

Functional Groups

Most organic chemistry involves substituents attached to hydrocarbon chains.

The substituents of organic molecules often contain oxygen, nitrogen, sulfur, and/or phosphorus.

They are called functional groups because they are the chemically functional parts of the molecules.

A **functional group** is a specific arrangement of atoms in an organic compound that is capable of characteristic chemical reactions.

Organic compounds can be classified according to their functional groups.

Look at Table 23.1 on page 726

The symbol "R" represents any carbon chain or rings attached to the functional group.

Table 23.1
Organic Compounds Classified by Functional Group

Compound type	Compound structure	Functional group
Halocarbon	$R-X$ (X = F, Cl, Br, or I)	Halogen
Alcohol	$R-OH$	Hydroxyl
Ether	$R-O-R$	Ether
Aldehyde	$\begin{array}{c} O \\ \\ R-C-H \end{array}$	Carbonyl
Ketone	$\begin{array}{c} O \\ \\ R-C-R \end{array}$	Carbonyl
Carboxylic acid	$\begin{array}{c} O \\ \\ R-C-OH \end{array}$	Carboxyl
Ester	$\begin{array}{c} O \\ \\ R-C-O-R \end{array}$	Ester
Amine	$R-NH_2$	Amino
Amide	$\begin{array}{c} O \quad H \\ \quad \\ R-C-N-R \end{array}$	Amide

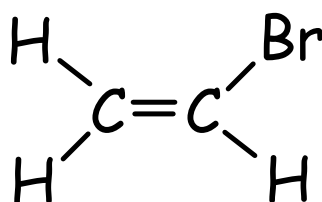
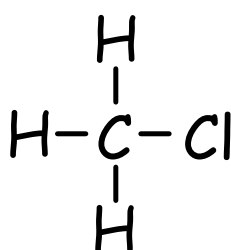
Halogen Substituents

A halocarbon is a carbon containing compound with a halogen substituent.

Halocarbons contain covalent bonds of F, Cl, Br, or I.

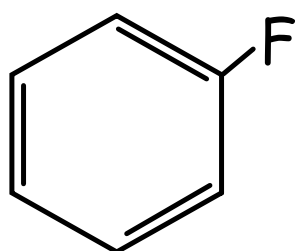
The IUPAC rules for naming halocarbons are based on the parent hydrocarbon. The halogens group is a substituent.

Example:



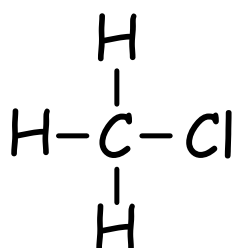
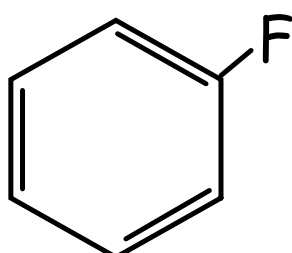
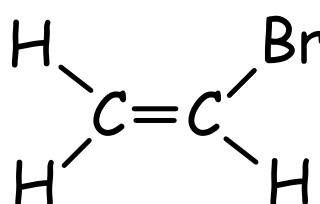
Practice

What would be the IUPAC name for the following compound?



The common names for each of them have rules as well. The first part names the hydrocarbon portion of the molecule as an **alkyl** group.

The second part gives the halogen with an *-ide* ending.

**Chloromethane****Bromoethene****Fluorobenzene**

When we use the common names, halocarbons in which a halogen is attached to a carbon of an **aliphatic*** chain are called **alkyl halides**.

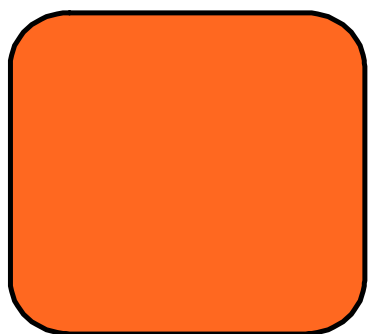
***Aliphatic chains** are non-aromatic. They have straight-chain or branch chained carbons.

