# HONORS: Naming Organic Compounds

**Organic chemistry centers around the element *carbon*.**

*Hydrocarbons* (compounds made of the elements *hydrogen* and *carbon* are the basic building foundation of organic chemistry.

Carbon is unique among the elements because it can have up to four bonds per Carbon atom.

**Numerical Prefixes = Number of Backbone Carbon Atoms**
The prefix in the name of an organic molecule indicates the **number of carbon atoms** found in the longest chain of carbon atoms. *You should memorize the prefixes:*

| Prefix | # C atoms |
|---|---|
| meth- | 1 |
| eth- | 2 |
| prop- | 3 |
| but- | 4 |
| pent- | 5 |
| hex- | 6 |
| hept- | 7 |
| oct- | 8 |
| non- | 9 |
| dec- | 10 |

---

alkanes: hydrocarbons having only _____ bonds

alkenes: hydrocarbons having at least one _____ bonds

alkynes: hydrocarbons having at least one _____ bond

| Types of Hydrocarbons | Alkanes | Alkenes | Alkynes |
|---|---|---|---|
| Name | prefix + ____ ending | prefix + ____ ending | prefix + ____ ending |
| Formula | | | |
| Bonds | | | |

**Bond Comparisons**

Bond Strength _____> _____> _____

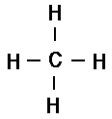
Bond Length _____> _____> _____

# Alkane, Alkene, Alkyne Naming

***Naming Straight-Chain Alkanes:***

1. Find the longest continuous chain of C atoms. Choose the appropriate prefix.
2. The name ends with –ane.

EX.  pentane

m*ethane* 

**Alkane Naming:** prefix + -ane

a. $CH_3CH_2CH_3$

b. $C_4H_{10}$

c. ethane

d. $CH_3$-$CH_2$-$CH_2$-$CH_2$-$CH_2$-$CH_2$-$CH_2$-$CH_3$

***Naming Straight-Chain Alkenes/Alkynes:***

Naming is a little bit more complex for alkenes and alkynes than for alkanes. Since the double bond could appear at various sites in a typical molecule, we have to specify where it is.

1. Count carbon atoms in the chain, and identify multiple bonds by the *–ene* or *–yne*, as appropriate.
2. Number carbon atoms so that the lowest number indicates the multiple bond position
3. Indicate the double/triple bond position with the number and dash, followed by the name

EX.  1-but<u>yne</u>

**Alkene Naming/Drawing:** prefix + -ene

a. $H_2C=CH_2$

b. 2-Pentyne

c. $H_2C=CHCH_2CH_3$ vs. $CH_3CH_2=CH_2CH_3$

e. $C_5H_{10}$

**Alkyne Naming/Drawing:** prefix + -yne

a. $CH_3C{\equiv}CCH_2CH_2CH_3$

b. $CH_3CH_2C{\equiv}CCH_2CH_3$

c. $CH_3CH_2CH_2C{\equiv}CCH_3$

d. $CH_3CH_2CH_2CH_2C{\equiv}CH$

# Alkane, Alkene, Alkyne Practice

1. 3-Octyne

2. 1-Hexene

3. 2-Nonene

4. Hexane

5. 4-Nonyne

6. 3-Hexene

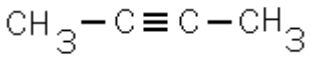
7. $CH_3$-$CH_2$-CH=CH-$CH_2$-$CH_2$-$CH_3$

8. $CH_3$-CH=CH-$CH_2$-$CH_2$-$CH_3$

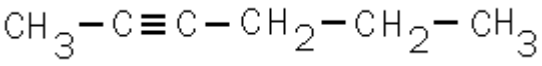
9. $CH_3$-$CH_2$-CH=CH-$CH_2$-$CH_2$-$CH_2$-$CH_3$

10. $CH_3$-$CH_3$

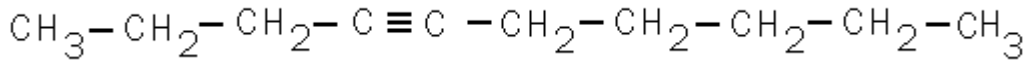
11.



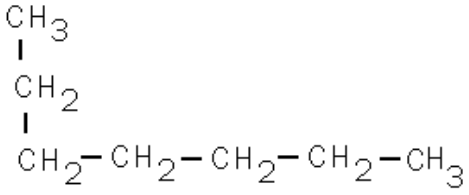
12.



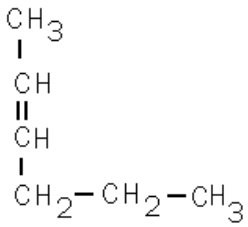
13.



21.



22.

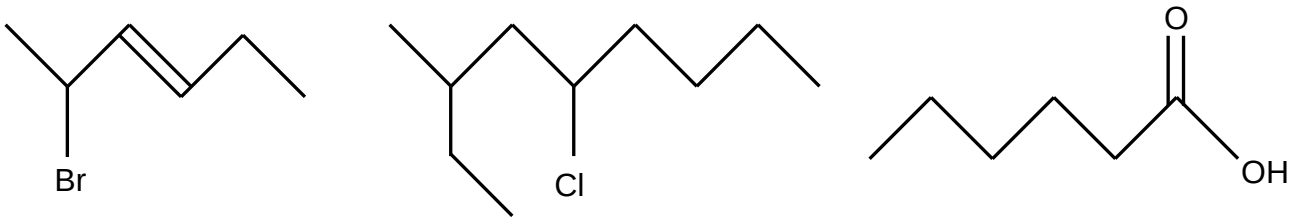


14. Why is 6-decene not possible?

# Functional Groups and Nomenclature

Branches of carbon atoms and functional group in an organic molecule replace a hydrogen atom in a hydrocarbon. **These replacement groups are much more reactive** than the hydrogen atom that was replaced. **They give the molecule its reactivity**.

