

Functional Group Summary

Table 8.2.3 summarizes what you have learned about the functional groups described in this section.

Table 8.2.3 *Functional groups*

Functional Group	Classification of Organic Compound
$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ -\text{C}-\text{C}- \\ \quad \\ \text{H} \quad \text{H} \end{array}$	alkane
$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ -\text{C}=\text{C}- \\ \quad \end{array}$	alkene
$-\text{C}\equiv\text{C}-$	alkyne
$\begin{array}{c} \text{H} \quad \quad \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{H}-\text{C} \quad \quad \quad \text{C}- \\ \diagdown \quad \diagup \\ \text{H} \quad \quad \quad \text{H} \end{array}$	aromatic hydrocarbon
$\begin{array}{c} \text{X} \\ \\ -\text{C}- \\ \end{array}$	alkyl halide
$\begin{array}{c} \text{OH} \\ \\ -\text{C}- \\ \end{array}$	alcohol
$\begin{array}{c} \quad \quad \quad \\ -\text{C}-\text{O}-\text{C}- \\ \quad \quad \quad \end{array}$	ether
$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{H} \end{array}$	aldehyde
$\begin{array}{c} \text{O} \\ \\ -\text{C}- \end{array}$	ketone
$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{OH} \end{array}$	carboxylic acid
$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{O}-\text{C}- \\ \end{array}$	ester
$\begin{array}{c} \text{NH}_2 \\ \\ -\text{C}- \\ \end{array}$	amine
$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{NH}_2 \end{array}$	amide

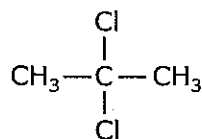
8.2 Review Questions

1. What elements other than carbon and hydrogen commonly appear in organic molecules?
2. What is a functional group? Give two examples of a functional group.
3. Alkyl halides contain one or more of which family of elements?
4. Complete the following table:

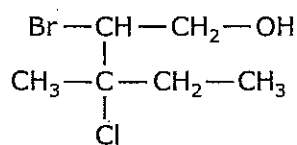
Name of group	Atoms and their arrangement
hydroxyl	
carbonyl	
carboxyl	

5. Name the following compounds:

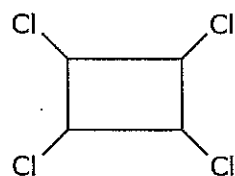
(a)



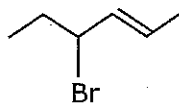
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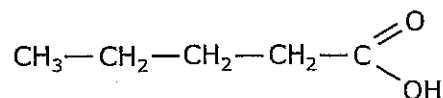
(c)



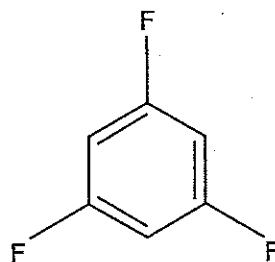
(d)



(e)



(f)



6. Draw condensed structural formulae for each compound below.

(a) cyclopentanol

(b) 1,1-dichloroethene

(c) 2-methyl-3-pentanol

(d) 2-chloropropane

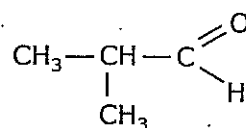
(e) 1,1-dichloro-3,3-dimethyl-2-hexanol

(f) 2,3,5-tribromocyclohexanol

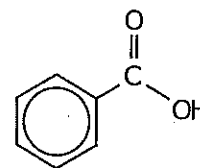
7. Both organic and inorganic compounds may contain an -OH group. In an ionic compound, what is the name of the -OH group? In an organic compound?
8. Which functional groups contain only the following?
 (a) single bonded oxygen atoms
 (b) double bonded oxygen atoms
 (c) both single and double bonded oxygen atoms
9. How is an amide different than a carboxylic acid? How are they similar?
10. For each of the following compounds named, classify the compound according to its functional group. For some compounds, more than one functional group may be used. Draw condensed structural formulas for as many of these as you can.
 (a) 2,3-dichloropentane
 (b) 2-decyne
 (c) *trans*-3-hexene
 (d) 1,2-dimethylbenzene
 (e) 2-chloro-2-pentanol
 (f) 3-methylbutanamide
 (g) propanal
 (h) pentanoic acid

