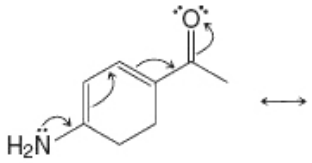
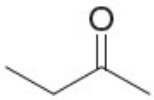
1. Problem 1.39

Draw the bonding pattern of the resonance structure that would result from moving the electrons in the way indicated by the curved arrows (include double bonds, lone pairs and any formal charges).



2. Problem 2.29a



Classify the compound below as an alkane, alkene, alkyne, alcohol, aldehyde, amine, and so forth.

Classification =

3. Problem 2.29b

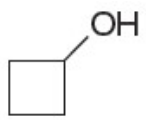
Classify the compound below as an alkane, alkene, alkyne, alcohol, aldehyde, amine, and so forth.

$H_3C-C\equiv CH$

Classification =

4. Problem 2.29c

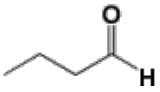
Classify the compound below as an alkane, alkene, alkyne, alcohol, aldehyde, amine, and so forth.



Classification =

5. Problem 2.29d

Classify the compound below as an alkane, alkene, alkyne, alcohol, aldehyde, amine, and so forth.



Classification =

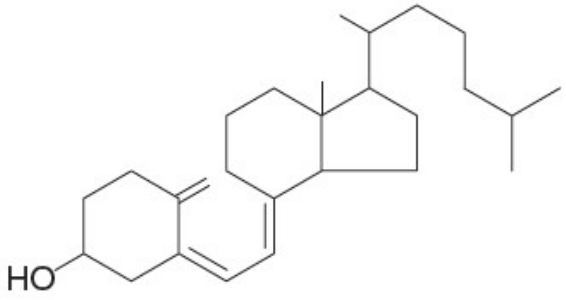
6. Problem 2.29f

Classify the compound below as an alkane, alkene, alkyne, alcohol, aldehyde, amine, and so forth.

Classification =

7. Problem 2.30a

Select all of the functional groups in the following compound:

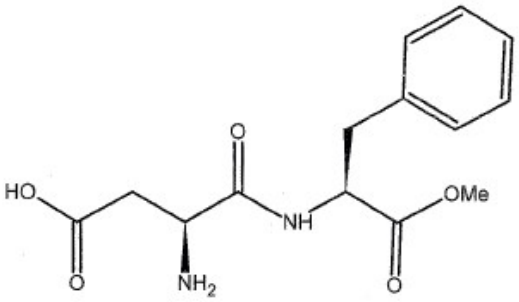


a. alcohol
b. amine
c. alkyne
d. aldehyde
e. amide
f. phenyl (arene)
g. halide
h. ketone
i. ether
j. nitro
k. nitrile
l. alkene
m. carboxylic acid
n. ester

Answer: _____

8. Problem 2.30b

Select all of the functional groups in the following compound:



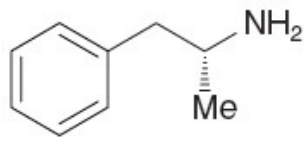
Aspartame

a. ketone
b. amine
c. alcohol
d. ether
e. nitrile
f. carboxylic acid
g. ester
h. amide
i. alkene
j. alkyne
k. phenyl (arene)
l. halide
m. nitro
n. aldehyde

Answer: _____

9. Problem 2.30c

Select all of the functional groups in the following compound:

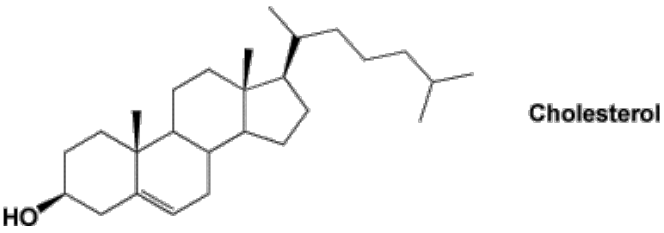


a. ester
b. amine
c. ketone
d. nitrile
e. aldehyde
f. ether
g. amide
h. phenyl (arene)
i. nitro
j. carboxylic acid
k. alkene
l. alkyne
m. halide
n. alcohol

Answer: _____

10. Problem 2.30d

Select all of the functional groups in the following compound:



