Chemistry 11

Organic Chemistry IV

Name: Key.
Date:
Block:

1. Functional Groups

Functional Groups

There are numerous functional groups that can be found in organic compounds. Often there are more than one in complex organic compounds.

- **Functional groups can be an atom, group of atoms or type of bond in an organic molecule that react in a predictable manner.**
- **Symbol "R" is used to represent the hydrocarbon fragment of the organic molecule.**

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1. Alkyl Halides (as branches)

- In general, organic compounds containing halogens are called alkyl halides.

R – X

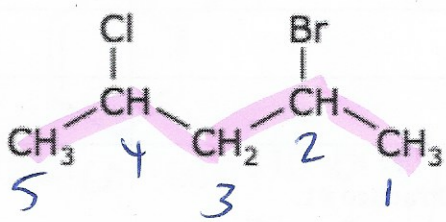
Where X = F, Cl, I, Br

- The prefixes are:

F = fluoro Cl = chloro Br = bromo I = iodo

Practice #1.

1. Parent Chain. pentane
2. Number the parent chain.



3. Name the branches.

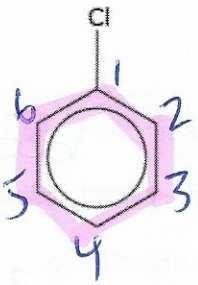
2- bromo 4- chloro

4. Name the compound

2- bromo - 4-chloropentane

Practice #2.

1. Parent Chain. benzene
2. Number the parent chain.



3. Name the branches.

1- Chloro

4. Name the compound

1-chlorobenzene

2. Alcohols

- **Organic compounds containing a hydroxyl (-OH) group are called** alcohols

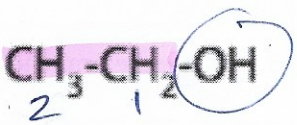
Naming alcohols:

a) The parent chain must contain the atom attached to the –OH group. Number the carbon atoms in the parent chain so that the -OH group is given the lower #.
b) The name of the parent chain ends with "-ol" instead of "-e"
c) Name and identify positions of the branches.
d) Name the compound

# of C Atoms	Prefix	Alcohol	Formula
1	Meth	methanol	CH_3OH
2	Eth-	ethanol	C_2H_5OH
3	Prop-	propanol	C_3H_7OH
4	But-	butanol	C_4H_9OH
5	Pent-	pentanol	$C_5H_{11}OH$
6	Hex-	hexanol	$C_6H_{13}OH$
7	Hept-	heptanol	$C_7H_{15}OH$
8	Oct-	octanol	$C_8H_{17}OH$
9	Non-	nonanol	$C_9H_{19}OH$
10	Dec-	decanol	$C_{10}H_{21}OH$

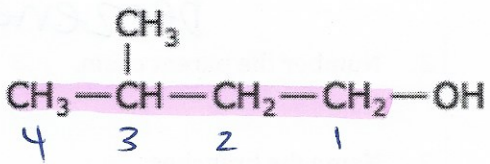
Practice #1.

1. Parent Chain. ethanol
2. Number the parent chain.
3. Name the branches. n/a
4. Name the compound 1-ethanol



Practice #2.

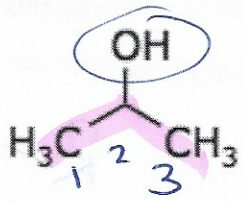
1. Parent Chain. butanol
2. Number the parent chain.
3. Name the branches. 3-methyl
4. Name the compound



3-methyl-1-butanol

Practice #3.

1. Parent Chain. propanol
2. Number the parent chain.
3. Name the branches. n/a
4. Name the compound 2-propanol



For the following functional groups, it is expected that you can recognize them in various molecules. You will not be required to know how to name or draw them.

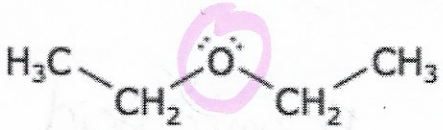
3. Ethers

- Two hydrocarbon fragments connected by an oxygen atom

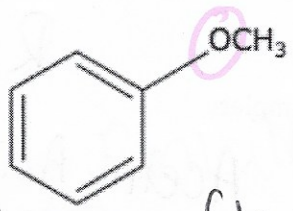
In general..