The number of carbon atoms attached to the carbon that is bonded to the halogen determines whether it is primary, secondary, or tertiary.

Table 23.2 lists some common alkyl groups

Pratice

What would be the structural compound of
2-bromo-2-chloro-1,1,1-trifluoroethane?



**It's common name is
halothane, which is used
as an anesthetic.*

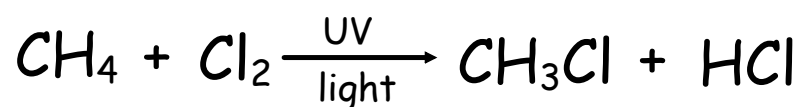
Substitution Reactions

Organic reactions often proceed more slowly than inorganic reactions.

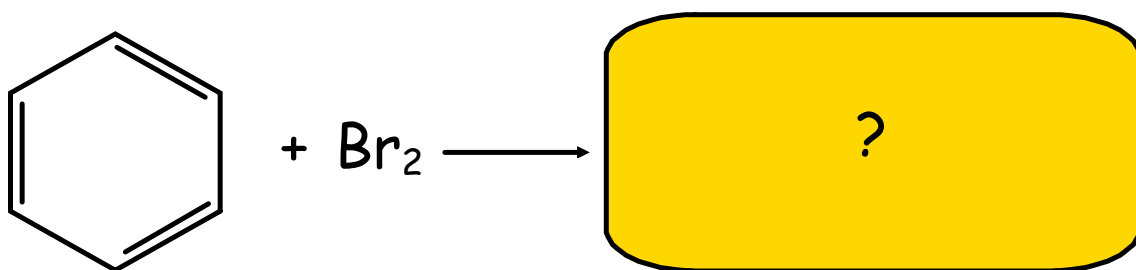
This is because organic reactions commonly involve the breaking of relatively strong covalent bonds. Catalysts are often needed.

A common type of organic reaction is a **substitution reaction**, where an atom, or a group of atoms, replaces another atom or group of atoms.

As an example, sunlight or another source of UV radiation usually serves as a catalyst.

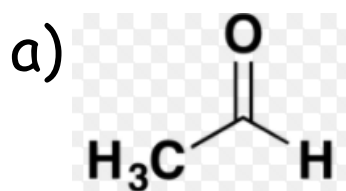


What do you suppose will happen if we have benzene reacting with bromine gas?

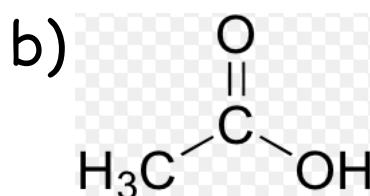


Practice

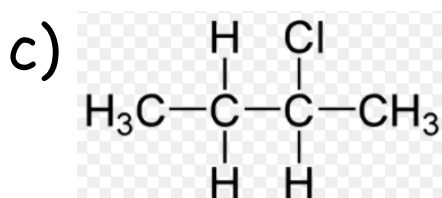
Using the chart, try to identify the functional group in each situation.



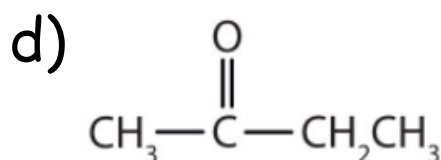
carbonyl
(aldehyde)



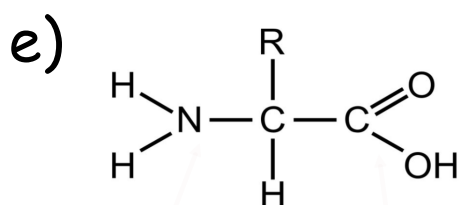
carboxyl



halogen



carbonyl
(ketone)



amino

carboxyl

Try questions on Pg. 729 #1-6