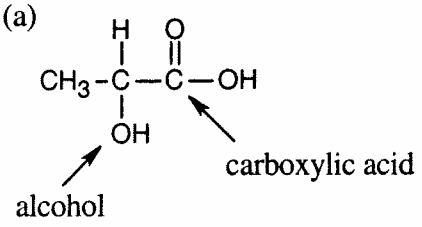
Solutions to Chapter 12 Problems

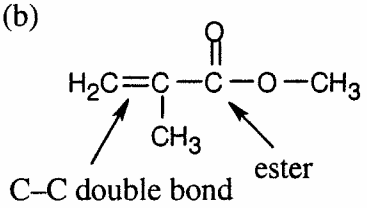
12.1

(a)



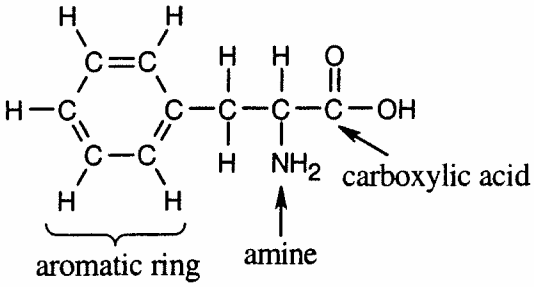
Lactic acid

(b)



Methyl methacrylate

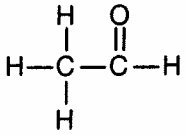
(c)



Phenylalanine

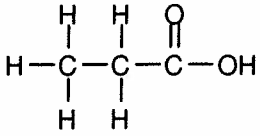
12.2

(a)



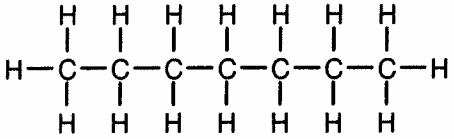
an aldehyde

(b)