Examples:

diethyl ether (early form anesthetic)



methoxybenzene



Licorice flavoring

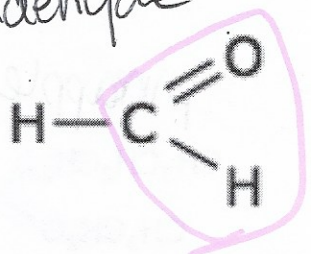
4. Aldehydes

- An organic compound containing a carbon atom double bonded to an oxygen atom at the end of a carbon chain.
- Carbonyl group = carbon atom double bonded to an oxygen C=O

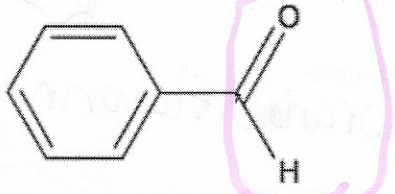
In general..

Examples:

Formaldehyde



Benzaldehyde



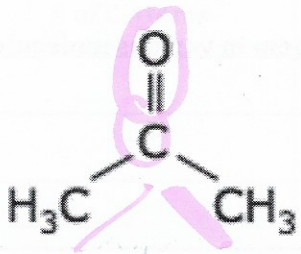
5. Ketones

- An organic compound containing a carbon atom double bonded to an oxygen atom
- Unlike an aldehyde, this carbonyl group is not at the end of the carbon chain

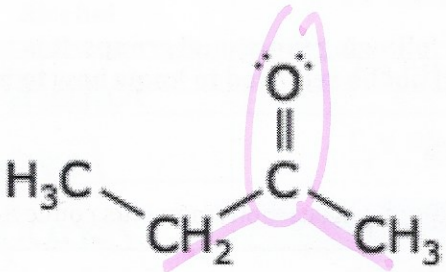
In general..

Examples:

Acetone



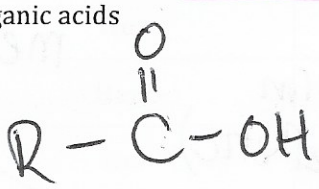
ethyl methyl ketone



6. Carboxylic Acid

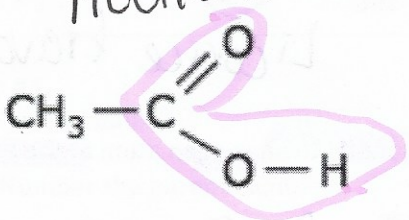
- An organic compound containing a carboxyl group (-COOH) and found at the end of compounds
- Sometimes called organic acids

In general..

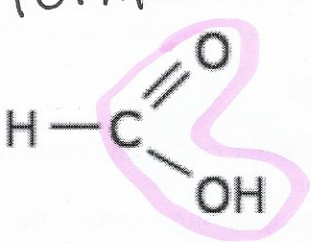


Examples:

Acetic Acid



Formic Acid



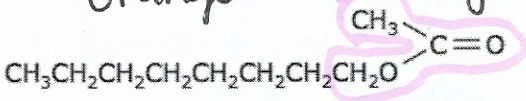
7. Esters

- An organic compound in which a –COO- group connects two other hydrocarbon fragments
- Strong fruity odors – used in perfumes and flavourings

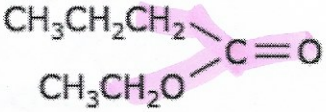
In general..

Examples:

orange flavoring



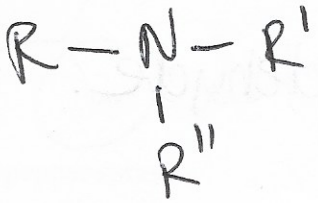
pineapple flavoring



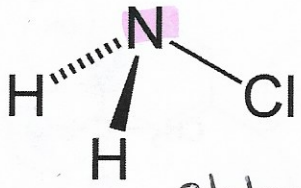
8. Amines

- An organic compound containing only single bonds and nitrogen atoms attached to a carbon atom

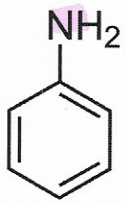
In general..



Examples:



Chloroamine (pool smell)

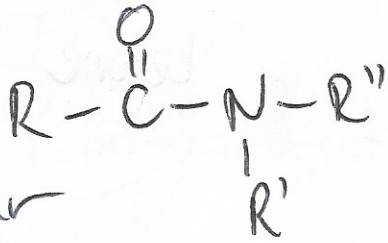


Aniline (rotten fish smell)

9. Amides

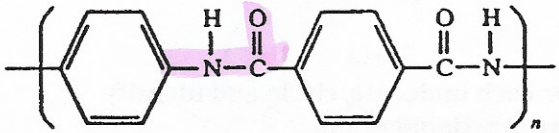
- An organic compound containing a nitrogen atom bonded to a carbonyl group (C=O)

In general..