11. Classify the following molecules according to their functional group.

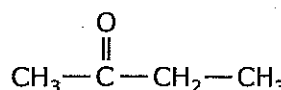
(a)



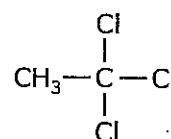
(b)



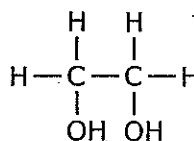
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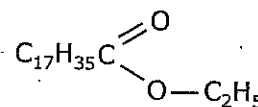
(d)



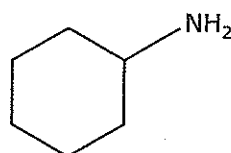
(e)



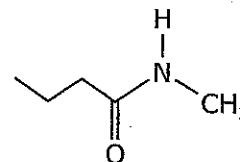
(f)



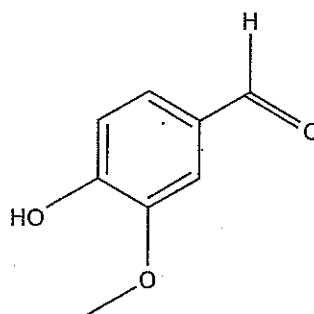
(g)



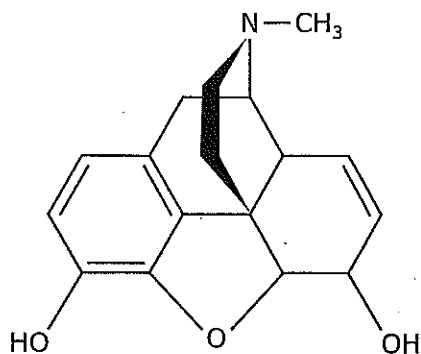
(h)



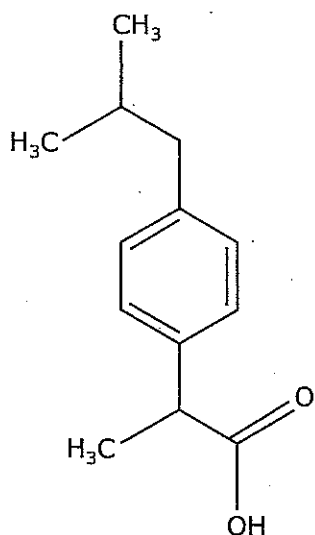
12. The following molecules are common organic compounds. For each molecule, circle and identify each functional group present. These molecules contain more than one functional group.
 (a) vanillin (a food flavoring)



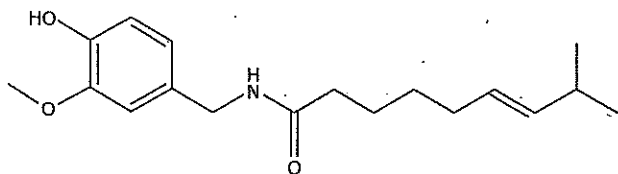
(b) morphine (a painkiller) Note that, in this diagram, the thicker black line represents a chain containing two carbon atoms coming out of the page towards you. This chain attaches the nitrogen atom to the carbon atom in the flat chain.



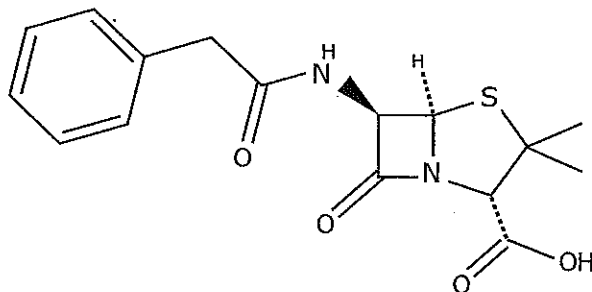
(c) ibuprofen (a painkiller)



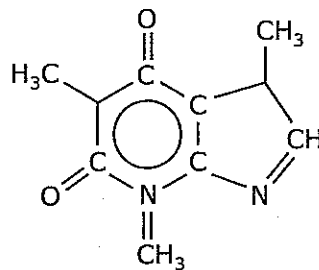
(d) capsaicin (the molecule that makes chili peppers "hot"; used in pepper spray)



(e) penicillin G (an antibiotic)



(f) caffeine (the active ingredient in coffee that keeps chemistry students awake while studying)



(g) theobromine (found in chocolate)

