

Student Packet: 10.2: Organic Nomenclature: Student Handout

Hydrocarbons

Alkanes — They are hydrocarbons in which all the carbon-carbon bonds are single bonds. These are called saturated hydrocarbons:

Methane, CH₄ Ethane, C₂H₆ Propane, C₃H₈ Butane, C₄H₁₀ Pentane, C₅H₁₂ Hexane, C₆H₁₄ Heptane C₇H₁₆ Octane C₈H₁₈

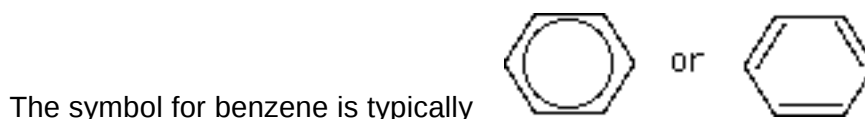
Alkenes — These are unsaturated hydrocarbons. They contain one carbon-carbon double bond. Use the same name convention as the alkanes to indicate the number of carbon atoms. They end in “ene”.

Use a number to indicate the position of the double bond: CH₃-CH=CH-CH₃ is 2-butene

Alkynes — Also unsaturated hydrocarbons. These contain one carbon-carbon triple bond. Use the same naming convention as the alkenes but end in “yne.”

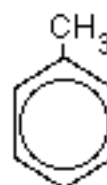
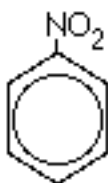
Use a number to indicate the position of the triple bond: CH₃-C≡C-CH₃ is 2-butyne

Arenes — Arenes are ring hydrocarbons derived from benzene, C₆H₆.



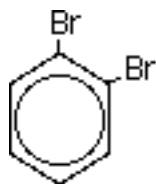
The three pi-bonds are delocalized over the entire sigma-bond ring.

Know the following monosubstituted benzene derivatives.

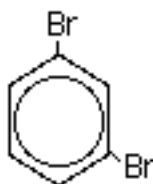


Chlorobenzene nitrobenzene aminobenzene (aniline) hydroxybenzene (phenol) methylbenzene (toluene)

When two functional groups are attached to the benzene ring, three isomers are possible. They are defined by the prefixes ortho-, meta-, and para-, (o-, m-, p-). These prefixes tell you the relative positions of the functional groups.



o-dibromobenzene
1,2-dibromobenzene



m-dibromobenzene
1,3-dibromobenzene



p-dibromobenzene
1,4-dibromobenzene

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IUPAC — International Union of Pure and Applied Chemists. The IUPAC name consists of a single word. It has two parts.

1. A suffix that identifies the parent chain. To find the suffix, count the carbon atoms in the longest continuous chain.
 2. A prefix that identifies branching alkyl groups and indicates by a number the carbon atom where the branching occurs.
- * If the same group is at two branches, the prefix di is used. If three, you'd use tri.
 * The number in the name is made as small as possible — that tells you which end to start at.

Functional groups — Lots of organic molecules are derived from hydrocarbons by substituting a functional group for a hydrogen atom. Know these guys, the special naming convention is underlined.

Organic halogen compounds — Adding a halogen to a hydrocarbon: $\text{CH}_3\text{CBrHCH}_2\text{CH}$ 2-bromobutane

Alcohols — Add a hydroxyl group (-OH) to a hydrocarbon: $\text{CH}_3\text{H}_7\text{OH}$ is propanol

Ethers — Within the hydrocarbon there is a (R - O - R) bond: $\text{CH}_3 - \text{O} - \text{CH}_3$ is dimethyl ether

Aldehydes — The hydrocarbon contains the group (R - $\overset{\text{O}}{\parallel}$ C - H): $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{H}$ is ethanal

Ketones — The hydrocarbon contains the group (R - $\overset{\text{O}}{\parallel}$ C - R): $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3$ is propanone

Carboxylic Acids — The hydrocarbon contains the carboxyl group (R - $\overset{\text{O}}{\parallel}$ C - OH): $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{OH}$ is ethanoic acid

Esters — The hydrocarbon contains the group (R - $\overset{\text{O}}{\parallel}$ C - O - R): $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{O} - \text{CH}_3$ is methyl acetate

Amines — The hydrocarbon contains the group (R - N -): CH_3NH_2 is aminomethane

Amides — The hydrocarbon contains the group (R - $\overset{\text{O}}{\parallel}$ C - NH_2): $\text{CH}_3 - \overset{\text{O}}{\parallel} \text{C} - \text{NH}_2$ is ethanamide

Be able to identify each type of organic compound and know that different names are often used. For example aminomethane is more often called methyl amine.