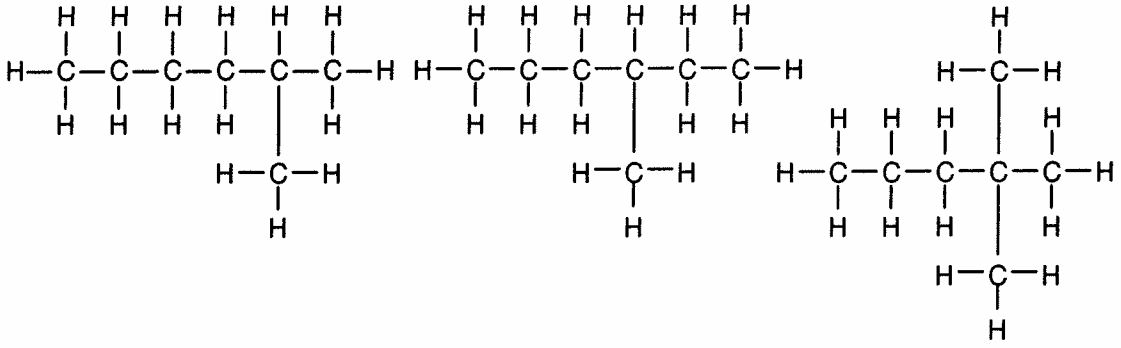
a carboxylic acid

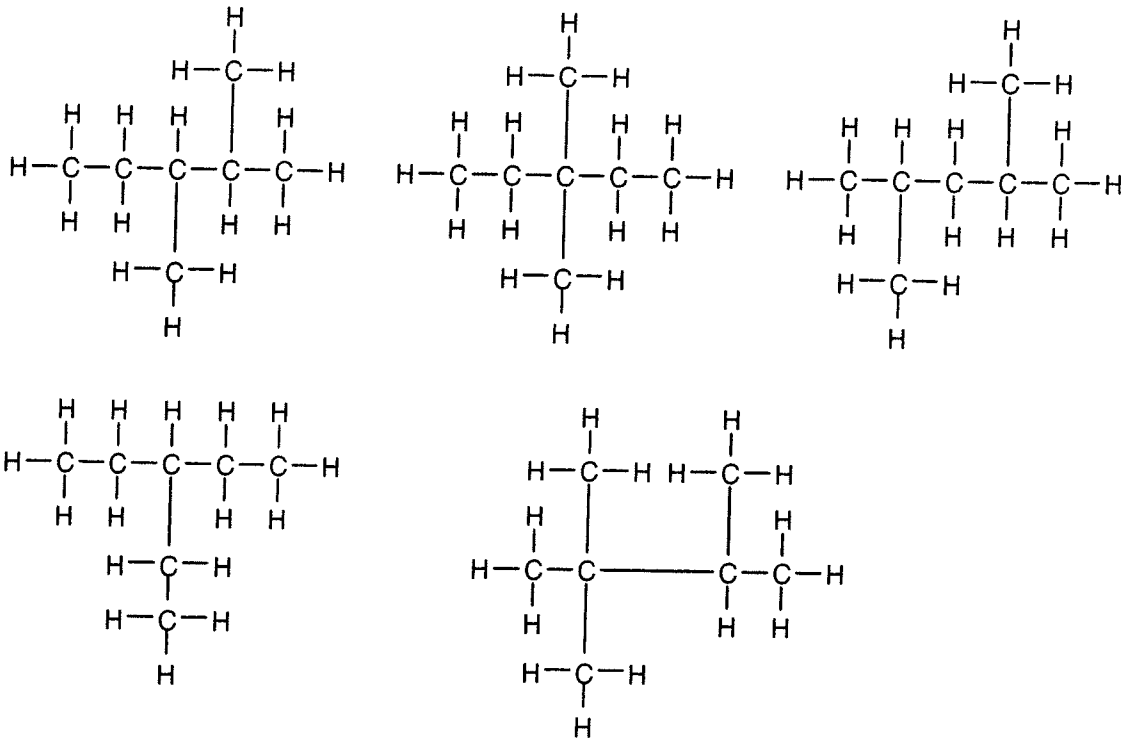
12.3



C_7H_{16} Heptane

12.4 There are eight branched-chain heptanes:





12.5

(a) $CH_3CH_2CH_2CH_2CH_3$

Pentane

(b) $CH_3CHCH_2CH_3$ (CH_3 above the second carbon)

2-Methylbutane

(c) CH_3CCH_3 (CH_3 above the central carbon, CH_3 below)

2,2-Dimethylpropane

12.6 All three structures have the same molecular formula (C_7H_{16}). Structures (a) and (c) are identical.

12.7 To solve this problem in a systematic way, use the following method:

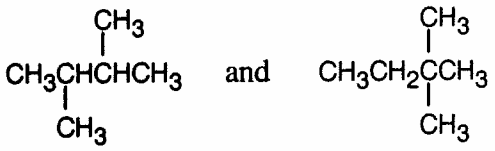
(a) Draw the isomer of C_6H_{14} having no branches:

$CH_3CH_2CH_2CH_2CH_2CH_3$

(b) Draw the C_5H_{12} isomer having no branches, and replace one of the $-CH_2-$ hydrogens with a $-CH_3$. There are two different isomers:

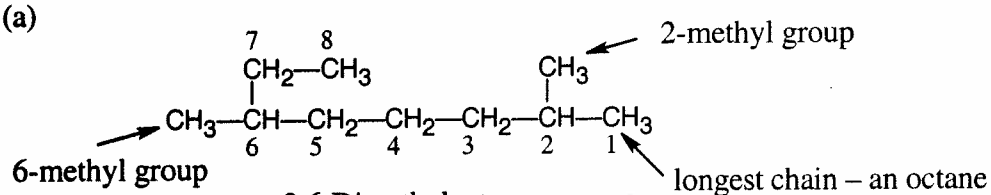
$CH_3CH_2CH_2CHCH_3$ (CH_3 above the last carbon) and $CH_3CH_2CHCH_2CH_3$ (CH_3 above the third carbon)

(c) Draw the C_4H_{10} isomer having no branches, and replace two of the $-CH_2-$ hydrogens with $-CH_3$ groups. There are two different isomers:



