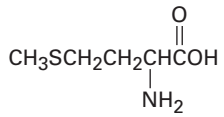
CHAPTER 3 (Lecture 4 HW)

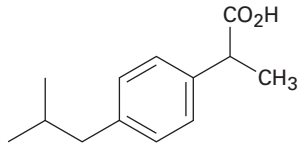
Problem 3.1

Identify the functional groups in each of the following molecules:

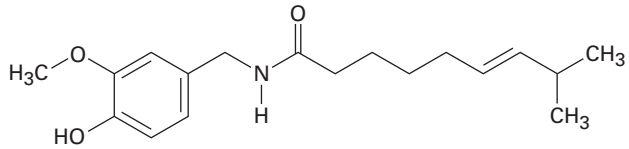
(a) Methionine, an amino acid:



(b) Ibuprofen, a pain reliever:

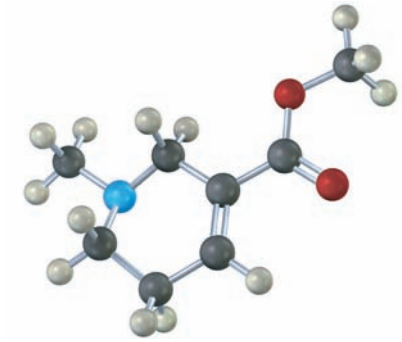


(c) Capsaicin, the pungent substance in chili peppers:



Problem 3.3

Identify the functional groups in the following model of arecoline, a veterinary drug used to control worms in animals. Convert the drawing into a line-bond structure and a molecular formula (red = O, blue = N).



Problem 3.4

Draw structures of the five isomers of C_6H_{14}.

Problem 3.5

Propose structures that meet the following descriptions:

(a) Two isomeric esters with the formula $C_5H_{10}O_2$

(b) Two isomeric nitriles with the formula C_4H_7N

(c) Two isomeric disulfides with the formula $C_4H_{10}S_2$

Problem 3.7

Draw the eight 5-carbon alkyl groups (pentyl isomers).

Problem 3.8

Identify the carbon atoms in the following molecules as primary, secondary, tertiary, or quaternary:

(a) $CH_3CH(CH_3)CH_2CH_2CH_3$

(b) $CH_3CH_2CH(CH_3)CH_2CH_3$

(c) $CH_3CH(CH_3)CH_2C(CH_3)_2CH_3$

Problem 3.9

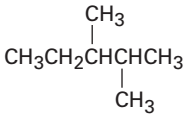
Identify the hydrogen atoms on the compounds shown in Problem 3.8 as primary, secondary, or tertiary.

Problem 3.11

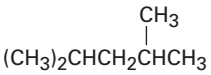
Give IUPAC names for the following compounds:

(a) The three isomers of C_5H_{12}

(b)



(c)



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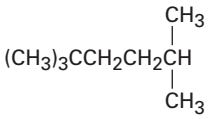


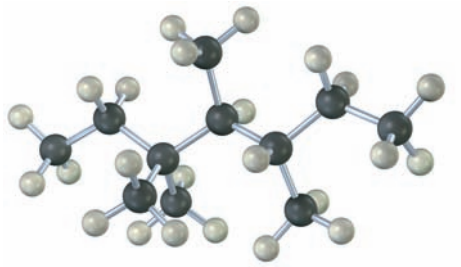
Problem 3.12

Draw structures corresponding to the following IUPAC names:

(a) 3,4-Dimethylnonane **(b)** 3-Ethyl-4,4-dimethylheptane
(c) 2,2-Dimethyl-4-propyloctane **(d)** 2,2,4-Trimethylpentane

Problem 3.14

Give the IUPAC name for the following hydrocarbon, and convert the drawing into a skeletal structure.



Problem 3.16

Sight along the C2—C1 bond, 2-methylpropane (isobutane) and

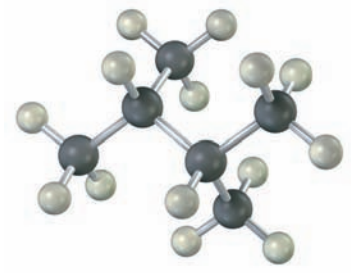
(a) draw a Newman projection of the most stable conformation.
(b) draw a Newman projection of the least stable conformation.
(c) make a graph of energy versus angle of rotation around the C2—C1 bond.
(d) Since an H⟷H eclipsing interaction costs 4.0 kJ/mol and an H⟷CH_3 eclipsing interaction costs 6.0 kJ/mol, assign relative values to the maxima and minima in your graph.

Problem 3.17

Sight along the C2—C3 bond of 2,3-dimethylbutane, and draw a Newman projection of the most stable conformation.