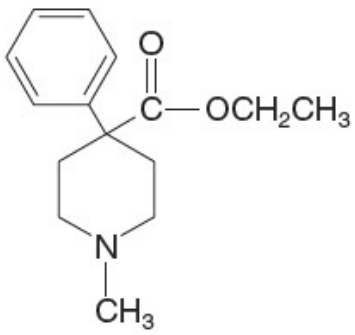
Cholesterol

a. phenyl (arene)
b. alkene
c. aldehyde
d. carboxylic acid
e. nitro
f. halide
g. alkyne
h. amide
i. nitrile
j. ester
k. alcohol
l. ether
m. amine
n. ketone

Answer: _____

11. Problem 2.30e

Select all of the functional groups in the following compound:

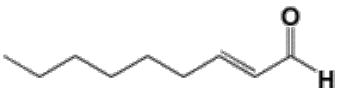


a. nitro
b. alcohol
c. halide
d. aldehyde
e. ether
f. amine
g. phenyl (arene)
h. ketone
i. carboxylic acid
j. alkyne
k. nitrile
l. ester
m. amide
n. alkene

Answer: _____

12. Problem 2.30f

Select all of the functional groups in the following compound:



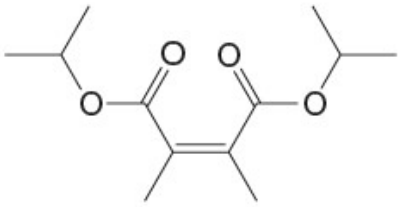
a cockroach repellent found in cucumbers

a. phenyl (arene)
b. halide
c. amide
d. amine
e. alkyne
f. alcohol
g. nitrile
h. aldehyde
i. nitro
j. ester
k. ketone
l. alkene
m. carboxylic acid
n. ether

Answer: _____

13. Problem 2.30g

Select all of the functional groups in the following compound:

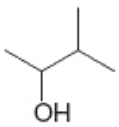


a. alcohol
b. phenyl (arene)
c. ketone
d. aldehyde
e. halide
f. ether
g. ester
h. amide
i. carboxylic acid
j. amine
k. alkyne
l. nitrile
m. nitro
n. alkene

Answer: _____

14. Problem 2.33

Classify the following alcohol as primary, secondary, or tertiary.



Classification = [ ]

15. Problem 2.35b

Write structural formulas for:

A primary alcohol with the formula C_4H_8O.

A secondary alcohol with the formula C_3H_6O.

A tertiary alcohol with the formula C_4H_8O.

16. Problem 2.35e

Write structural formulas for:

Ester with the formula $C_3H_6O_2$ whose alkoxyl group (-OR) is a methyl.

Ester with the formula $C_3H_6O_2$ whose alkoxyl group (-OR) is an ethyl.

17. Problem 2.35f

Write structural formulas for:

A primary alkyl halide with the formula $C_5H_{11}Br$.

18. Problem 2.35i

Write structural formulas for:

An aldehyde with the formula $C_5H_{10}O$.

A ketone with the formula $C_5H_{10}O$.

19. Problem 2.35n

Write structural formulas for:

A primary amide with the formula C_2H_5NO.

A secondary amide with the formula C_2H_5NO.

20. Problem 2.35k

Write structural formulas for:

A primary amine with the formula C_3H_9N.

21. Problem 2.35l

Write structural formulas for:

A secondary amine with the formula C_3H_9N.

22. Problem 2.35m

Write structural formulas for:

A tertiary amine with the formula C_3H_9N.

23. Problem 2.35g

Write structural formulas for:

A secondary alkyl halide with the formula $C_5H_{11}Br$.

24. Problem 2.35h

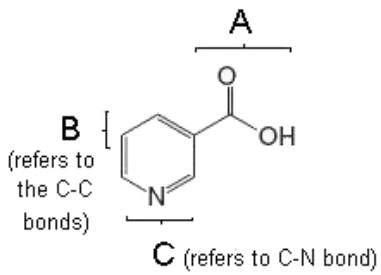
Write structural formulas for:

A tertiary alkyl halide with the formula $C_5H_{11}Br$.

25. Problem 2.38

Consider the following molecules.

Vitamin A



Vitamin B_3 or niacin

Indicate the hydrophobic part(s) of Vitamin A.

a. A
b. B
c. C
d. A and B
e. A and C
f. B and C
g. A, B, and C

Answer: _____

Indicate the hydrophilic part(s) of Vitamin A.

a. A
b. B
c. C
d. A and B
e. A and C
f. B and C
g. A, B, and C

Answer: _____

Choose whether you would expect Vitamin A to be soluble in water or not.

a. Vitamin A is soluble in water.
b. Vitamin A is not soluble in water.