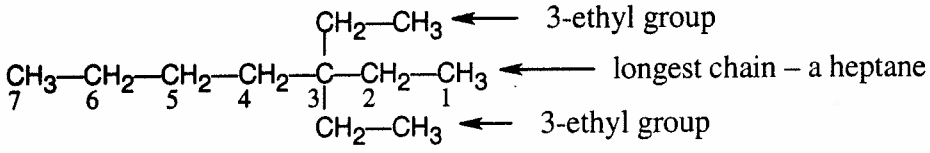
12.8

(a)



2,6-Dimethyloctane

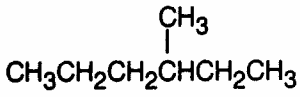
(b)



3,3-Diethylheptane

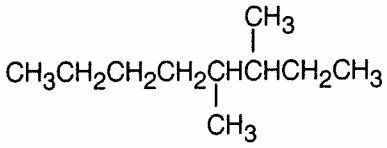
12.9 To answer this problem, draw the straight-chain hydrocarbon corresponding to the parent name, and replace –H's with the groups indicated.

(a)



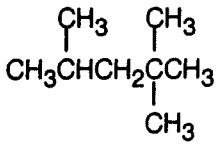
3-Methylhexane

(b)



3,4-Dimethyloctane

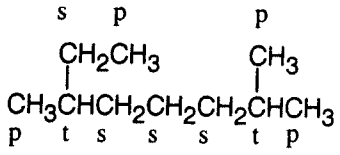
(c)



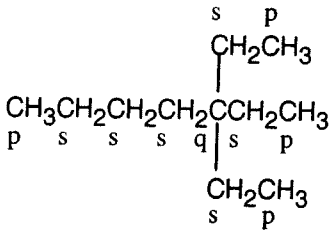
2,2,4-Trimethylpentane

12.10

(a)



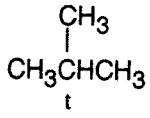
(b)



Where p = primary, s = secondary, t = tertiary, and q = quaternary

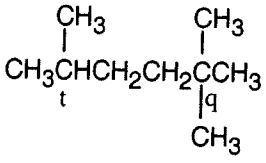
12.11 There are many answers to this question. For example:

(a)



2-Methylpropane

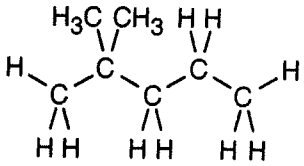
(b)



2,2,5-Trimethylhexane

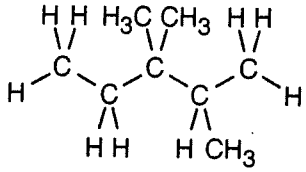
12.12

(a)



2,2-Dimethylpentane

(b)

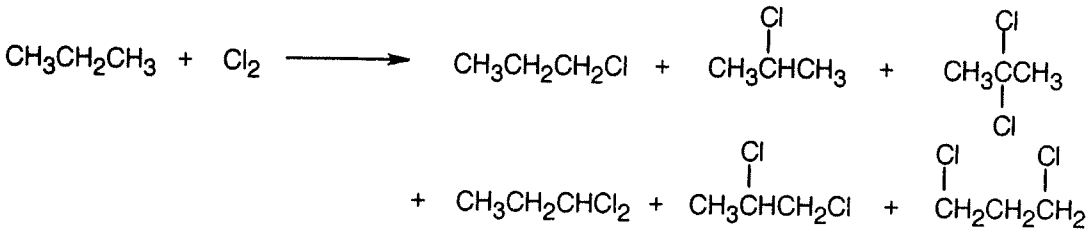


2,3,3-Trimethylpentane

12.13

$$2\ CH_3CH_3 + 7\ O_2 \longrightarrow 4\ CO_2 + 6\ H_2O$$

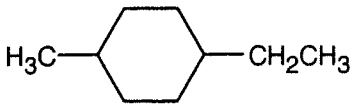
12.14



Six different mono- and disubstitution products can be formed from the reaction of propane with chlorine.

12.15

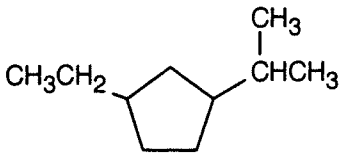
(a)



1-Ethyl-4-methylcyclohexane

The parent ring is a cyclohexane The two substituents are an ethyl group and a methyl group. The ethyl group receives the smaller number because it has alphabetical priority

(b)

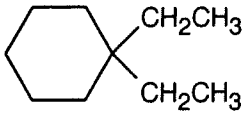


1-Ethyl-3-isopropylcyclopentane

The parent ring is a cyclopentane. The two substituents are an ethyl group and an isopropyl group The ethyl group receives the smaller number because it has alphabetical priority.

