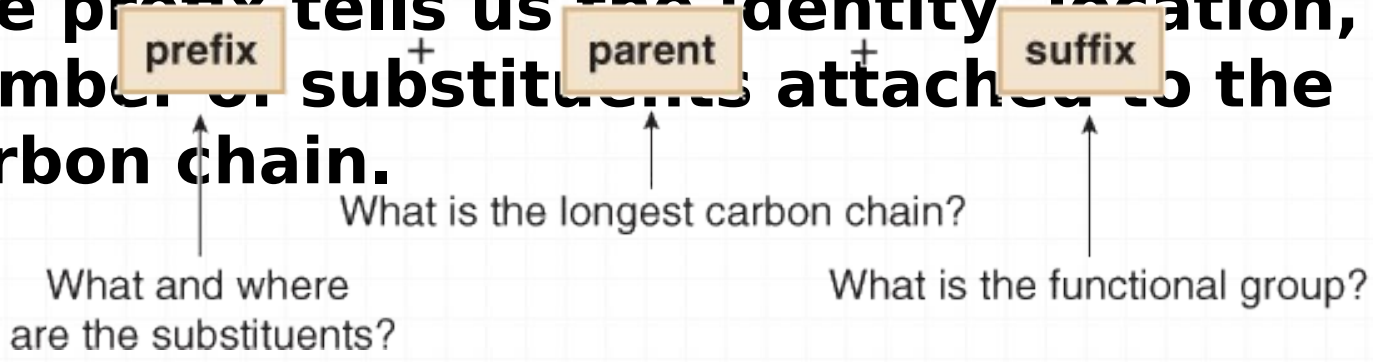
Alkanes - Nomenclature

The name of every organic molecule has 3 parts:

1. **The parent name indicates the number of carbons in the longest continuous chain.**
2. **The suffix indicates what functional group is present.**
3. **The prefix tells us the identity, location, and number of substituents attached to the carbon chain.**



Alkanes - Nomenclature

Parent – Longest straight carbon

TABLE 4.1 Summary: Straight-Chain Alkanes

Number of C atoms	Molecular formula	Name (*n*-alkane)	Number of constitutional isomers
1	CH_4	methane	—
2	C_2H_6	ethane	—
3	C_3H_8	propane	—
4	C_4H_{10}	butane	2
5	C_5H_{12}	pentane	3
6	C_6H_{14}	hexane	5
7	C_7H_{16}	heptane	9
8	C_8H_{18}	octane	18
9	C_9H_{20}	nonane	35
10	$C_{10}H_{22}$	decane	75
20	$C_{20}H_{42}$	eicosane	366,319

Alkanes - Nomenclature

Suffix – Our first functional group is alkane, so the suffix is –ane

For later functional groups we will drop the –ane root suffix for others

Alkane chain	# Carbons	Name
CH_4	1	methane
CH_3CH_3	2	ethane
$CH_3CH_2CH_3$	3	propane
$CH_3CH_2CH_2CH_3$	4	butane
$CH_3CH_2CH_2CH_2CH_3$	5	pentane
$CH_3CH_2CH_2CH_2CH_2CH_3$	6	hexane
$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$	7	heptane
$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	8	octane
$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	9	nonane
$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	10	decane
$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	11	undecane
$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	12	dodecane

Alkanes – Nomenclature

Prefix – Our substituents will be branches in the alkane structure

A branch is another alkane minus one hydrogen – **an alkyl group**

Example – if CH_3- is a branch on a longer chain:

CH_3- is CH_4 minus 1 hydrogen

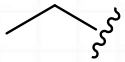
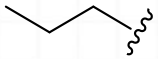
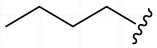
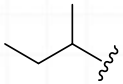
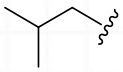
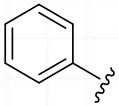
Since it is a side chain it will replace the –ane suffix with –yl

CH_3- is a methyl group

We can also abbreviate this group as Me-

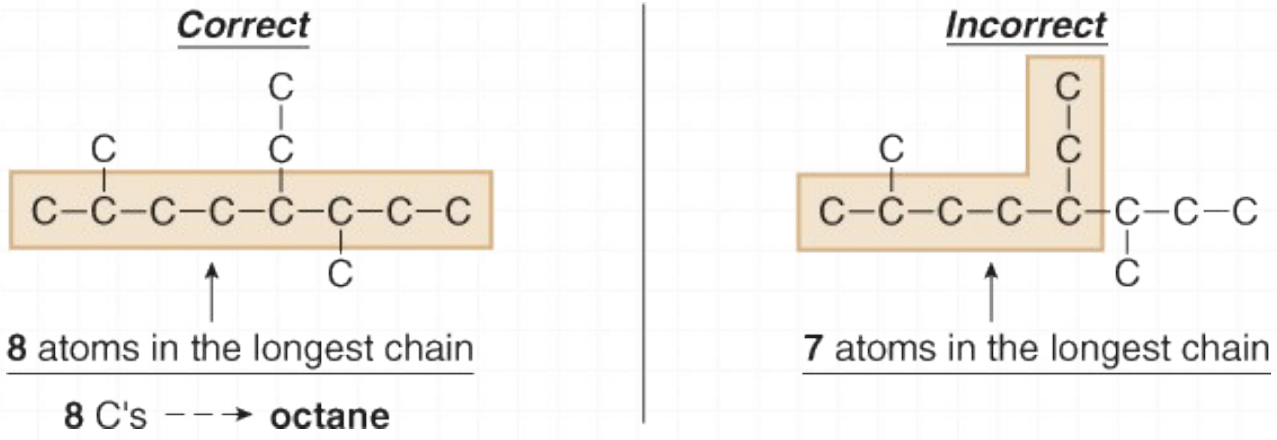
Alkanes - Nomenclature

Prefixes -

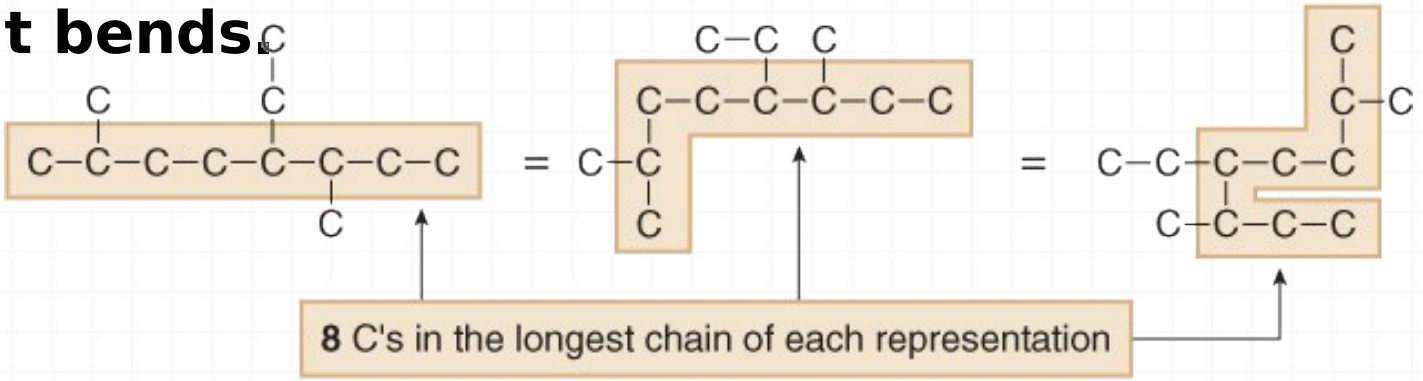
Alkyl group	Structure	IUPAC name	Abbreviation
CH_3-	CH_3-	methyl	Me-
CH_3CH_2-		ethyl	Et-
$CH_3CH_2CH_2$-		*n*-propyl	*n*-Pr
CH_3CHCH_3		isopropyl or *i*-propyl	*i*-Pr
$CH_3CH_2CH_2CH_2$-		*n*-butyl	*n*-Bu
$CH_3CH_2CHCH_3$		*sec*-butyl	*s*-Bu
$(CH_3)_2CHCH_2$-		isobutyl or *i*-butyl	*i*-Bu
$(CH_3)_3C$-		*tert*-butyl or *t*-butyl	*t*-Bu
C_6H_5-		phenyl	Ph

