounds is known as acetic acid?

- a. c.



- b. d.



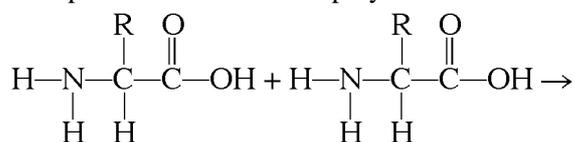
___ 115. Which of the following compounds is the most soluble in water?

- a. propanal
b. 1-bromopropane
c. propane
d. propanoic acid

___ 116. The IUPAC name for a carboxylic acid with two carbons in a straight chain would be ____.

- a. ethanalic acid
b. dimethylmethanoic acid
c. methacarboxylic acid
d. ethanoic acid

130. How many carbon and hydrogen atoms are in a 1-octene molecule?
131. How many more hydrogen atoms does a cyclohexane molecule have than a benzene molecule?
132. Write the general structure for halocarbon compounds.
133. Write an equation using structural formulas for the reaction of benzene and chlorine.
134. Write complete, balanced equations for the reaction of 2-pentene and water. Use structural formulas.
135. Write the general structure for aldehyde compounds.
136. Draw the structure of benzaldehyde.
137. Write the general structure for carboxylic acid compounds.
138. Write the general structure for ester compounds.
139. What is the expected product when the following compound is oxidized?
 $\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—CH}_2\text{OH}$
140. Complete the condensation polymerization reaction between two amino acids to form a peptide bond:



Numeric Response

141. How many arrangements are possible for two methyl groups with respect to a rigid double bond?
142. How many forms of coal are there?
143. What percent of the composition of natural gas is methane?

Essay

144. Explain why carbon is able to form such a large number of compounds.
145. Explain why hydrocarbon compounds are not soluble in water.
146. Why does the presence of a double or triple bond have little effect on the physical properties of an aliphatic hydrocarbon?
147. Describe in your own words what the difference is between unsaturated and saturated hydrocarbons. What is a saturated compound saturated with?
148. Describe the arrangement of atoms in ethyne. What is the significance of this arrangement?
149. Explain how geometric isomers differ from each other. Describe the difference between the *trans* and *cis* configurations of geometric isomers. Provide an example of each configuration for a molecule that has geometric isomers.
150. What are optical isomers? Provide examples.
151. Why is benzene not as reactive as other six-carbon alkenes?
152. Why is burning coal a major source of pollution?

153. Describe how fractional distillation is used to refine petroleum. Relate the structure of hydrocarbons present in crude oil to their boiling points.
154. Describe what happens in a substitution reaction. Give an example of a substitution reaction and name the atoms involved in the replacement.
155. Compare the properties of the alcohols with the properties of the halocarbons and the alkanes.
156. Give an example of an addition reaction and describe what happens in the reaction.
157. Compare the properties of the aldehydes and ketones with the properties of alcohols, ethers, alkanes, and halocarbons.
158. Compare the properties of carboxylic acids with the properties of compounds with other functional groups.
159. Describe oxidation-reduction reactions of organic molecules. Give an example.
160. Describe a polymerization condensation reaction. Give an example.