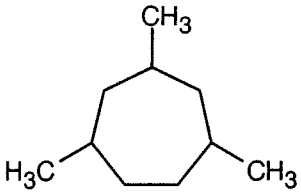
12.16

(a)



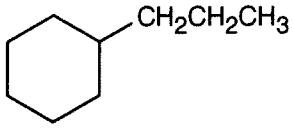
1,1-Diethylcyclohexane

(b)



1,3,5-Trimethylcycloheptane

12.17

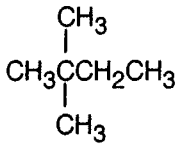


Propylcyclohexane

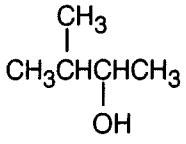
Understanding Key Concepts

12.18

(a)

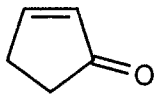


(b)

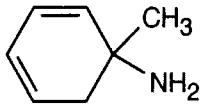


12.19 In a line drawing, a carbon is assumed to be at the intersection of lines.

(a)

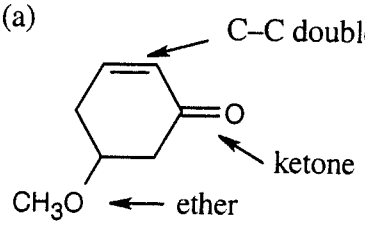


(b)

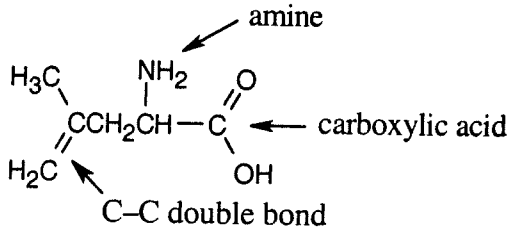


12.20

(a)

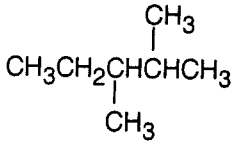


(b)



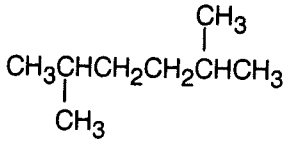
12.21

(a)



2,3-Dimethylpentane

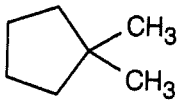
(b)



2,5-Dimethylhexane

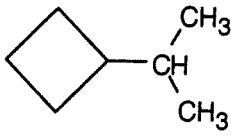
12.22

(a)



1,1-Dimethylcyclopentane

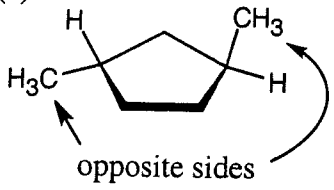
(b)



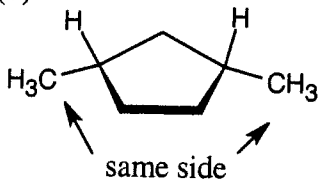
Isopropylcyclobutane

12.23 In one of the isomers (b), the methyl groups are on the same side of the ring, and in the other isomer (a), they are on opposite sides.

(a)



(b)



Organic Molecules and Functional Groups

12.24 If you look at the periodic table you will see that carbon belongs to group 4A, whose elements can form four bonds. Because carbon is in the middle of the periodic table, these bonds are covalent, and because it is in period 2, these bonds are strong. Consequently, carbon is unique in that it can form four strong bonds to other elements and to other carbon atoms, making possible a great many different compounds.

12.26 Most organic compounds don't dissolve in water because they are nonpolar. They don't conduct electricity because they are covalent, not ionic.

12.28 A polar covalent bond is a covalent bond in which electrons are shared unequally, being more attracted to one atom than the other. For example, the electrons in the C–Br bond of bromomethane are attracted more strongly to the electronegative bromine than to carbon.