A **functional group** in an organic molecule is an atom or a group of atoms that replaces 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 functionality, or its reactivity.

Reference Table R is very helpful to name and draw structure of organic molecules that contain a functional group. The table lists the class of compound, the functional group, the general formula and an example to help in the naming. The *R* and *R’* in the general formula stands for the hydrocarbon that makes up the rest of the molecule.

**Directions: *For each Model below, determine how the name is derived from the structural formula. Using table R in your reference table and the models, circle the functional group and name the compound.***

**MODEL 1: Halide or Halocarbon (group 17)**

Halides have a *halogen* (group 17 element) in place of a hydrogen atom. The name is derived by changing the ending of the halogen name to ***–o*** and adding it to the hydrocarbon name. A number is used to identify the carbon in the chain to which the halogen is attached.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **General Formula** | **Structural formula** | **Condensed formula** |
| *2-chloropropane* | **Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-28 at 2.22.17 PM.png** |  | CH3CHClCH3 |
|  *1,2 dibromoethane* | **Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-28 at 2.19.53 PM.png** |  CHBrCHBr |

Using Reference Table R and the model above, circle the functional group(s) then name the organic molecule.

****

Name:

**MODEL 2: Alcohols** (-OH group) = **-*ol*** ending

Alcohols have a hydroxyl group (-OH). The hydroxyl group is NOT the same as a hydroxide ion…it has no charge. (Alcohols are NOT bases!) Alcohols are named just like alkanes, but the **-e** at the end is replaced with an **-*ol*** ending**.**  You also need to put a number in front of the name, separated with a dash, to indicate which carbon atom the -OH group is attached. As always, use the smallest possible number.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **General Formula** | **Structural formula** | **Condensed formula** |
| *1-propanol* | Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-28 at 2.28.42 PM.png |  | CH3CH2CH2OH |
| *2-pentanol* | 2pentanol |  OH | CH3CHCH2CH2CH2CH3 |
| *3-pentanol* | 3pentanol |  OH | CH3CH2CHCH2CH2CH3 |

Circle the functional group then name the organic molecule.



Name:

***MODEL 3: Ethers*** *(-O-)*

*Ethers have an oxygen bonded between two hydrocarbon chains. In an ether, the carbon chain on each side of the –o– is named separately with a –yl ending then the word* ***ether****. The hydrocarbon chains* ***should*** *be named in alphabetical order (except for the \*\* below.)*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **General Formula** | **Structural formula** | **Condensed formula** |
| *\*\*\*methyl ethyl ether* | Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-28 at 2.33.12 PM.png | Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-22 at 8.28.13 PM.png |   CH3OCH2CH3  |
| *dimethyl ether* | Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-22 at 8.28.05 PM.png |  CH3OCH3 |
| *diethyl ether* | Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-22 at 8.28.22 PM.png |   CH3CH2OCH2CH3  |

**\*\*\*\*The *R* and *R’* in the general formula stands for the hydrocarbon that makes up the rest of the molecule. Notice that there are hydrocarbons on both sides of the oxygen atom.**

*Circle the functional group then name the organic molecule.*

**

*Name:*

 **O**

 **||**

**MODEL 4: Aldehydes** (–C–H group or –CHO group) = **-*al*** ending

An aldehyde is an organic molecule that has an oxygen atom doubly bonded to the **end** carbon of the backbone carbon chain. The C=O group is referred to as a *carbonyl* group.  An aldehyde is named like an alkane except with an **-*al* ending**.  Since the **CHO** must be on the terminal #1 carbon atom, the position of the CHO is *not specified* in the name. *(No number is needed).*

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **General Formula** | **Structural formula** | **Condensed formula** |
| *propanal* | Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-28 at 2.40.58 PM.png |  |  O || CH3CH2C-H |
| *ethanal* | ethanal |   O || CH3C-H |
| *pentanal* |  |  O ||CH3CH2CH2CH2C-H |

**\*\*\*\*The *R* in the general formula stands for the hydrocarbon that makes up the rest of the molecule. Notice that the functional group is on the end of the compound (carbon 1)**

Circle the functional group then name the organic molecule.