Alkanes - Nomenclature

1. Find the parent carbon chain and add the suffix.

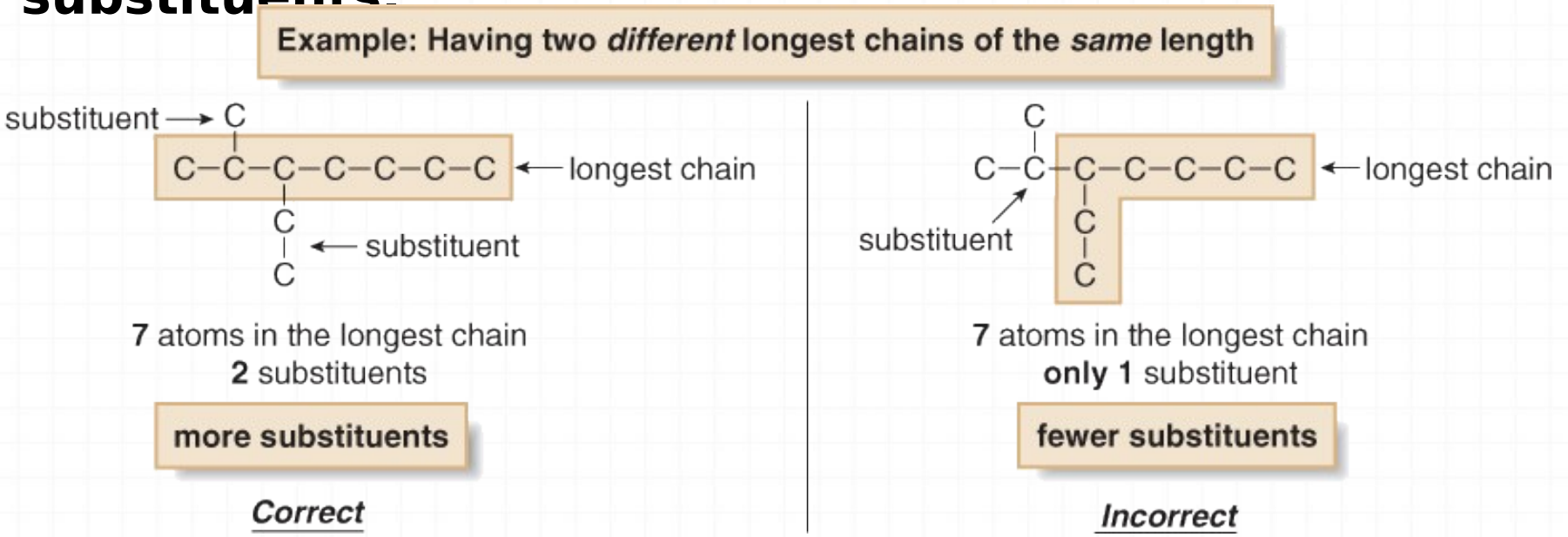


Note that it does not matter if the chain is straight or it bends.



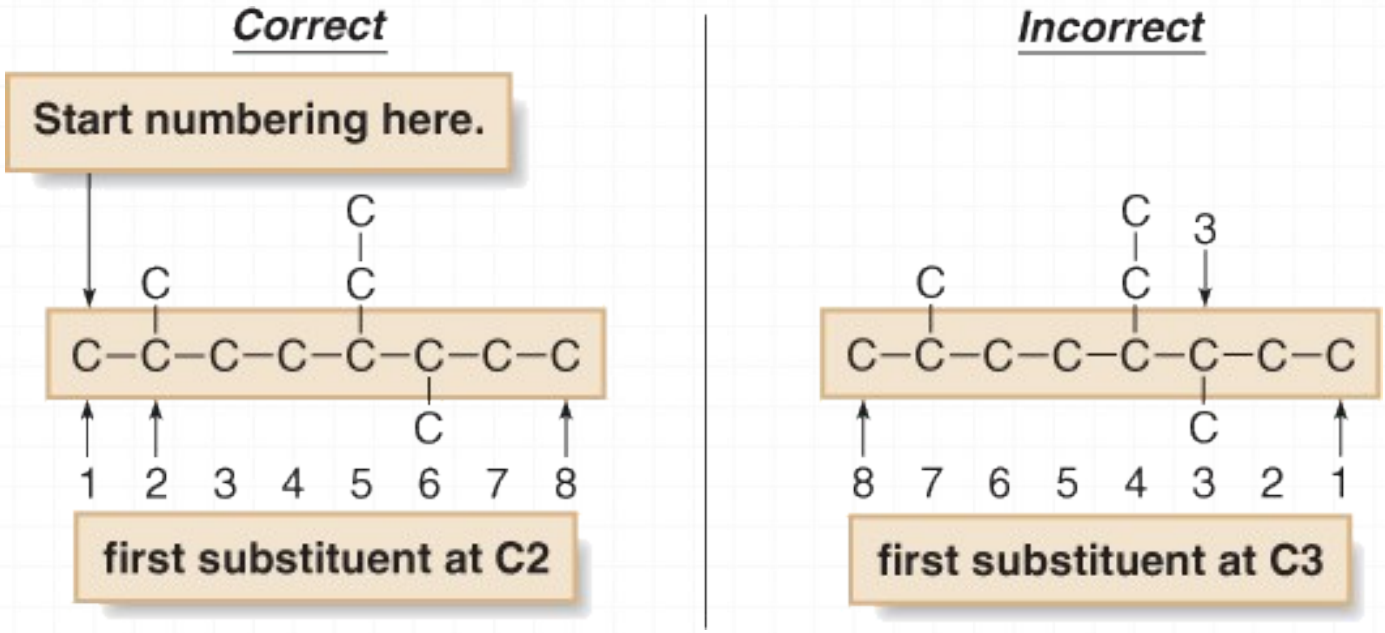
Alkanes - Nomenclature

Also note that if there are two chains of equal length, pick the chain with *more* substituents. In the following example, two different chains in the same alkane have seven C atoms. We circle the longest continuous chain as shown in the diagram on the left, since this results in the greater number of substituents.



Alkanes - Nomenclature

2. Number the atoms in the carbon chain to give the first substituent the lowest number.

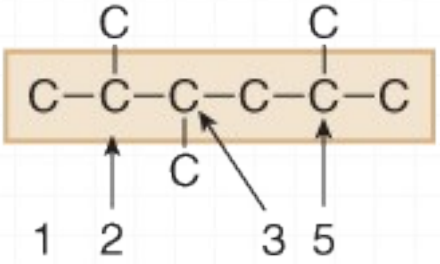


Alkanes - Nomenclature

If the first substituent is the same distance from both ends, number the chain to give the second substituent the lower number.

Example: Giving a lower number to the *second* substituent

Numbering from *left* to right

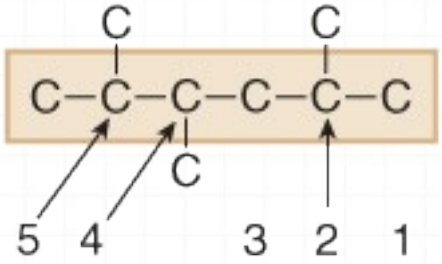


CH_3 groups at C2, **C3**, and C5.

The second substituent has a lower number.

Correct

Numbering from *right* to left



CH_3 groups at C2, **C4**, and C5.

higher number

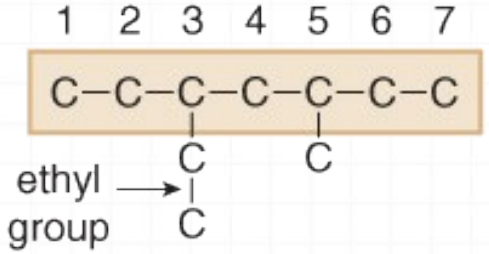
Incorrect

Alkanes - Nomenclature

When numbering a carbon chain results in the same numbers from either end of the chain, assign the lower number alphabetically to the first substituent.

