

CHAPTER 23 STUDY GUIDE FOR CONTENT MASTERY

Substituted Hydrocarbons and Their Reactions

Section 23.1 Functional Groups

In your textbook, read about functional groups.

Circle the letter of the choice that best completes the statement or answers the question.

- In hydrocarbons, carbon atoms are generally linked to
 - other carbon atoms only.
 - hydrogen atoms only.
 - both carbon and hydrogen atoms.
 - atoms of any element.
- Which of the following is an element commonly found in organic compounds?
 - nitrogen
 - argon
 - cesium
 - calcium
- Atoms or groups of atoms, other than hydrogen and carbon, that occur in organic molecules and react in a certain way are called
 - functional groups.
 - polymers.
 - radicals.
 - monomers.
- Which of the following is NOT a functional group?
 - a double bond
 - a triple bond
 - an alkane chain
 - a chlorine atom

In your textbook, read about organic compounds containing halogens.

Use each of the terms below just once to complete the passage.

alkyl halide	aryl halide	benzene	chiral	halocarbon	optical isomer
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Any organic compound containing a fluorine, chlorine, bromine, or iodine substituent is called a(n) **(5)** _____. Such a compound in which the substituent replaces a hydrogen in a hydrocarbon containing only single bonds is called a(n) **(6)** _____. If the substituent replaces a hydrogen bonded to an aromatic compound such as **(7)** _____, the resulting compound is called a(n) **(8)** _____. If an organic compound contains four different groups attached to the same carbon atom, the compound is referred to as a(n) **(9)** _____. In that case, the carbon atom is called a(n) **(10)** _____ carbon.

Section 23.2 Alcohols, Amines, and Ethers

In your textbook, read about the structure and properties of alcohols.

Circle the letter of the choice that best completes the statement or answers the question.

- An alcohol is an organic compound in which a hydrogen atom of a hydrocarbon has been replaced by
 - a hydroxyl group.
 - an oxygen atom.
 - an NH_2 group.
 - a COOH group.
- Which of the following suffixes is used in naming alcohols?
 - al*
 - oic*
 - ol*
 - ane*
- The alcohol produced commercially in largest quantity is
 - methanol.
 - isopropyl.
 - ether.
 - ethanol.
- Alcohol molecules are generally
 - nonpolar.
 - ionic.
 - very slightly polar.
 - moderately polar.
- The alcohol produced by yeasts is
 - methanol.
 - ethanol.
 - isopropanol.
 - cyclohexanol.
- The simplest alcohol is
 - methanol.
 - ethanol.
 - isopropanol.
 - butanol.
- A poisonous alcohol used as a solvent for certain plastics and in the manufacture of insecticides is
 - butanol.
 - ethanol.
 - cyclohexanol.
 - isopropanol.
- Which of the following describes the solubility of ethanol in water?
 - completely insoluble
 - slightly soluble
 - immiscible
 - completely miscible
- What intermolecular attraction gives alcohols many of their physical properties?
 - London forces
 - hydrogen bonds
 - ionic forces
 - dipole-dipole forces
- Denatured alcohol is
 - a mixture of two alcohols.
 - ethanol to which noxious solvents have been added.
 - ethanol that has been distilled.
 - ethanol diluted with water.
- How is ethanol generally removed from a water solution?
 - filtration
 - distillation
 - adsorption
 - precipitation
- The position of the functional group in an alcohol is indicated in its name by a
 - letter at the end.
 - letter at the beginning.
 - number and dash at the end.
 - number and dash at the beginning.

