

Tutorial 17: An Introduction to Organic Functional Groups

Goals:

- ✓ Be able to recognize some common functional groups.
- ✓ Learn how to name organic molecules containing a functional group by the IUPAC nomenclature system.
- ✓ Learn some relevant common names of organic molecules containing a functional group.
- ✓ Know some of the reactions that alkanes and alkenes undergo.

Functional Groups

When a small portion of a molecule is responsible for the reactivity of that molecule, we call that small portion a functional group.

Basic IUPAC Nomenclature for Molecules with a Functional Group

Hydrocarbons:

- *Alkanes: Use the -ane ending*
- *Alkenes: Use the -ene ending; specify the double bond location if necessary*
- *Alkynes: Use the -yne ending; specify the triple bond location if necessary*
- *Aromatics: The simplest is benzene; the term aromatic refers to the class of organic compounds containing benzene-like rings; benzene contains six equivalent bonds*

Functional Groups Containing O and/or N:

- *Alcohol: Replace the -e ending with the -ol ending; use number to specify alcohol location if there are 3 or more carbons in the chain*
 - *Examples: ethanol, 2-propanol*
- *Amine: Name the alkyl group with the -yl ending and the suffix -amine (primary amines only)*
 - *Example: propylamine*
 - *NOTE: IUPAC also accepts naming amines as alkanamines where the -e ending is replaced by the word -amine (propanamine)*

IUPAC Nomenclature for Molecules with a Functional Group Continued

- *Aldehyde: Replace the -e ending with the -al ending; in condensed formulas aldehydes are often shown as –CHO.*
 - *Examples: methanal and ethanal*
 - *NOTE: common names formaldehyde and acetaldehyde are often used in place of these two IUPAC names*
- *Ketone: Replace the -e ending with the -one ending; specify the location of the carbonyl when there are more than 3 carbons in the chain*
 - *Example: 4-octanone*
 - *NOTE: acetone is the common name for propanone*
- *Carboxylic Acid: Replace the -e ending with -oic acid ending*
 - *Example: methanoic acid and ethanoic acid*
 - *NOTE: common names formic acid and acetic acid are often used in place of these two IUPAC names; common names are used for fatty acids*
- *Amide: Replace the -e ending with -amide ending*
 - *Example: ethanamide*
 - *NOTE: acetamide is often used in place of this IUPAC name*
- *Ester: Name the alkyl group off of the oxygen, then name the alkyl group that includes the carbonyl, replace the –e ending with the -oate ending*
 - *Example: ethyl butanoate*
 - *NOTE: formate is commonly used in place of methanoate and acetate is commonly used in place of ethanoate*

Reactions of Hydrocarbons

- Alkanes: Not very reactive. Takes energy from a spark or heat to get over the activation energy barrier.
 - Combustion:
 - Halogenation:
- Alkenes: more reactive than alkanes.
 - Combustion:
 - Hydrogenation:
 - Halogenation:
 - Hydrohalogenation:
 - Hydration:
- Alkynes: similar to alkenes.
- Aromatics: have their own unique reactivity.