Example: Two *different* groups *equidistant* from the ends

Numbering from *left* to right

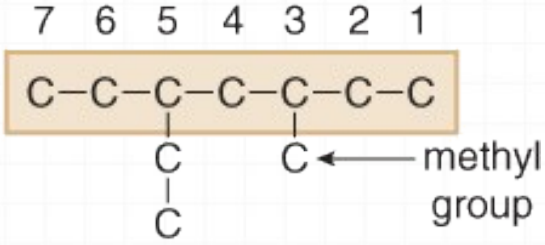


- **e**thyl at **C3**
- **m**ethyl at **C5**

Earlier letter → lower number

Correct

Numbering from *right* to left



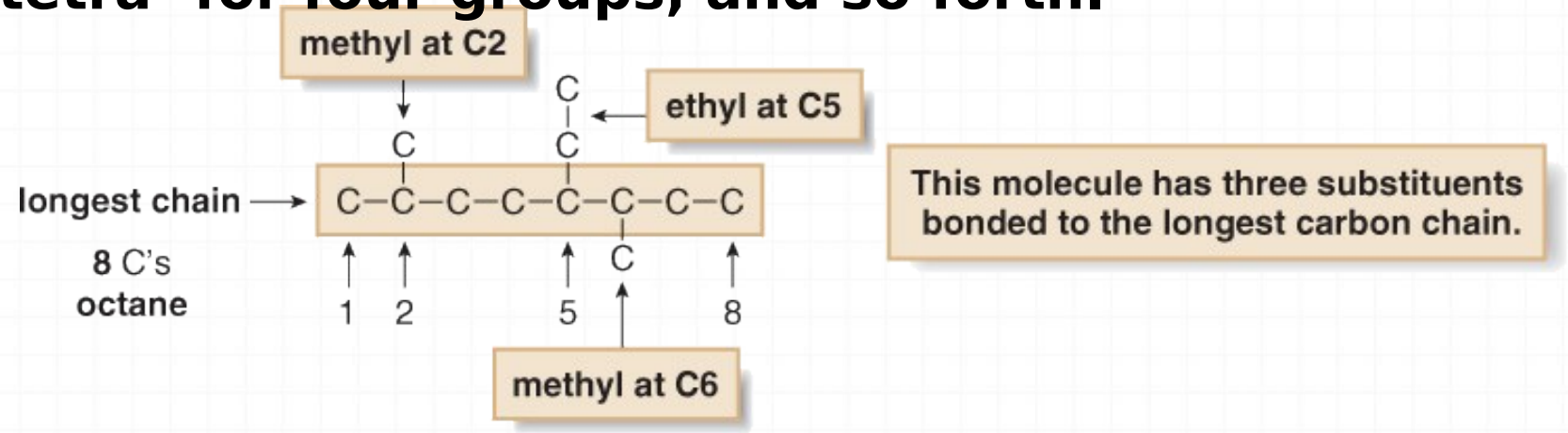
- **m**ethyl at **C3**
- **e**thyl at **C5**

Incorrect

Alkanes - Nomenclature

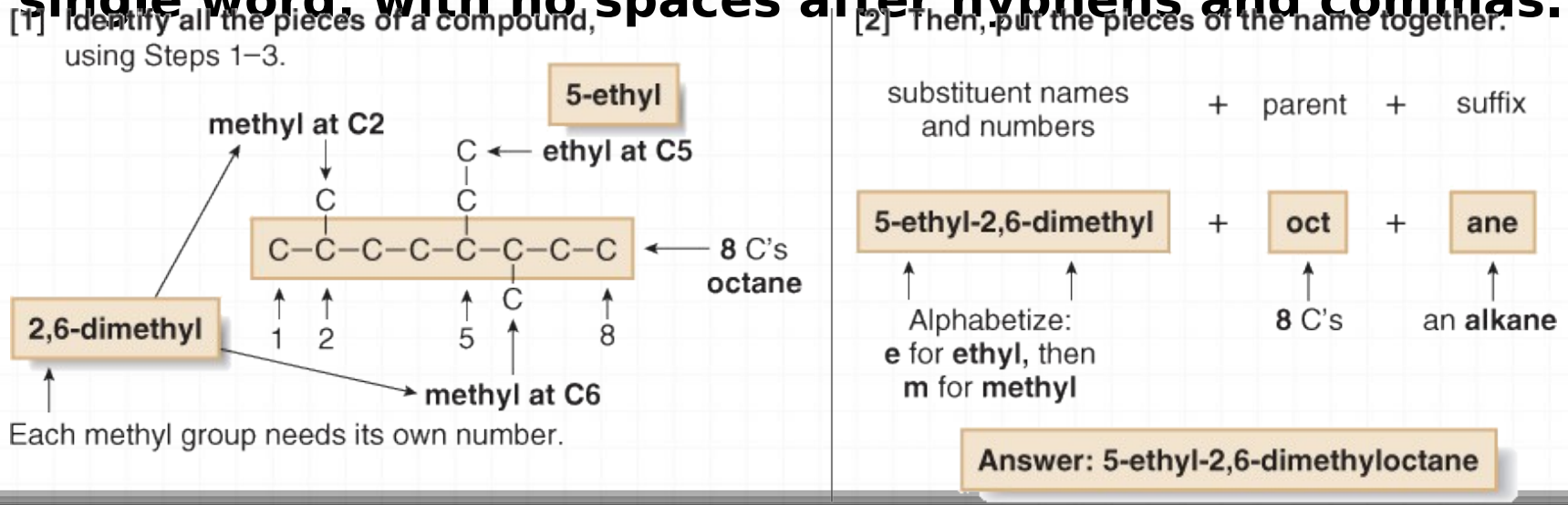
3. Name and number the substituents.

- **Name the substituents as alkyl groups.**
- **Every carbon belongs to either the longest chain or a substituent, not both.**
- **Each substituent needs its own number**
- **If two or more identical substituents are bonded to the longest chain, use prefixes to indicate how many: di- for two groups, tri- for three groups, tetra- for four groups, and so forth.**



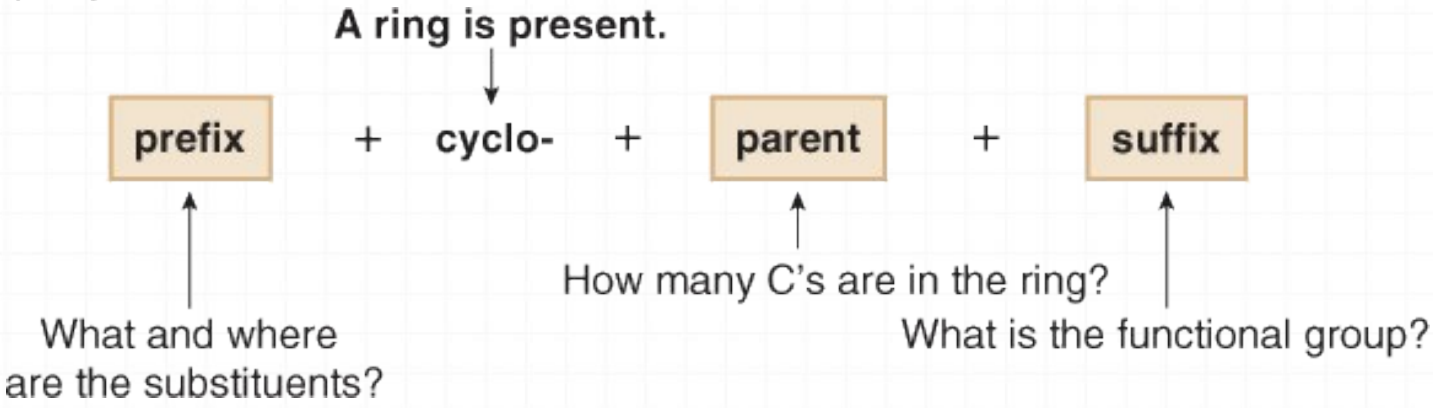
Alkanes - Nomenclature

4. **Combine substituent names and numbers + parent and suffix.**
   - **Precede the name of the parent by the names of the substituents.**
   - **Alphabetize the names of the substituents, ignoring all prefixes except iso, as in isopropyl and isobutyl.**
   - **Precede the name of each substituent by the number that indicates its location.**
   - **Separate numbers by commas and separate numbers from letters by hyphens. The name of an alkane is a single word, with no spaces after hyphens and commas.**

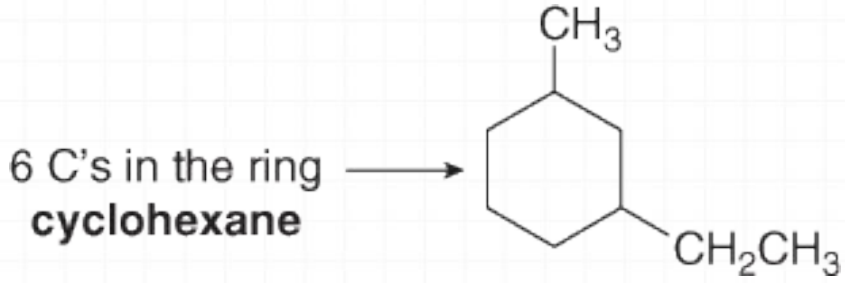


Alkanes - Nomenclature

Cycloalkanes are named by using similar rules, but the prefix cyclo- immediately precedes the name of the parent.