CHAPTER 23

STUDY GUIDE FOR CONTENT MASTERY

Section 23.2 *continued*

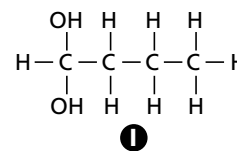
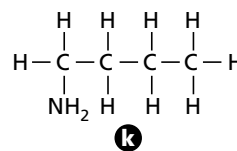
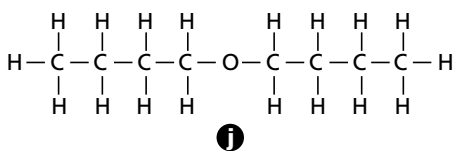
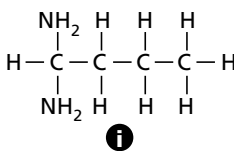
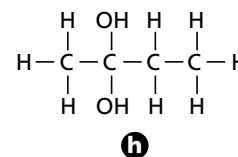
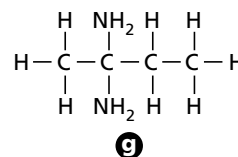
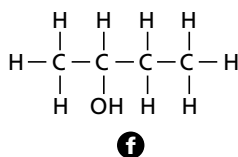
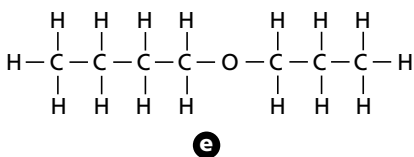
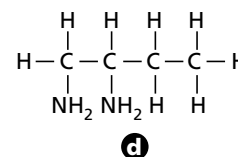
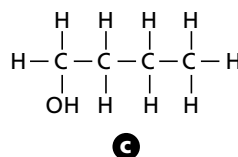
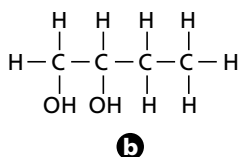
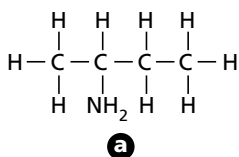
In your textbook, read about the structure and properties of ethers and amines.

For each statement below, write *true* or *false*.

- _____ **13.** An ether contains an oxygen atom bonded to two carbon atoms.
- _____ **14.** Ethers generally have much lower boiling points than alcohols of the same size.
- _____ **15.** Ethers generally are more soluble in water than are alcohols.
- _____ **16.** Ether molecules form hydrogen bonds with each other.
- _____ **17.** Amines contain nitrogen bonded to carbon.
- _____ **18.** More than one amino group can be present in an amine molecule.
- _____ **19.** Amines are typically acids.
- _____ **20.** Volatile amines tend to have pleasant odors.

In your textbook, read about naming alcohols, amines, and ethers.

Match each of the lettered structures (a–l) to the following names.



- | | |
|---------------------------------|------------------------------------|
| _____ 21. 1-butanol | _____ 27. butylpropyl ether |
| _____ 22. 2-butanol | _____ 28. 1-butylamine |
| _____ 23. 1,1-butanediol | _____ 29. 2-butylamine |
| _____ 24. 2,2-butanediol | _____ 30. 1,1-butyldiamine |
| _____ 25. 1,2-butanediol | _____ 31. 2,2-butyldiamine |
| _____ 26. butyl ether | _____ 32. 1,2-butyldiamine |

Section 23.3 Carbonyl Compounds

In your textbook, read about aldehydes and ketones.

Circle the letter of the choice that best completes the statement or answers the question.

- In a carbonyl group, an oxygen atom is
 - single-bonded to a carbon atom.
 - double-bonded to a carbon atom.
 - bonded to a hydrogen atom.
 - bonded to a carbon atom and another oxygen atom.
- Which of the following makes a compound a ketone?

a. a carboxyl group at the end	c. a carbonyl group at the end
b. a carboxyl group between carbon atoms	d. a carbonyl group between carbon atoms
- The formal names of aldehydes end with the suffix

a. <i>-one</i> .	b. <i>-al</i> .	c. <i>-oic</i> .	d. <i>-ane</i> .
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- Which of the following correctly expresses the order of solubility, from greatest to least, of aldehydes, alcohols, and alkanes?

a. aldehydes, then alkanes, then alcohols	c. alcohols, then aldehydes, then alkanes
b. aldehydes, then alcohols, then alkanes	d. alcohols, then alkanes, then aldehydes
- Which of the following is true of ketones in comparison to aldehydes?
 - Neither is polar, and they are equally reactive.
 - Ketones are polar, but aldehydes are not, and ketones are less reactive.
 - Both are polar, and ketones are more reactive.
 - Both are polar, and ketones are less reactive.

In your textbook, read about carboxylic acids, esters, and amides.