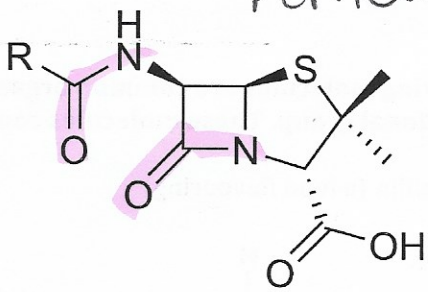


Examples:

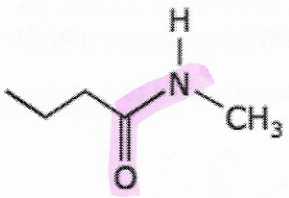
Kevlar



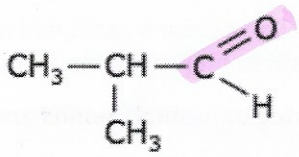
Penicillin



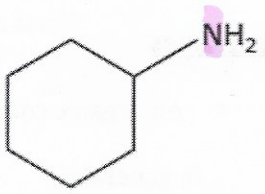
Classify the following molecules according to their functional group.



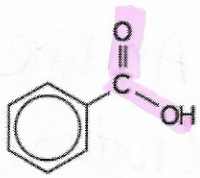
Amide



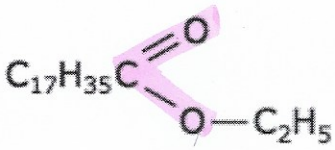
Aldehyde.



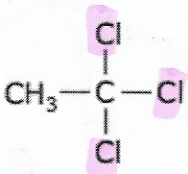
Amine



carboxylic acid

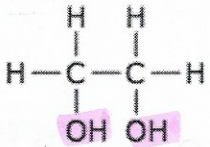


ester

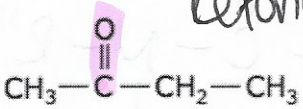


Alkyl halide

alcohol

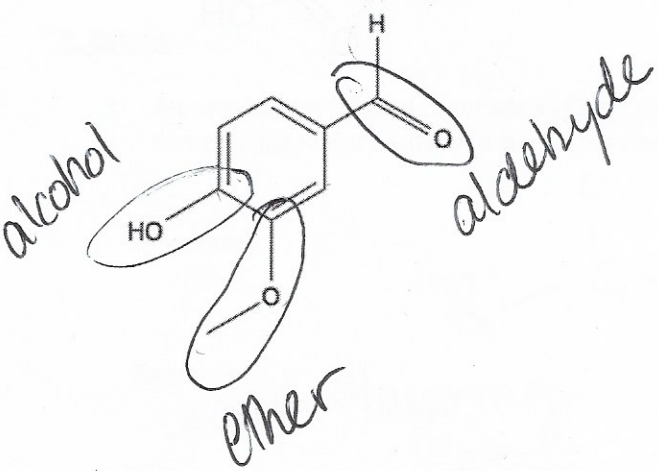


Ketone

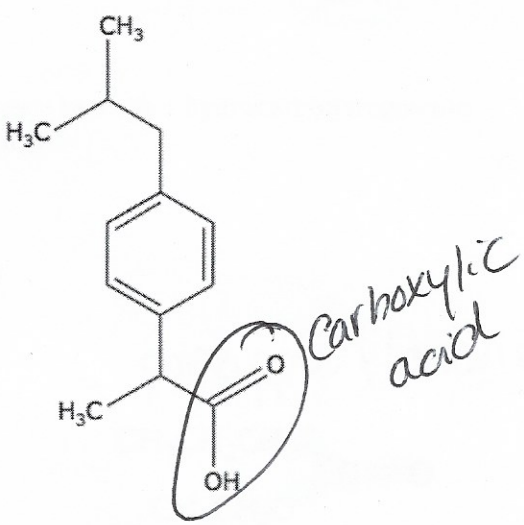


The following molecules are common organic compounds. For each molecule, circle and identify each functional group. These molecules contain more than one functional group.

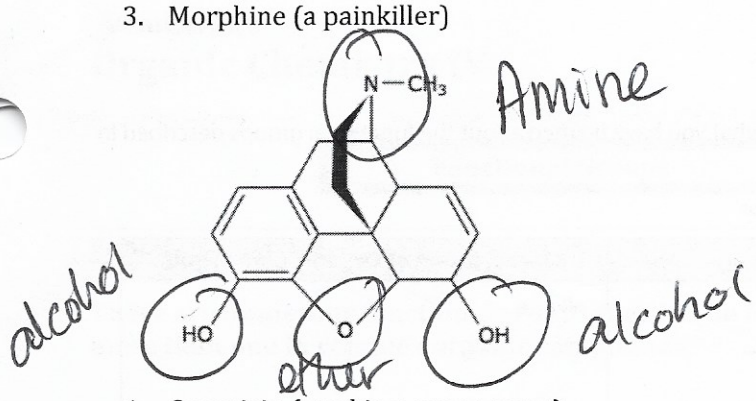
1. Vanillin (a food flavouring)