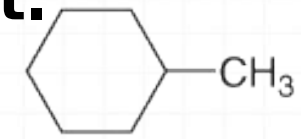


1. Find the parent cycloalkane.

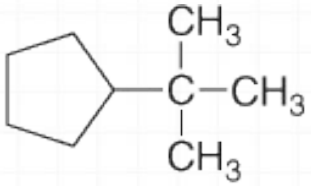


Alkanes - Nomenclature

2. Name and number the substituents. No number is needed to indicate the location of a single substituent.



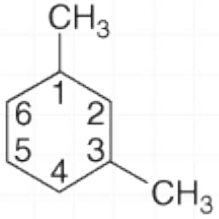
methylcyclohexane



tert-butylcyclopentane

For rings with more than one substituent, begin numbering at one substituent and proceed around the ring to give the second substituent the lowest number.

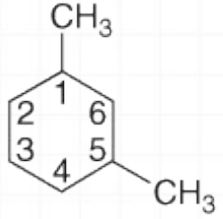
numbering clockwise



CH_3 groups at C1 and **C3**
The 2nd substituent has a lower number.

Correct: **1,3-dimethylcyclohexane**

numbering counterclockwise



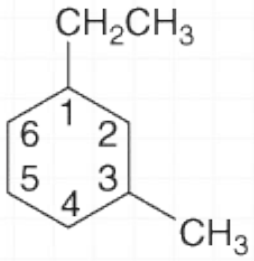
CH_3 groups at C1 and **C5**

Incorrect: 1,5-dimethylcyclohexane

Alkanes - Nomenclature

With two different substituents, number the ring to assign the lower number to the substituents alphabetically.

Begin numbering at the ethyl group.

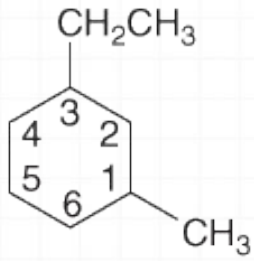


- **e**thyl group at **C1**
- **m**ethyl group at **C3**

earlier letter → lower number

Correct: **1-ethyl-3-methylcyclohexane**

Begin numbering at the methyl group.



- **m**ethyl group at **C1**
- **e**thyl group at **C3**

Incorrect: 3-ethyl-1-methylcyclohexane

Note the special case of an alkane composed of both a ring and a long chain. If the number of carbons in the ring is greater than or equal to the number of carbons in the longest chain, the compound is named as a cycloalkane.

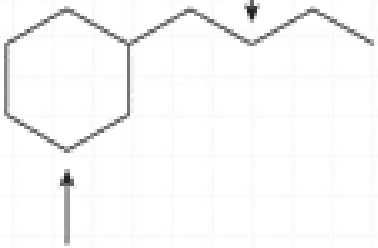
Alkanes - Nomenclature

Figure 4.2 Naming compounds containing both a ring and a long chain of carbon atoms

Contrast two different examples

more carbons in the ring

4 C's in the chain — a **butyl** group



6 C's in the ring—**cyclohexane**

Name as a **cyclohexane** with a substituent.

Answer: butylcyclohexane

more carbons in the chain

6 C's in the chain — a **hexane**



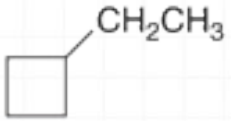
4 C's in the ring—a **cyclobutyl** group

Name as a *hexane* with a substituent.

Answer: 1-cyclobutylhexane

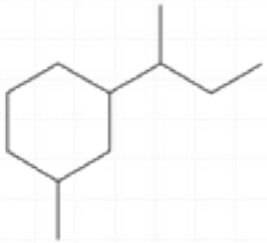
Alkanes - Nomenclature

Figure 4.3 Examples of cycloalkane nomenclature



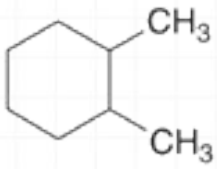
ethylcyclobutane

No number is needed with only one substituent.



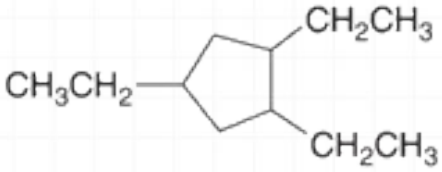
1-*sec*-butyl-3-methylcyclohexane

Assign the lower number to the 1st substituent alphabetically: the **b** of **b**utyl before the **m** of **m**ethyl.



1,2-dimethylcyclohexane

Number to give the 2nd CH_3 group the lower number: 1,2- not 1,6-.



1,2,4-triethylcyclopentane

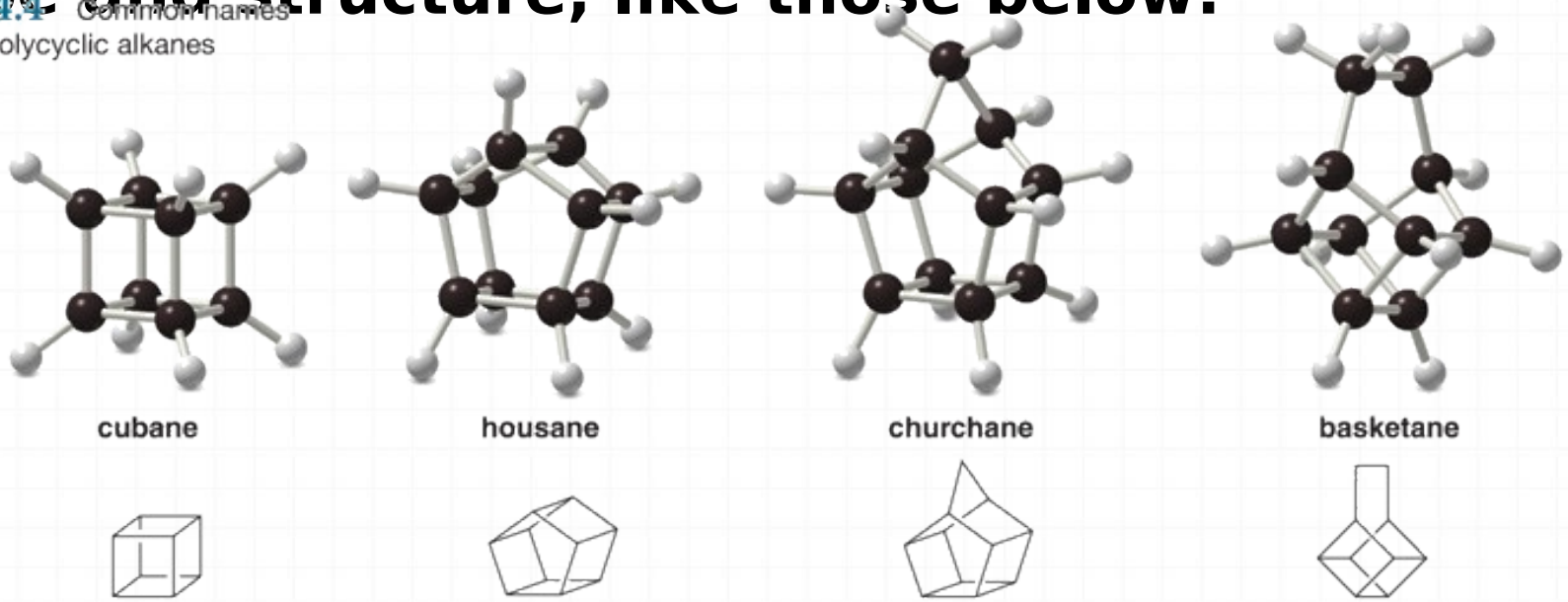
Number to give the 2nd CH_3CH_2 group the lower number: 1,2,4- not 1,3,4- or 1,3,5-.