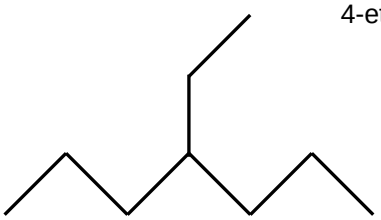
Many organic compounds are combinations of several categories:




***Naming Branched Alkanes***

1. Number the "longest chain" carbons. Start with the end nearest the branch.
2. Name and give the carbon # of the branch/functional group using prefixes, but end in –yl.

EX. 4-ethylhexane

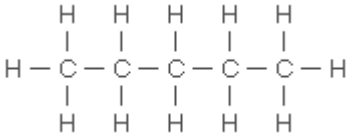


***Naming Alcohols*** *(-OH group) = -ol ending*

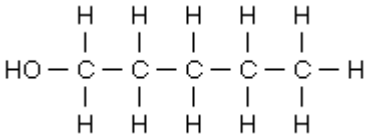
Alcohols are named just like alkanes but contain a hydroxyl group in place of a hydrogen. Alcohols are designated with an **-ol ending.**

1. Specify the location of the OH group(s) by placing a number with dash representing the carbon atom the hydroxyl group is attached to
2. Name the carbon chain using the prefix system, but ending in the suffix –ol for alcohols

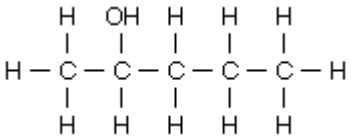
a.



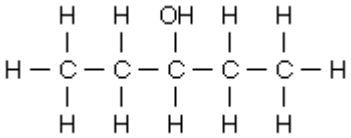
b.



c.



d.



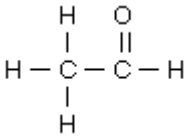
# Carbonyl Naming:

| | Ketones | Aldehydes | Esters | Carboxylic Acids |
|---|---|---|---|---|
| **Functional groups containing the <u>carbonyl</u> group** | | | | |
| | Names end in *–one*, [w]/the C in the carbonyl having the lowest possible number. | Names end in *–al*, [w]/the C in the carbonyl being C #1. | The C in the carbonyl is C #1. Whatever is attached to the –O– is named first, then the name ends in *–oate*. | Names end in *–oic acid*, [w]/the C in the carbonyl being C #1. |

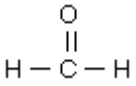
***<u>Naming Aldehydes</u>*** *(CH =O group) = -al ending*

An aldehyde is an organic molecule that has an oxygen atom doubly bonded to the *terminal* carbon of the backbone carbon chain. An aldehyde is named with the **-al ending**. Since the **CHO** must be on the terminal #1 carbon atom, the position of the CHO does not need to be specified in the name.

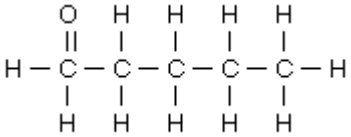
a.



b.



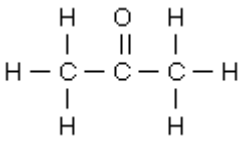
c.



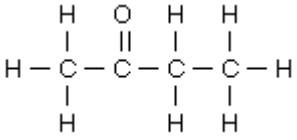
***<u>Naming Ketones</u>*** *(–C=O group) = -one ending*

Ketones are very similar to aldehydes. The only difference is that the C=O in a ketone is in the middle of a chain, and not on the terminal carbon. To name a ketone, use the **-one ending** and specify the position of the C=O with a number at the beginning of the name.

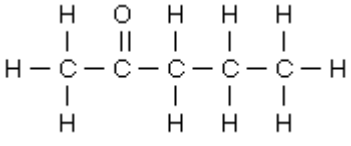
a.



b.



c.



**NOMENCLATURE Worksheet – Functional Groups**
Draw the following organic molecules.

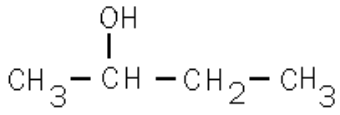
1. 2-pentanol

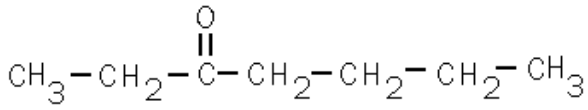
2. 1-butanol

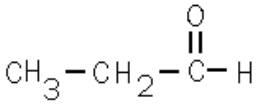
3. 3-pentanone

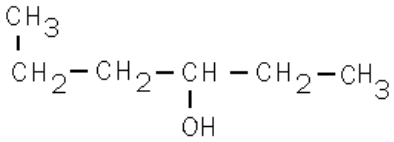
4. ethanal

**Name the following compounds.**

5. 

6. 

7. 

8. 

9. $CH_3$-$CH_2$-$CH_2$-$CH_2$-$CH_2$-$CH_2$-$CH_2$-OH

10.