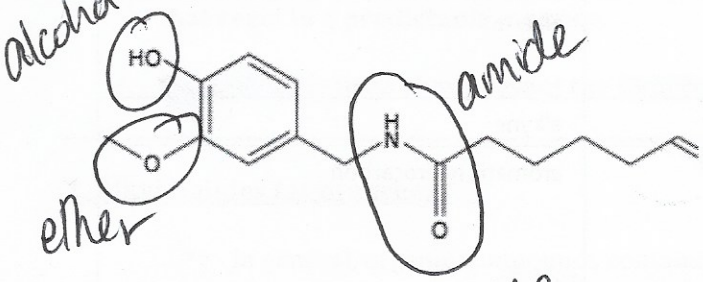
2. Ibuprofen (a painkiller)



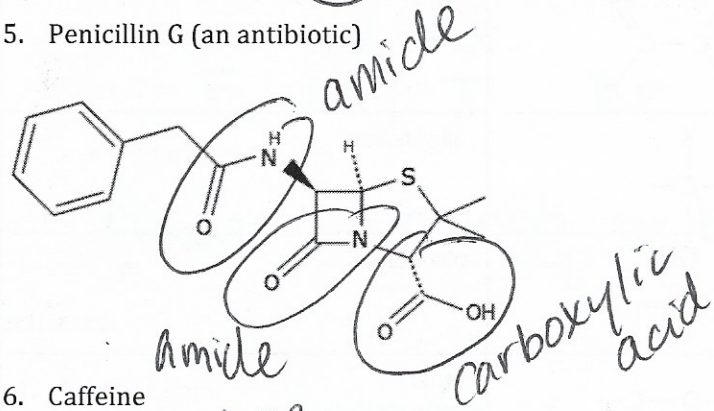
3. Morphine (a painkiller)



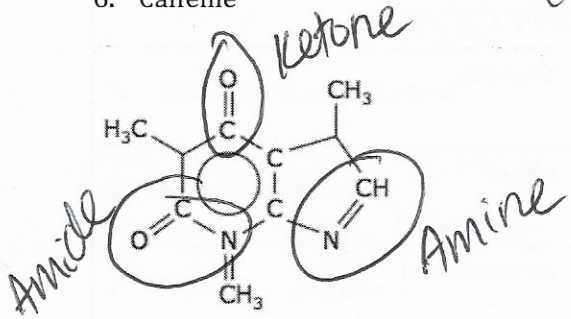
4. Capsaicin (used in pepper spray)



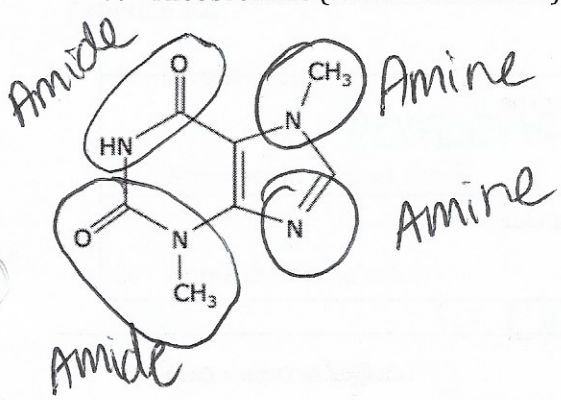
5. Penicillin G (an antibiotic)



6. Caffeine



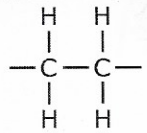
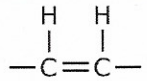
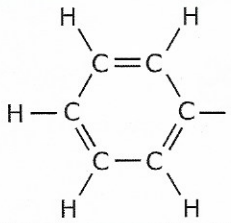
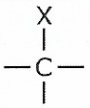
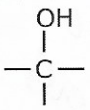
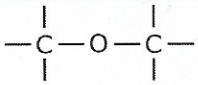
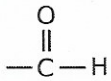
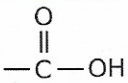
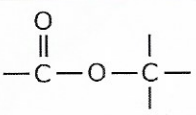
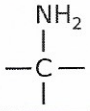
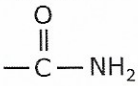
7. Theobromine (found in chocolate)



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
	alkane
	alkene
	alkyne
	aromatic hydrocarbon
	alkyl halide
	alcohol
	ether
	aldehyde
	ketone
	carboxylic acid
	ester
	amine
	amide