Alkanes - Nomenclature

Nomenclature—Common Names

Some organic compounds are identified using common names that do not follow the IUPAC system of nomenclature. Many of these names were given long ago before the IUPAC system was adopted, and are still widely used. Additionally, some names are descriptive of shape and structure, like those below:

Figure 4.4 Common names for some polycyclic alkanes



Other Functional Groups - Nomenclature

The IUPAC rules for all other functional groups will differ only by the following:

1. Suffix will change to reflect functional group

2. Some functional groups have priority over others

3. We actually cover the functional groups in 210/212 in order of this priority (except Amines, Ch 22):

For now: Alcohol > Alkyne > Alkene > alkane=alkyl halide

4. The longest chain must contain the suffix functional group – even if not the longest chain overall

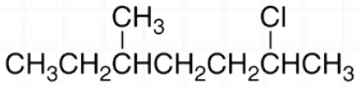
5. Numbering gives this functional group the lowest number – even if there are other groups that would be lower

6. If an alkene has *stereochemistry*, it must be specified in the prefix

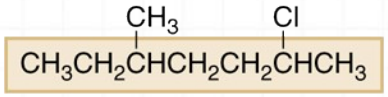
Alkyl Halides - Nomenclature

HOW TO Name an Alkyl Halide Using the IUPAC System

Example Give the IUPAC name of the following alkyl halide:



Step [1] Find the parent carbon chain containing the halogen.



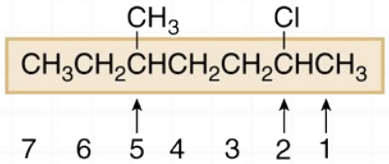
7 C's in the longest chain

7 C's ----→ **heptane**

- Name the parent chain as an ***alkane,*** with the halogen as a substituent bonded to the longest chain.

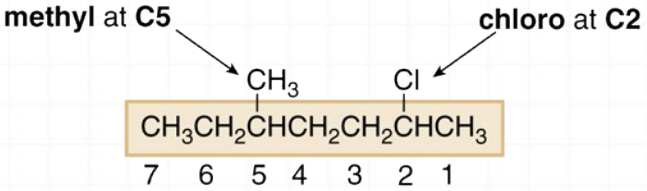
Step [2] Apply all other rules of nomenclature.

a. **Number** the chain.



- Begin at the end nearest the first substituent, either alkyl or halogen.

b. **Name** and **number** the substituents.



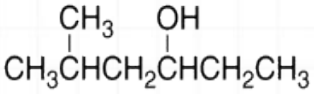
c. **Alphabetize: c** for **c**hloro, then **m** for **m**ethyl.

ANSWER: 2-chloro-5-methylheptane

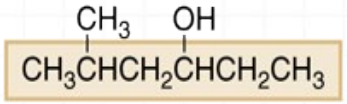
Alcohols - Nomenclature

HOW TO Name an Alcohol Using the IUPAC System

Example Give the IUPAC name of the following alcohol:



Step [1] Find the longest carbon chain containing the carbon bonded to the OH group.



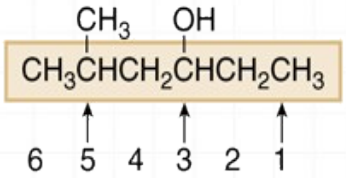
6 C's in the longest chain

6 C's → **hexan*e*** → **hexan*ol***

- Change the ***-e*** ending of the parent alkane to the suffix ***-ol.***

Step [2] Number the carbon chain to give the OH group the lower number, and apply all other rules of nomenclature.

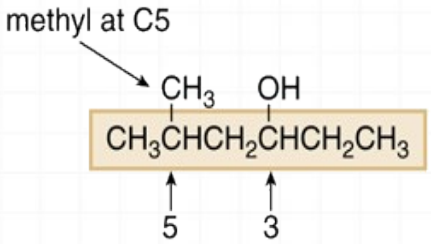
a. **Number** the chain.



- Number the chain to put the OH group at C3, not C4.

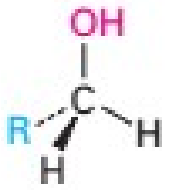
3-hexanol

b. **Name** and **number** the substituents.

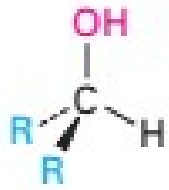


Answer: 5-methyl-3-hexanol

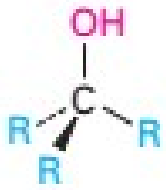
- Alcohols are classified as primary (1°), secondary (2°), or tertiary (3°), depending on the number of carbon substituents bonded to the hydroxyl-bearing carbon.



A primary (1°) alcohol



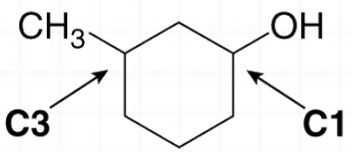
A secondary (2°) alcohol



A tertiary (3°) alcohol

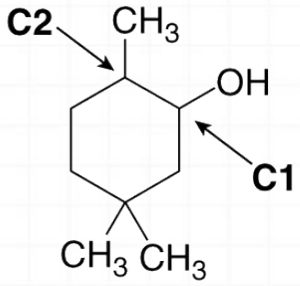
Alcohols - Nomenclature

- When an OH group is bonded to a ring, the ring is numbered beginning with the OH group.
- Because the functional group is at C1, the 1 is usually omitted from the name.
- The ring is then numbered in a clockwise or counterclockwise fashion to give the *next* substituent the lowest number.



3-methylcyclohexanol

[The OH group is at C1; the second substituent (CH_3) gets the lower number.]

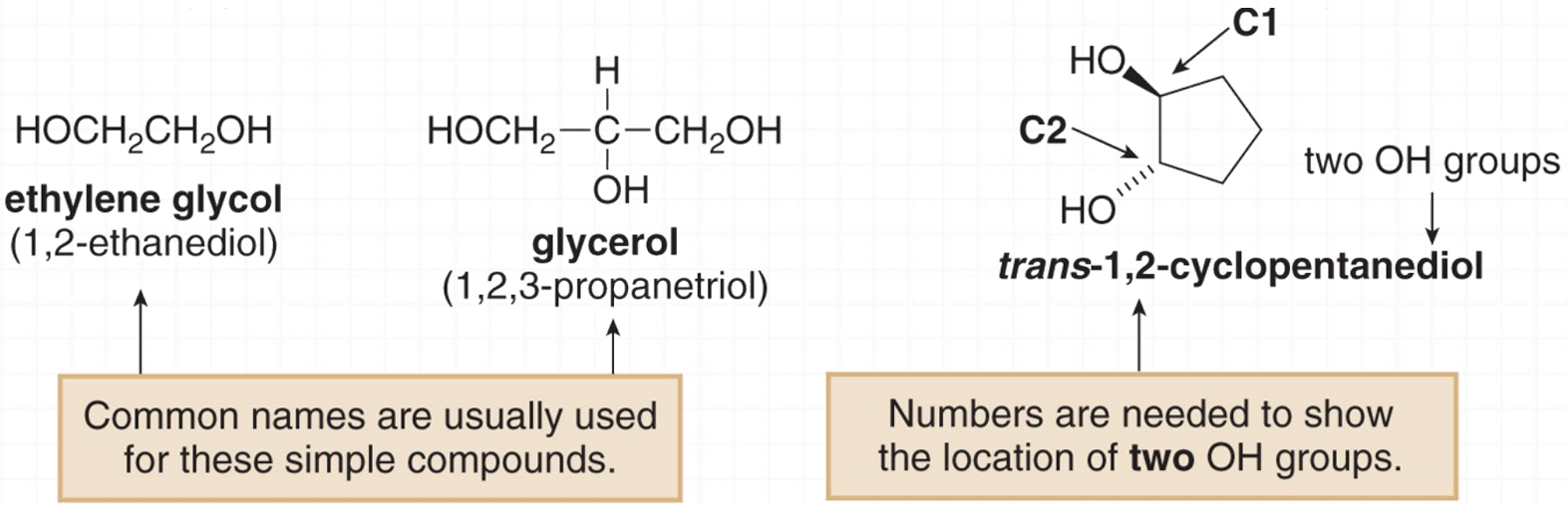


2,5,5-trimethylcyclohexanol

[The OH group is at C1; the second substituent (CH_3) gets the lower number.]

