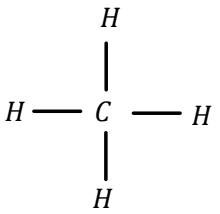
C11 - 6.1 - Alkane/Alkyl Notes

$HydroCarbon$
C_nH_{2n+2}
$H = 2C + 2$

Alkane: *A Hydrocarbon where Carbon is attaced by single bonds.*

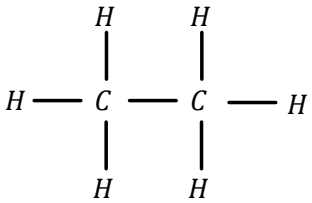
$Naming$: *ane*

$Methane$: CH_4



Full

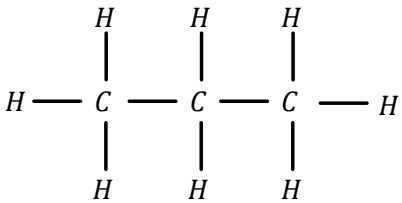
$Ethane$: C_2H_6



$CH_3 - CH_3$

Condensed / Line

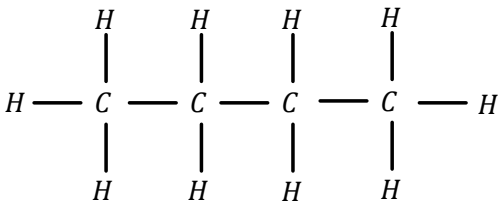
$Propane$: C_3H_8



$CH_3 - CH_2 - CH_3$

# C	
Meth	1
Eth	2
Prop	3
But	4
Pent	5
Hex	6
Hept	7
Oct	8
Non	9
Dec	10

$Butane$: C_4H_{10}



$CH_3 - CH_2 - CH_2 - CH_3$

$CH_3 - CH_2 - CH_2 - CH_3$
$CH_3 - CH_2 - CH_2 - CH_2 - CH_3$
$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$
$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$

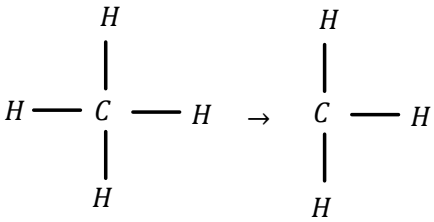
C_5H_{12}	$Pentane$:
C_6H_{12}	$Hexane$:
C_7H_{14}	$Heptane$:
C_8H_{18}	$Octane$:

Alkyl: *An Alkane that has lost a Hydrogen Atom*

$Naming$: *Ane* $\rightarrow$ *yl*

methane $\rightarrow$ *methyl*

$CH_4 \rightarrow CH_3-$



ethane $\rightarrow$ *ethyl*

$CH_3 - CH_3 \rightarrow CH_3 - CH_2 -$

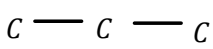
propane $\rightarrow$ *propyl*

$CH_3 - CH_2 - CH_3 \rightarrow CH_3 - CH_2 - CH_2 -$

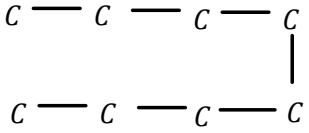
OR

$CH_3 - CH_2 - CH_3 \rightarrow CH_3 - \underset{|}{CH} - CH_3$

Parent: *Longest Chain*

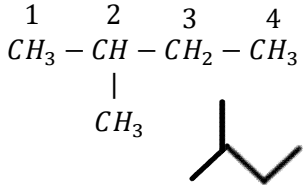


3 *Carbons* $\rightarrow$ *propane*



8 *Carbons* $\rightarrow$ *octane*

Each Carbon needs a combination of dashes and H's attched to add to 4!