Name:

 **O**

 **||**

**MODEL 5: Ketones** (–C– group) = ***-one*** ending

Ketones are very similar to aldehydes.  Aldehydes and ketones with the same number of carbons are isomers. The only difference is that the *C=O in a ketone is in the middle of a chain and* ***not on the end*** ***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.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **General Formula** | **Structural formula** | **Condensed formula** |
|  *2-pentanone* | Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-28 at 2.45.14 PM.png | 2pentanone |  O || CH3CCH2CH2CH3 |
| *propanone* | acetone |   O  ||  CH3CCH3 |
| *butanone* | butanone |   O || CH3CCH2CH3 |

**\*\*\*\*The *R* and *R’* in the general formula stands for the hydrocarbon that makes up the rest of the molecule. Notice that there are hydrocarbons on both sides of the functional group (C=O).**

What is the difference between an aldehyde and a keytone?

Why is it not necessary to number propanone and butanone?

Circle the functional group then name the organic molecule.



Name:

 **O**

 **||**

 **MODEL 6: Organic Acids** (–C–OH or –COOH group)

Organic acids have a carboxyl group at the end of the carbon chain. The acidic H is attached to the oxygen in the carboxyl group. To name an acid, change the end of the hydrocarbon to –***oic acid***. No number is needed because the functional group is at the ***end*** of the carbon chain.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **General Formula** | **Structural formula** | **Condensed formula** |
| *propanoic acid*  | Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-28 at 2.46.45 PM.png |  |   O  ||  CH3CH2C-OH *(or* CH3CH2COOH) |
| *ethanoic acid*  |  |   O  ||  CH3C-OH (or CH3COOH) |
| *butanoic acid* | Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-27 at 7.10.07 PM.png |  O  ||  CH3CH2CH2C-OH(or CH3CH2CH2COOH) |

**\*\*\*\*The *R* in the general formula stands for the hydrocarbon that makes up the rest of the molecule. Notice that the functional group is on the end of the compound (carbon 1)**

Circle the functional group then name the organic molecule.



Name:

 **O**

 **||**

 **MODEL 7: Esters** (–C–O– or –COO– group)

Esters are named by the right side first (side bonded to oxygen) with a ***–yl*** ending. The second part of the name come from the left side (side bonded to C=O) with the ending ***–oate***.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **General Formula** | **Structural formula** | **Condensed formula** |
| *methyl propanoate* | **Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-28 at 2.59.32 PM.png** | http://www.ivyroses.com/Chemistry/Organic/molecules/methyl-esters/methyl-propanoate.gif | O||CH3CH2COCH3 |
|  *ethyl propanoate* | http://www.ivyroses.com/Chemistry/Organic/molecules/ethyl-esters/ethyl-propanoate.gif | O||CH3CH2COCH2CH3 |

**\*\*\*\*The *R* and *R’* in the general formula stands for the hydrocarbon that makes up the rest of the molecule. Notice that there are hydrocarbons on both sides of the functional group.**

What is the difference between and ester and an organic acid?

Circle the functional group then name the organic molecule.



Name:

**MODEL 8: Amines** (-N- group)

To name an amine, drop the end ***–e*** in the hydrocarbon name and replace it with -***amine***. Be sure to number the carbon in the chain to which the -NH2 group is attached.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **General Formula** | **Structural formula** | **Condensed formula** |
| *1-propanamine* | Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-28 at 3.19.12 PM.png | **Macintosh HD:Users:martinpalermoimac:Desktop:amine1a.gif** |  CH3CH2CH2NH2 |
| *ethanamine*  | http://www.ivyroses.com/Chemistry/Organic/molecules/amines/ethylamine.gif | CH3CH2NH2 |

Circle the functional group then name the organic molecule.



Name:

 **O**

 **||**

**MODEL 9: Amides** (–C–OH group)

To name amides, replace the –e in the name of the hydrocarbon with –amide. No number is needed as the functional group is at the end of the hydrocarbon chain.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **General Formula** | **Structural formula** | **Condensed formula** |
|  *propanamide* | **Macintosh HD:Users:martinpalermoimac:Desktop:Screen Shot 2016-03-28 at 3.29.02 PM.png** |  | O|| CH3CH2C-NH2 |
| *ethanamide* | http://docs.exdat.com/data/235/234358/234358_html_m57c90e0f.gif | O||CH3C-NH2 |

Circle the functional group then name the organic molecule.

 Name:

***Practice:***

*Identify the class of organic compounds to which each of the following belongs. Name the compound using the IUPAC name. It may be helpful to draw structural formulas first!*

CH3COOH CH3CH2COOCH3

CH3COCH3 CH3CH2COOH

CH3CH2OH CH3OCH3

CH3CH2OCH3 CH3CH2COCH3

CH3CH2CHO CH3CH2CH2CONH2

***Draw the structural formula for each of the following:***

butanoic acid methyl methanoate

methanal 3-pentanol