Use each of the terms below just once to complete the passage.

amide	carboxyl	carboxylic acids	ester	<i>-oic</i>	proteins
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The COOH group is called a(n) **(6)** _____. That group is found in the organic compounds called **(7)** _____. The formal name of such compounds is formed by adding the suffix **(8)** _____ to the corresponding alkane, followed by the word *acid*. A(n) **(9)** _____ is a compound in which the acidic hydrogen of an organic acid is replaced by a carbon atom or hydrocarbon chain. A(n) **(10)** _____ is a compound in which the –OH group of an organic acid is replaced by a nitrogen atom bonded to other atoms. The functional group of such compounds is found in **(11)** _____.

Section 23.4 Other Reactions of Organic Compounds

In your textbook, read about categories of organic reactions.

Match the descriptions of reactions in Column A with the types of reactions in Column B.

Column A	Column B
_____ 1. An atom or a group of atoms is replaced by other atoms or groups.	a. elimination
_____ 2. An atom or a group of atoms is replaced by F, Cl, Br, or I.	b. dehydration
_____ 3. Additional bonds are formed between adjacent carbon atoms by the removal of atoms from the carbons.	c. condensation
_____ 4. H atoms are removed.	d. substitution
_____ 5. Atoms that form water are removed.	e. addition
_____ 6. Other atoms bond to carbons that are double or triple bonded.	f. dehydrogenation
_____ 7. Molecules join to form a larger molecule, with the loss of a small molecule.	g. halogenation

In your textbook, read about predicting the products of organic reactions.

Circle the letter of the choice that best answers the question.

- 8.** What would be the products of a dehydration reaction in which ethanol was the reactant?
a. ethyne and water **b.** ethyne and hydrogen **c.** ethene and water **d.** ethene and hydrogen
- 9.** What would be the product of a hydrogenation reaction in which propene and hydrogen were the reactants?
a. propyne **b.** propane **c.** propanol **d.** propanal
- 10.** Suppose that ethene and chlorine react to form 1,2-dichloroethane. What type of reaction would that be?
a. addition **b.** elimination **c.** substitution **d.** condensation
- 11.** What kind of reaction is represented by the following equation, which contains structural formulas?
- $$\begin{array}{c}
 \text{F} \quad \text{F} \\
 | \quad | \\
 \text{H}-\text{C}-\text{C}-\text{H} \\
 | \quad | \\
 \text{H} \quad \text{H}
 \end{array}
 \rightarrow
 \begin{array}{c}
 \text{H} \quad \text{H} \\
 | \quad | \\
 \text{H}-\text{C}=\text{C}-\text{H} \\
 | \quad | \\
 \text{H} \quad \text{H}
 \end{array}
 + \text{F}-\text{F}$$
- a.** addition
b. elimination
c. substitution
d. condensation
- 12.** What kind of reaction occurs when an unsaturated fat is converted to a saturated fat?
a. dehydrogenation **b.** hydrogenation **c.** dehydration **d.** hydration

Section 23.5 Polymers

In your textbook, read about monomers and polymers.

Use each of the terms below just once to complete the passage.

addition	catalyst	cellulose	condensation	celluloid
monomer	polymer	water	polymerization	

A large molecule consisting of many repeating structural units is called a(n) **(1)** _____.

A reaction in which such a compound is produced is called a(n) **(2)** _____ reaction.

Each of the unit molecules from which such a large molecule is made is called a(n) **(3)** _____. The natural polymer **(4)** _____, which is found in wood fiber, was treated with nitric acid to produce the first plastic, **(5)** _____.

A substance called a(n) **(6)** _____ is often required to make a polymerization proceed at a reasonable rate. In a(n) **(7)** _____ polymerization, all the atoms present in the monomers are present in the product. In a(n) **(8)** _____ polymerization, the product is formed with the loss of a small by-product, usually **(9)** _____.

In your textbook, read about polymerization and the properties of polymers.

For each statement below, write *true* or *false*.

- _____ **10.** The repeating group of atoms formed by the bonding of monomers is called the structural unit of the polymer.
- _____ **11.** The number of structural units in a polymer chain is represented by the letter n .
- _____ **12.** Nylon is made by means of an addition polymerization.
- _____ **13.** Polymers do not differ greatly in their properties.
- _____ **14.** Thermosetting plastics are generally more difficult to recycle than are thermoplastic polymers.
- _____ **15.** Most of the plastic waste produced in the United States is recycled.

Draw the following structure.

- 16.** The monomer that reacts to make the polymer shown below