Answer: _____

Indicate the hydrophobic part(s) of Vitamin B.

a. A
b. B
c. C
d. A and B
e. A and C
f. B and C
g. A, B, and C

Answer: _____

Indicate the hydrophilic part(s) of Vitamin B.

a. A
b. B
c. C
d. A and B
e. A and C
f. B and C
g. A, B, and C

Answer: _____

Choose whether you would expect Vitamin B to be soluble in water or not.

a. Vitamin B is soluble in water.
b. Vitamin B is not soluble in water.

Answer: _____

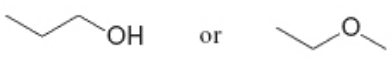
26. Problem 2.39

Hydrogen fluoride has a dipole moment of 1.83 D; its boiling point is 19.34°C. Ethyl fluoride (CH_3CH_2F) has an almost identical dipole moment and has a larger molecular weight, yet its boiling point is -37.7°C. Why?

The attractive forces between hydrogen fluoride molecules are the very strong dipole-dipole attractions that we call [ ]. (The partial positive charge of a hydrogen fluoride molecule is relatively exposed because it resides on the [ ]. By contrast, the positive charge of an ethyl fluoride molecule is buried in the [ ] and is shielded by the surrounding electrons. Thus the positive end of one hydrogen fluoride can approach the [ ] end of another hydrogen fluoride much more closely, with the result that the attractive force between them is much stronger.)

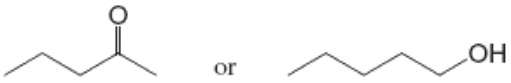
27. Problem 2.47

Predict the key IR absorption bands whose presence would allow each compound in the following pairs to be distinguished from each other.

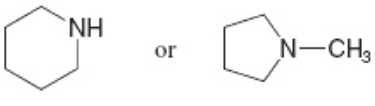


(a)

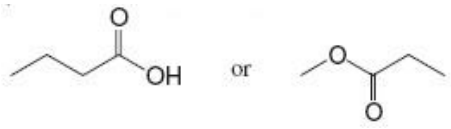
The alcohol would have [ ] absorption from the O—H group in the [ ] cm^{-1} region of its IR spectrum. The ether would have no such absorption.

(b) 

The ketone would have a strong absorption from its [ ] near [ ] cm^{-1} in its IR spectrum. The alcohol would have the same absorption as the alcohol in part (a).

(c) 

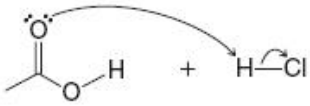
The secondary amine would have an absorption near [ ] cm^{-1} arising from N—H stretching. The tertiary amine would have no such absorption since [ ].

(d) 

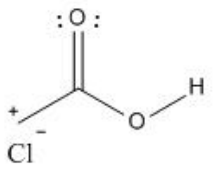
Both compounds would exhibit absorptions near [ ] cm^{-1} due to carbonyl stretching vibrations. The carboxylic acid would also have a broad absorption somewhere between [ ] cm^{-1} due to its [ ] group. The ester would not have this absorption.

28. Problem 3.24

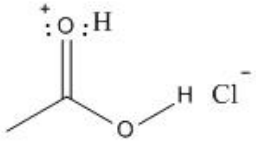
Choose the correct product by following the arrows.



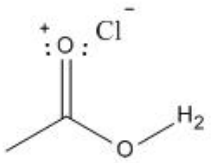
a.



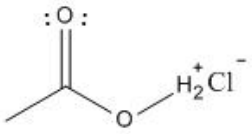
b.



c.



d.



Answer: _____

29. Problem 3.34

Whereas H_3PO_4 is a triprotic acid, H_3PO_3 is a diprotic acid. Draw structures for these two acids that account for this difference in behavior.

H_3PO_4:

H_3PO_3:

30. Problem 3.35

Write an equation, using the curved-arrow notation, for the following reactions.

Include lone pairs and formal charges in your drawing.

Only draw out acidic hydrogen with a covalent bond from the heteroatom from which the hydrogen are attached. When drawing hydroxide and water (or any other hydrogen) do not draw the hydrogen as a separate bond from the oxygen or heteroatom.