Student Packet: 10.2: Organic Nomenclature: AssessMe questions

- 1) Molecules with the same molecular formula but different structural formulas are called:
- A) isobars B) isotopes C) isomers D) isotherms E) I'm clueless
- 2) Hydrocarbons would be expected to always have which physical characteristic?
- A) soluble in water
B) soluble in carbon tetrachloride
C) low boiling point
D) soluble in alcohols
E) I'm clueless
- 3) C_2H_2 is called?
- A) methane
B) ethylene
C) acetylene (ethyne)
D) propane
E) I'm clueless
- 4) C_4H_{10} is called?
- A) methane
B) ethane
C) propane
D) butane
E) I'm clueless
- 5) What is the density of UF_6 gas at 25°C and 752 mm Hg?
- A) 7.1 g/L B) 14.2 g/L C) 28.4 g/L D) 14.5 g/L E) I'm clueless
- 6) How many moles of gas are contained in a 578 ml cylinder at 22°C and 758 mm Hg?
- A) 0.006 moles
B) 0.012 moles
C) 0.024 moles
D) 0.036 moles
E) I'm clueless

Student Packet: 10.2: Organic Nomenclature: ShowMe questions

1) What are the structural formulas for the following organic compounds?

2-pentyne
 2-methyl-2-butene
 propanoic acid
 1-chloro-2-methylpropane
 2-butanol

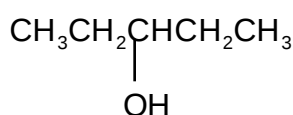
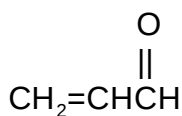
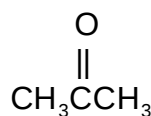
2) What are the structural formulas for the following organic compounds?

n-pentane
 2-methylbutane
 2, 2-dimethylpropane
 1, 2-dibromoethene
 1, 1-dichloroethane

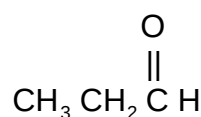
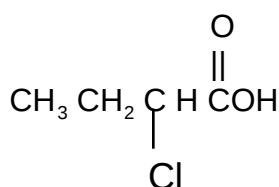
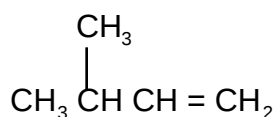
3) What are the structural formulas for the following organic compounds?

butanoic acid
 2-ethylhexanal
 aminopropane
 propenoic acid
 2-bromo-3-pentanone

4) Given the following geometric formulas, name the compounds according to IUPAC conventions.

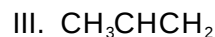


5. Given the following geometric formulas, name the compounds according to IUPAC conventions.



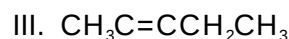
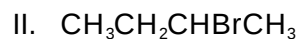
Student Packet: 10.2: Organic Nomenclature: TestMe questions

1) Name the following compounds in order. (Use IUPAC)



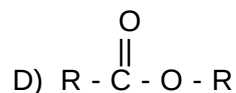
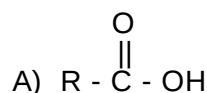
- A) 1-pentanol, 1,2-dichloroethane, propane
- B) 1-butanol, 1,2-dichloroethane, propene
- C) 1-pentanol, ethyl dichloride, 1-propene
- D) 1-pentanol, 1,2-dichloroethane, 1-propene
- E) None of the above

2) Name the following compounds in order (use IUPAC).



- A) 2-pentanol, 2-bromobutane, 3-pentyne
- B) 2-methylbutanol, 2-bromobutane, 3-pentyne
- C) 2-pentanol, 2-bromobutane, 2-pentyne
- D) 2-methylbutanol, 2-bromobutane, 2-pentyne
- E) 2-methylbutanol, 2-bromobutane, 2-pentyne

3) Which of the following functional groups is an amide? (R stands for a hydrocarbon)



4) In what class of organic molecules is



- A) carboxylic acid
- B) alcohol
- C) aldehyde
- D) ketone
- E) ether

5) What is the name of $\text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$?

- A) dimethyl ether
- B) diethyl ether
- C) diethyl ester
- D) 3-pentanol
- E) diethanol