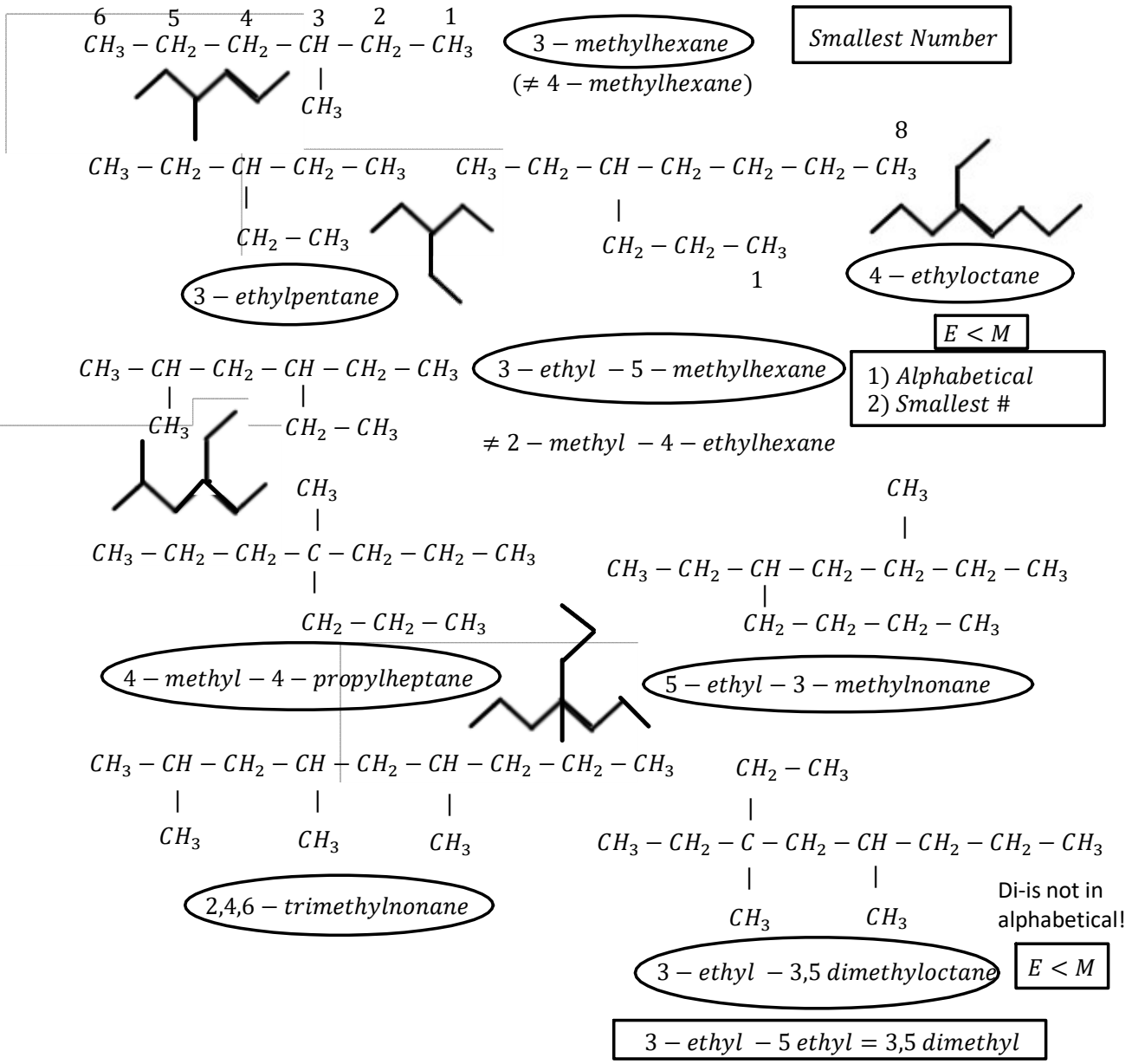


$2 - methylbutane$
$(aka\ methylbutane)$

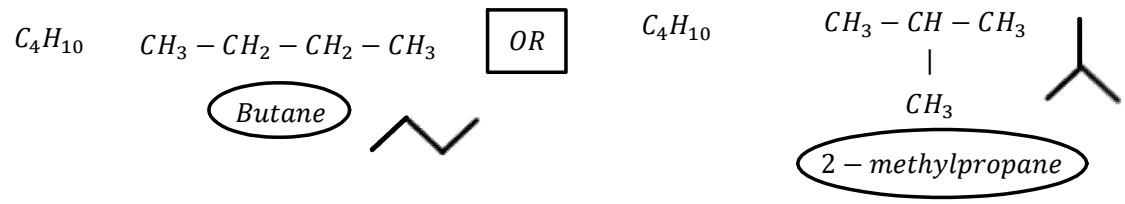
1) *butane*: *Longest Alkane Chain*
2) *methly*: *Attached Alkyl*
2) $2 - Location\ of\ attached\ methyl$