Alcohols - Nomenclature

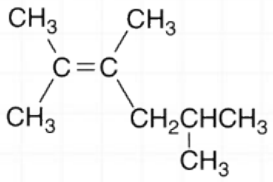
- Compounds with two hydroxyl groups are called diols or glycols.
- Compounds with three hydroxyl groups are called triols.



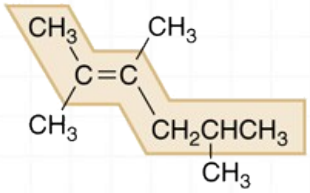
Alkenes - Nomenclature

HOW TO Name an Alkene

Example Give the IUPAC name of the following alkene:



Step [1] Find the longest chain that contains *both* carbon atoms of the double bond.



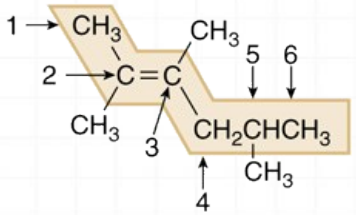
6 C's in the longest chain

hex*ane* ----→ **hex*ene***

- Change the ***-ane*** ending of the parent alkane to ***-ene.***

Step [2] Number the carbon chain to give the double bond the lower number, and apply all other rules of nomenclature.

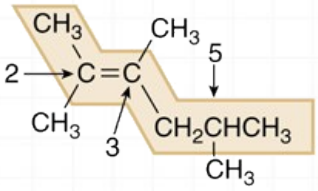
a. **Number** the chain, and name using the ***first*** **number** assigned to the C=C.



- Number the chain to put the C=C at C2, not C4.

2-hexene

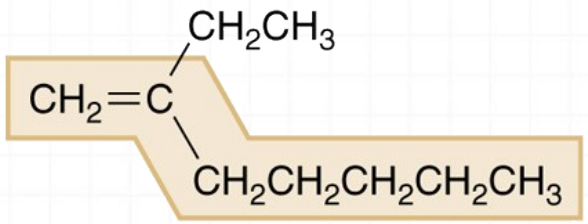
b. **Name** and **number** the substituents.



three methyl groups at C2, C3, and C5

Answer: 2,3,5-trimethyl-2-hexene

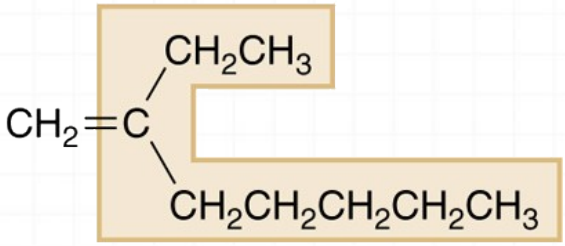
Alkenes - Nomenclature



7 C's ----→ heptene

Both C's of the C=C are contained in this long chain.

***Correct:* 2-ethyl-1-heptene**

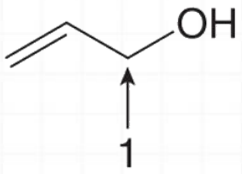


8 C's

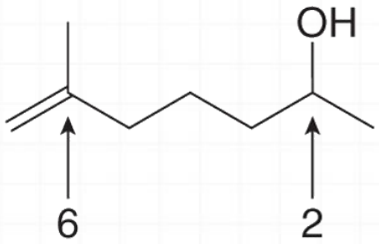
Both C's of the C=C are NOT contained in this long chain.

Incorrect

- Compounds that contain both a double bond and a hydroxy group are named as alkenols and the chain (or ring) is numbered to give the OH group the lower number.



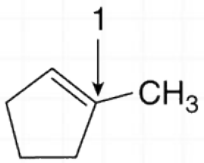
2-propen-1-ol



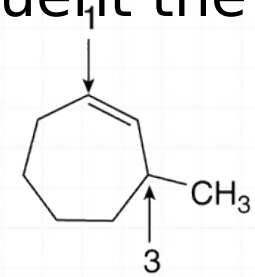
6-methyl-6-hepten-2-ol

Alkenes - Nomenclature

- Compounds with two double bonds are named as dienes by changing the “-ane” ending of the parent alkane to the suffix “-adiene”.
- Compounds with three double bonds are named as trienes, and so forth.
- In naming cycloalkenes, the double bond is located between C1 and C2, and the “1” is usually omitted in the name.
- The ring is numbered clockwise or counterclockwise to give the first substituent the lower number.

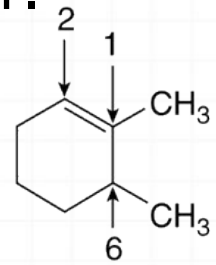


1-methylcyclopentene



3-methylcycloheptene

Number clockwise beginning at the C=C and place the CH_3 at C3.



1,6-dimethylcyclohexene

Number counterclockwise beginning at the C=C and place the first CH_3 at C1.

Alkenes - Nomenclature

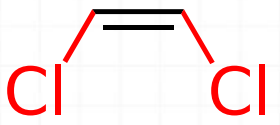
Disubstituted Alkenes - Stereochemistry:

There is no free rotation about the π-bond

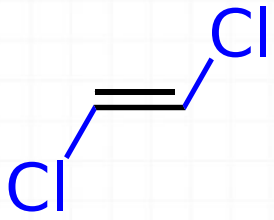
cis- vs. *trans*-

- *cis:* two identical or substantial groups on the same side of C=C

- *trans:* two identical or substantial groups on the opposite side of C=C



cis-1,2-Dichloroethene



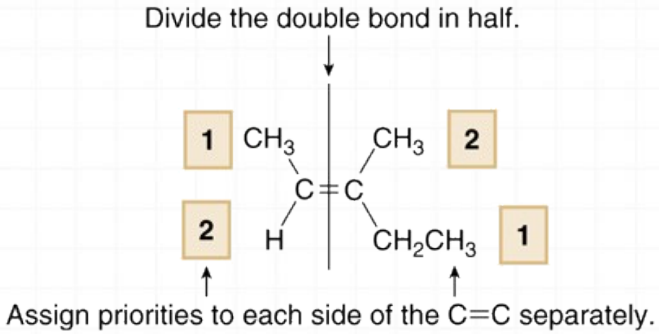
trans-1,2-Dichloroethene

Alkenes - Nomenclature

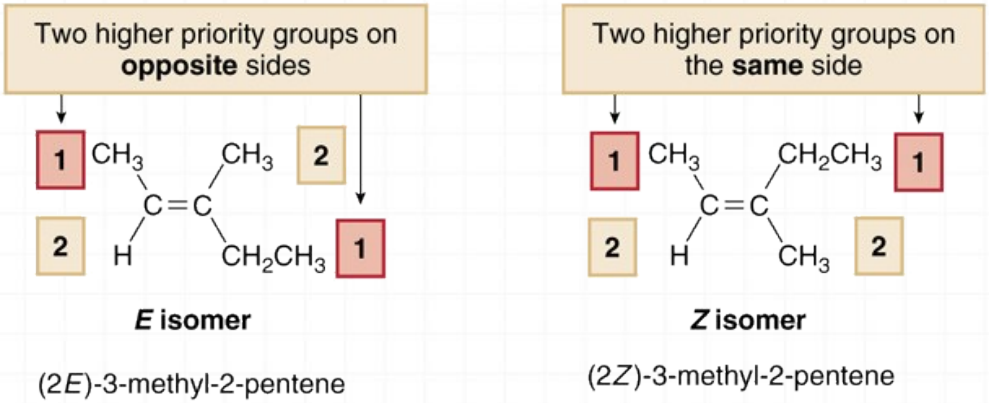
HOW TO Assign the Prefixes *E* and *Z* to an Alkene

Step [1] Assign priorities to the two substituents on each end of the C = C by using the priority rules for *R,S* nomenclature (Section 5.6).