Problem 3.18

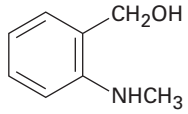
Draw a Newman projection along the C2—C3 bond of the following conformation of 2,3-dimethylbutane, and calculate a total strain energy:



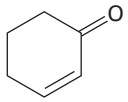
Functional Groups

3.22 Locate and identify the functional groups in the following molecules.

(a)



(b)



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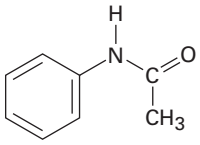
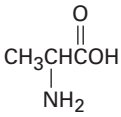


(d)



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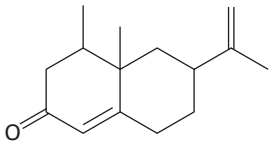

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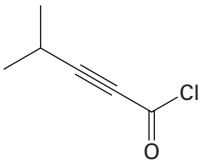


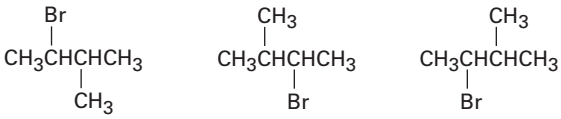
3.25 Predict the hybridization of the carbon atom in each of the following functional groups:

(a) Ketone **(b)** Nitrile **(c)** Carboxylic acid

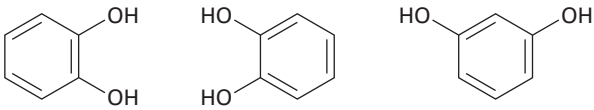
Isomers

3.29 In each of the following sets, which structures represent the same compound and which represent different compounds?

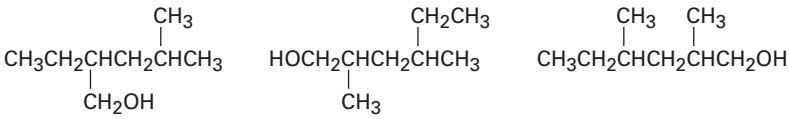
(a)



(b)



(c)



3.31 Draw as many compounds as you can that fit the following descriptions:

(a) Alcohols with formula $C_4H_{10}O$ **(b)** Amines with formula $C_5H_{13}N$
(c) Ketones with formula $C_5H_{10}O$ **(d)** Aldehydes with formula $C_5H_{10}O$

Naming Compounds

3.35 Draw structures for the following:

(a) 2-Methylheptane **(b)** 4-Ethyl-2,2-dimethylhexane
(c) 4-Ethyl-3,4-dimethyloctane **(d)** 2,4,4-Trimethylheptane
(e) 3,3-Diethyl-2,5-dimethylnonane **(f)** 4-Isopropyl-3-methylheptane

3.38 Give IUPAC names for the following compounds:

(a) $CH_3CH(CH_3)CH_2CH_2CH_3$

(b) $CH_3CH_2C(CH_3)_2CH_3$

(c) $CH_3CH(CH_3)C(CH_3)CH_2CH_2CH_3$

(d) $CH_3CH_2CH(CH_2CH_3)CH_2CH_2CH(CH_3)CH_3$

(e) $CH_3CH_2CH_2CH(CH_3)CH_2C(CH_3)_2CH_2CH_3$

(f) $(CH_3)_3C-C(CH_3)_2CH_2CH_2CH_3$

Conformations

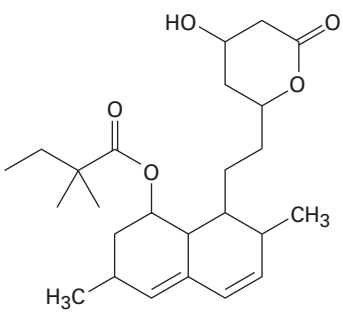
3.42 Consider 2-methylbutane (isopentane). Sighting along the C2–C3 bond:

(a) Draw a Newman projection of the most stable conformation.
(b) Draw a Newman projection of the least stable conformation.
(c) If a $CH_3 \longleftrightarrow CH_3$ eclipsing interaction costs 11 kJ/mol (2.5 kcal/mol) and a $CH_3 \longleftrightarrow CH_3$ gauche interaction costs 3.8 kJ/mol (0.9 kcal/mol), make a quantitative plot of energy versus rotation about the C2–C3 bond.

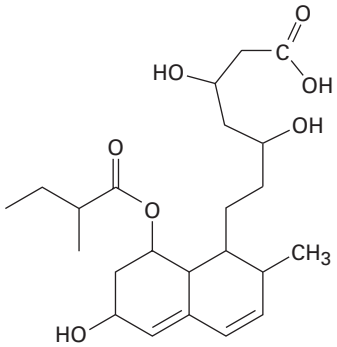
3.43 What are the relative energies of the three possible staggered conformations around the C2–C3 bond in 2,3-dimethylbutane? (See Problem 3.42.)

General Problems

3.53 The cholesterol-lowering agents called *statins,* such as simvastatin (Zocor) and pravastatin (Pravachol), are among the most widely prescribed drugs in the world, with annual sales estimated at approximately $15 billion. Identify the functional groups in both, and tell how the two substances differ.



Simvastatin (Zocor)



Pravastatin (Pravachol)