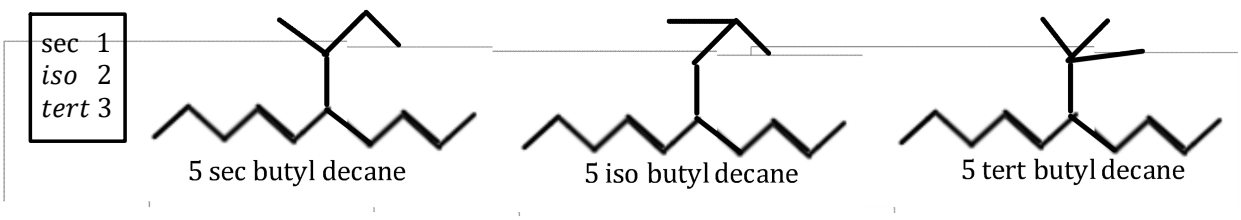
Alphabetical *Smallest Number*

C11 - 6.1 - Alkane/Alkyl/Structural Isomers Notes



Structural Isomers: Structurally different with the same molecular formula.





C11 - 6.2 - Cycloalkanes/Alkyl Halides Notes

$Cycloalkanes$
C_nH_{2n}
$H = 2C$

$Cycloalkanes$: $Hydrocarbon\ chains\ in\ a\ circle$

Naming: → $cyclo$

$cyclopropane$:

C_3H_6

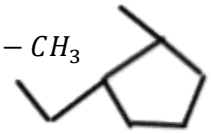
$H_2C - CH_2$
$\backslash\ /$
CH_2

$methylcyclopropane$:

$H_2C - CH - CH_3$
$\backslash\ /$
CH_2

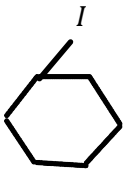
$1 - ethyl - 2 - methylcyclopentane$

$CH - CH_3$
$/$
H_2C $CH - CH_2 - CH_3$
$\backslash\ /$
$H_2C - CH_2$



$Iodocyclohexane$

CH_2
$/$
H_2C $CH - I$
$|$ $|$
H_2C CH_2
$\backslash\ /$
CH_2



$Alkyl\ Halides$: $Halogens\ attached\ to\ Alkanes$

$Naming$: $ine\ \rightarrow o$

Prefixes

$bromomethane$

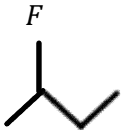
$CH_3 - Br$

$iodoethane$

$CH_3 - CH_2 - I$

$2 - flourobutane$

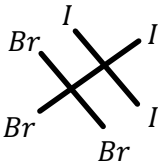
$CH_3 - CH - CH_2 - CH_3$
$|$
F



$CH_3 - CHF - CH_2 - CH_3$

$1,1,1\ tribromo - 2,2,2\ trichloroethane$

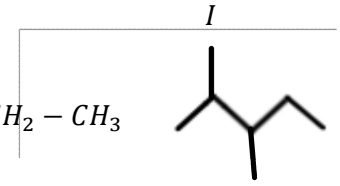
Br Cl
$|$ $|$
$Br - C - C - Cl$
$|$ $|$
Br Cl



$CBr_3 - CCl_3$

$2 - iodo - 3 - methylpentane$

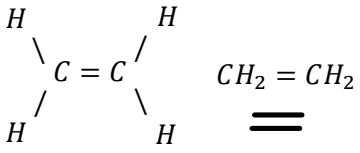
CH_3
$|$
$CH_3 - CH - CH - CH_2 - CH_3$
$|$
I