- Divide the double bond in half, and assign the numbers **1** and **2** to indicate the relative priority of the two groups on each end—the higher priority group is labeled **1,** and the lower priority group is labeled **2.**



Step [2] Assign *E* or *Z* based on the location of the two higher priority groups (1).



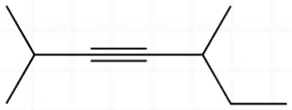
- The ***E*** isomer has the two higher priority groups on the **opposite sides.**
- The ***Z*** isomer has the two higher priority groups on the **same side.**

Alkynes - Nomenclature

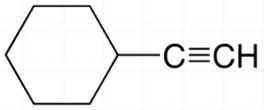
- Alkynes are named in the same general way that alkenes are named.
- In the IUPAC system, change the –*ane* ending of the parent alkane name to the suffix –*yne*.
- Choose the longest continuous chain that contains both atoms of the triple bond and number the chain to give the triple bond the lower number.

Alkynes - Nomenclature

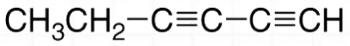
- Compounds with two triple bonds are named as diynes, those with three are named as triynes and so forth.
- Compounds with both a double and triple bond are named as enynes.
- The chain is numbered to give the first site of unsaturation (either C=C or C≡C) the lower number.



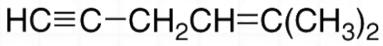
2,5-dimethyl-3-heptyne



ethynylcyclohexane



1,3-hexadiyne



5-methyl-4-hexen-1-yne

Aldehydes - Nomenclature

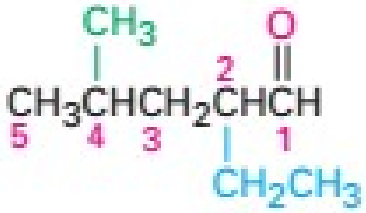
- Aldehydes are named by replacing the terminal -*e* of the corresponding alkane name with -*al.*
- The parent chain must contain the -CHO group, and numbering begins at the -CHO carbon, which is always C1.



Ethanal
(acetaldehyde)

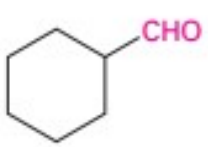


Propanal
(propionaldehyde)

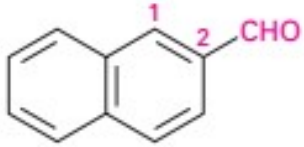


2-Ethyl-4-methylpentanal

- For more complex aldehydes in which the -CHO group is attached to a ring, the suffix *-carbaldehyde* is used.

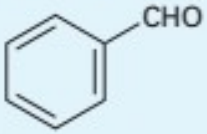


Cyclohexanecarbaldehyde



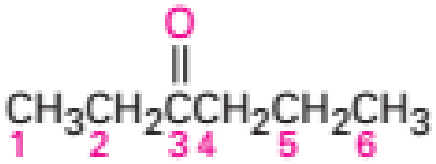
Naphthalene-2-carbaldehyde

Table 9.1 Common Names of Some Simple Aldehydes

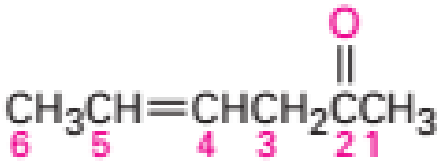
Formula	Common name	Systematic name
HCHO	Formaldehyde	Methanal
CH_3CHO	Acetaldehyde	Ethanal
$H_2C{=}CHCHO$	Acrolein	Propenal
$CH_3CH{=}CHCHO$	Crotonaldehyde	But-2-enal
	Benzaldehyde	Benzenecarbaldehyde

Ketones - Nomenclature

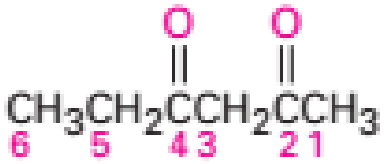
- Ketones are named by replacing the terminal *-e* of the corresponding alkane name with *-one.*
- The parent chain is the longest one that contains the ketone group, and numbering begins at the end nearer the carbonyl carbon.
- As with alkenes and alcohol, the numerical locant is placed immediately before the *-one* suffix in newer IUPAC recommendations.



Hexan-3-one



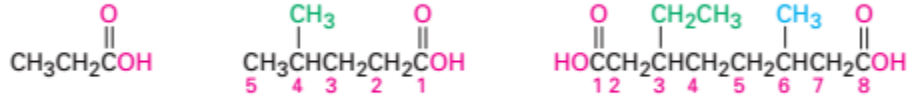
Hex-4-en-2-one



Hexane-2,4-dione

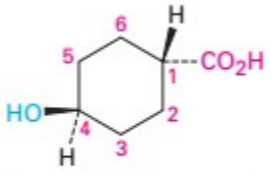
Carboxylic Acids - Nomenclature

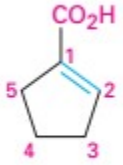
- Simple open-chain carboxylic acids are named by replacing the terminal *-e* of the corresponding alkane name with *-oic acid.* The -CO2H carbon is numbered C1.



Propanoic acid **4-Methylpentanoic acid** **3-Ethyl-6-methyloctanedioic acid**

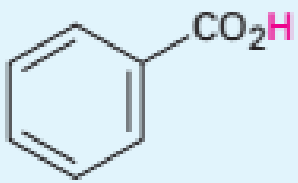
- Compounds that have a -CO2H group (a **carboxyl group**) bonded to a ring are named using the suffix *-carboxylic acid.* The carboxyl carbon is attached to C1 on the ring and is not itself numbered.





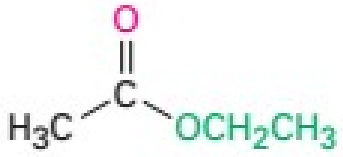
***trans*-4-Hydroxycyclohexanecarboxylic acid** **Cyclopent-1-enecarboxylic acid**

Table 10.1 Some Common Names of Carboxylic Acids and Acyl Groups

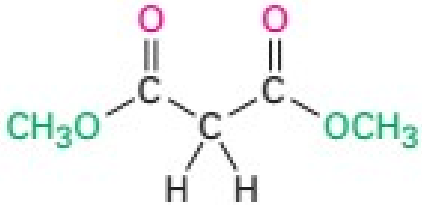
Structure	Name	Acyl group
HCO_2H	Formic	Formyl
CH_3CO_2H	Acetic	Acetyl
$CH_3CH_2CO_2H$	Propionic	Propionyl
$CH_3CH_2CH_2CO_2H$	Butyric	Butyryl
HO_2CCO_2H	Oxalic	Oxalyl
$HO_2CCH_2CO_2H$	Malonic	Malonyl
$HO_2CCH_2CH_2CO_2H$	Succinic	Succinyl
$HO_2CCH_2CH_2CH_2CO_2H$	Glutaric	Glutaryl
$HO_2CCH_2CH_2CH_2CH_2CO_2H$	Adipic	Adipoyl
$H_2C{=}CHCO_2H$	Acrylic	Acryloyl
$HO_2CCH{=}CHCO_2H$	Maleic (cis)	Maleoyl
	Fumaric (trans)	Fumaroyl
	Benzoic	Benzoyl

Esters - Nomenclature

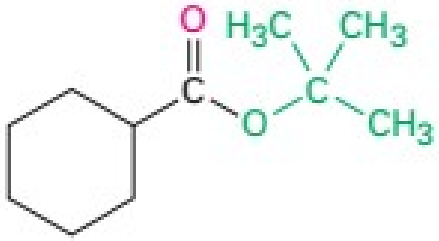
- Esters are named by first giving the name of the alkyl group attached to oxygen and then identifying the carboxylic acid, with *-ic acid* replaced by *-ate.*



Ethyl acetate



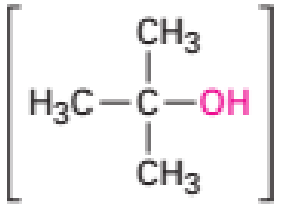
Dimethyl malonate



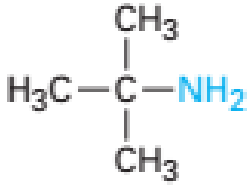
***tert*-Butyl cyclohexane-carboxylate**

Amines - Nomenclature

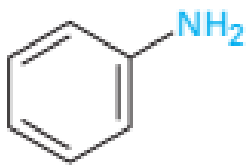
- Amines can be either alkyl-substituted (**alkylamines**) or aryl-substituted (**arylamines**) and can be classed as *primary* (RNH2), *secondary* (R2NH), or *tertiary* (R3N), depending on the number of organic substituents attached to nitrogen.
- Note that this usage of the terms primary, secondary, and tertiary is different from our previous usage.