C11 - 6.3 - Alkene = Alkyne ≡ Bonds/Cis/Trans Isomers Notes

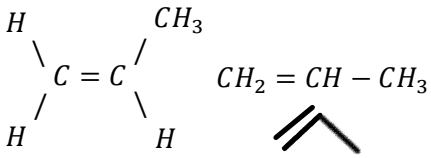
Alkene: Double Bond | *Naming:* ane → ene | C_nH_{2n}

ethene



$CH_2 = CH_2$

propene



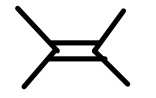
$CH_2 = CH - CH_3$

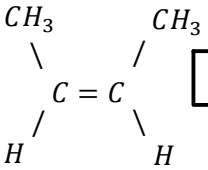
Isomers

Cis: Same side of double *Bond*

Imagine a horizontal line

Trans: Opposite side of double *Bond*

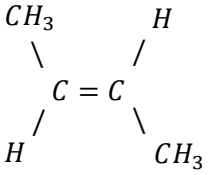




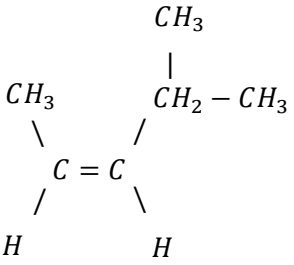
cis/trans $2 - Butene$

$CH_3 - CH = CH - CH_3$

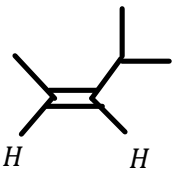
C_4H_8



$4\ -ethyl\ -2-pentene$



$CH_3 - CH = CH - CH_2 - CH_3$



<u>dienes</u>: two double bonds

Naming: diene

$2,3\ -\ pentadiene$

$CH_3 - CH = C = CH - CH_3$

Alkyne: Triple Bond | *Naming:* ane → yne | C_nH_{2n-2}

Ethyne

$CH \equiv CH$

Propyne

$CH \equiv C - CH_3$

OR

$2 - Butyne$

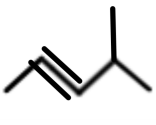
$CH_3 - C \equiv C - CH_3$

OR

$4 - methyl - 2 - pentyne$

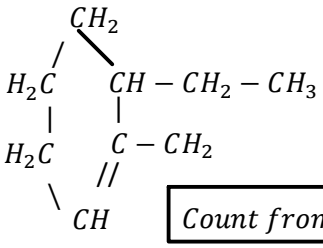
$CH_3 - C \equiv C - CH - CH_2$

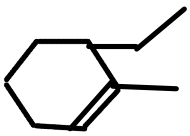
CH_3



Double/Triple Bond Overrides Alphabetical!

$3 - ethyl - 2\ -methyl\ -1 - cyclohexene$





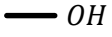
Count from before the double/triple bond

C11 - 6.4 - Alcohols/Aldehydes/Keytones/Aromatic Compounds Notes

Alcohols: *Organic compound with an OH.* | *Naming*: *ane → anol* | Group (last) Overrides Ethyl! Right to Left

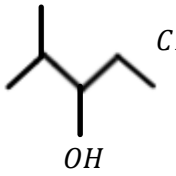
methanol

$CH_3 - OH$



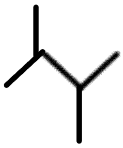
2,3 − pentadiol

$CH_3 - CH(OH) - CH_2 - CH_2 - CH_3$



3 − methyl − 2 − butanol

$CH_3 - CH(CH_3) - CH(OH) - CH_3$



Aldehydes: *an Organic Compound with a* $C = O$ *at the end* | *Naming*: *ane → anal*

methanal

$H - C(=O) - H$

"formaldehyde"

2 − methyl − 1 − butanal

$CH_3 - CH_2 - CH_2 - CHO$ with CH_3 branch

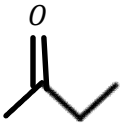
Keytones: *Organic Compound with a* $C = O$ *NOT at the end*! | *Naming*: *ane → anone*

butanone:

$CH_3 - C(=O) - CH_2 - CH_3$

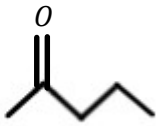
OR

$CH_3COCH_2CH_3$

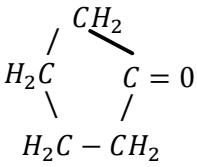


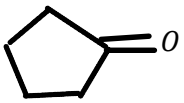
2 − pentanone

$CH_3COCH_2CH_2CH_3$



cyclopentanone

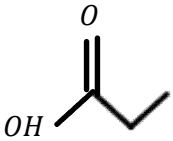




Carboxylic Acids: *an Organic Compound with COOH attached* | *Naming*: *'ethyl' e → oic Acid*

propanoic acid

$CH_3 - CH_2 - COOH$



alcohol + aldehyde

Aromatic Molecule: *Contains one or more Benzene Rimgs* | *Naming*: *Benzene*

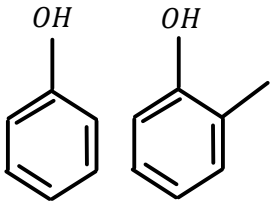
benzene

C_6H_6

(*Not** 1,3,5 *cyclohexatriene*)

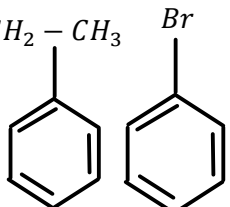
"phenol"

hydroxybenzene



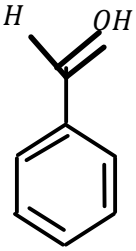
benzene − 1,2 − diol

ethylbenzene

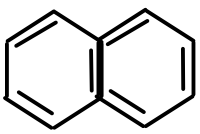


1,4 − dibromobenzene

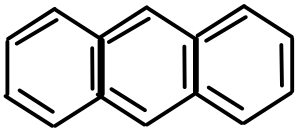
benzaldahyde



napthalene



anthracene



C11 - 6.5 - Amines/Amides/Carboxylic Acids/Esters/Ethers Notes

Amines: an Organic Compound with NH_2 attached

Naming: amino 'ethane'

aminopropane

$CH_3 - CH_2 - CH_2 - NH_2$

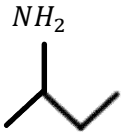
1,3 − diaminopropane

$NH_2 - CH_2 - CH_2 - CH_2 - NH_2$

2 − aminobutane

$CH_3 - CH - CH_2 - CH_3$

NH_2

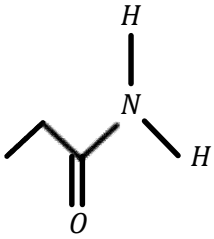


Amides: an Organic Compound with $CONH_2$ attached

Naming: abe → amide

propanamide

$CH_3 - CH_2 - CONH_2$

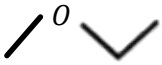


Ethers: an Organic Compound with an 'O' attached to two hydrocarbon groups

Naming: Smaller # side prefix 'oxy' Larger # Side ethane

methoxyethane

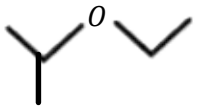
$CH_3 - O - CH_2 - CH_3$



"*methyl ethyl ether*"

2 − ethoxypropane

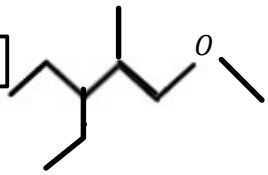
$CH_3 - CH_2 - CH_2 - O - CH_2 - CH_3$



3 − ethyl − 1 − methoxy − 2 methylpentane ?

$CH_3 - O - CH_2 - CH(CH_3) - CH(CH_2 - CH_3) - CH_3$

Count away from the 'Group"

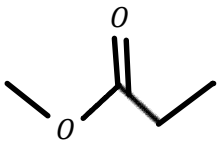


Esters: an Organic Compound with an COO attached to two hydrocarbon chains

Naming: Smaller # side ethyl, Larger # Side (inc C in COO)ethane e → oate

methyl propanoate

$CH_3 - CH_2 - CH_2 - COO - CH_3$



ethyl pentanoate

ether + keytone

$CH_3 - CH_2 - CH_2 - CH_2 - COO - CH_2 - CH_3$