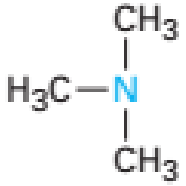
***tert*-Butyl alcohol**
(a tertiary alcohol)



***tert*-Butylamine**
(a primary alkylamine)

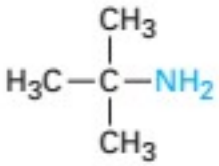


Aniline
(a primary arylamine)

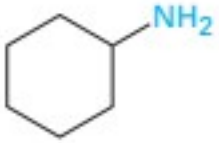


Trimethylamine
(a tertiary alkylamine)

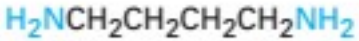
- Primary amines, RNH2, are named in the IUPAC system by adding the suffix -*amine* to the name of the organic s



tert-Butylamine

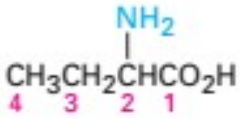


Cyclohexylamine

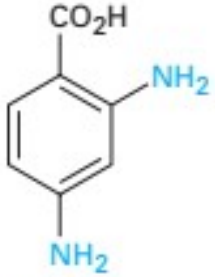


Butane-1,4-diamine

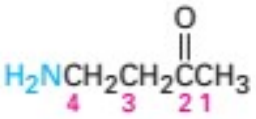
- Amines with more than one functional group are named by considering the -NH2 as an *amino* substituent on the parent molecule.



2-Aminobutanoic acid

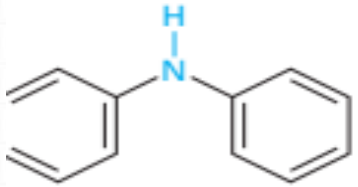


2,4-Diaminobenzoic acid

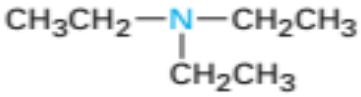


4-Aminobutan-2-one

- Symmetrical secondary and tertiary amines are named by adding the prefix *di*- or *tri*- to the alkyl group.

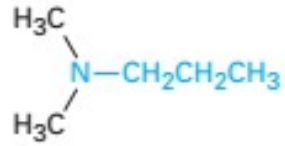


Diphenylamine

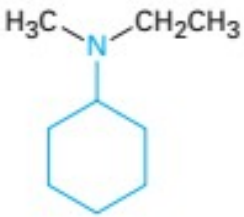


Triethylamine

- Unsymmetrically substituted secondary and tertiary amines are named as *N*-substituted primary amines. The largest organic group is chosen as the parent, and the other groups are considered as *N* substituents on the parent
(*N* because t



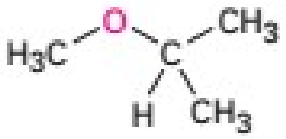
***N*,*N*-Dimethylpropylamine**



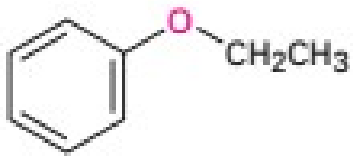
***N*-Ethyl-*N*-methylcyclohexylamine**

Ethers - Nomenclature

- Simple ethers that contain no other functional groups are named by identifying the two organic groups and adding the word

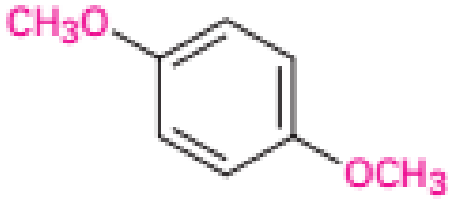


Isopropyl methyl ether

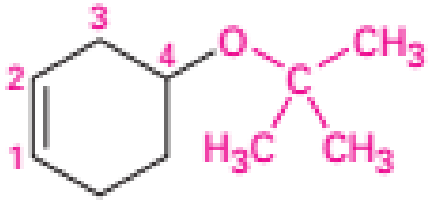


Ethyl phenyl ether

- If other functional groups are present, the ether part is na



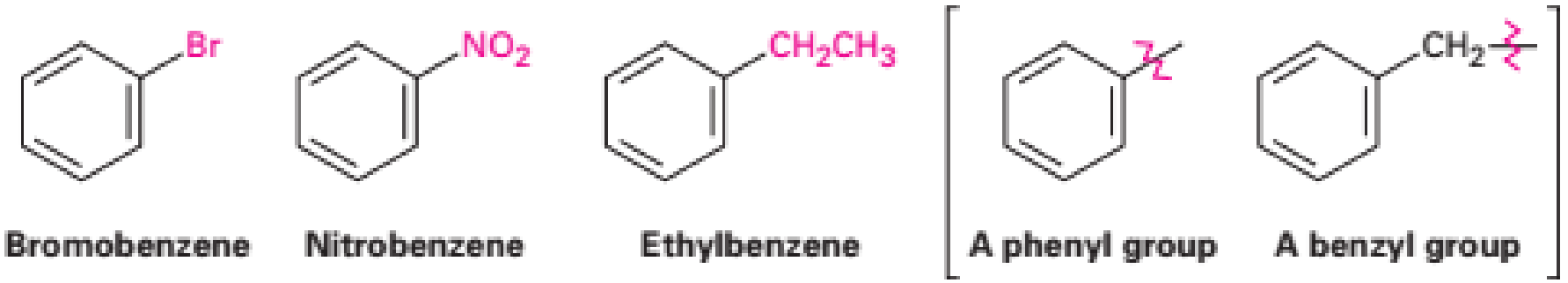
p-Dimethoxybenzene



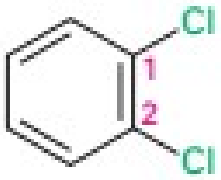
4-*tert*-Butoxycyclohex-1-ene

Aromatic Compounds - Nomenclature

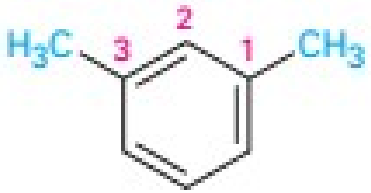
- Monosubstituted benzenes are systematically named in the same manneras other hydrocarbons, with -*benzene* as the parent name.
- The name **phenyl**, pronounced **fen**-nil and sometimes abbreviated as Ph is used for the -C6H5 unit when the benzene ring is considered as a substituent.
- In addition, a generalized aromatic substituent is called an **aryl group**, abbreviated as Ar, and the name **benzyl** is used for the C6H5CH2- group.



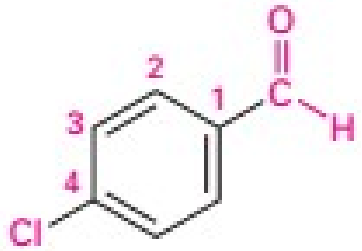
- Disubstituted benzenes are named using one of the prefixes *ortho*- (*o*), *meta*- (*m*), or *para*- (*p*). An ortho-disubstituted benzene has its two substituents in a 1,2 relationship on the ring; a meta-disubstituted benzene has its two substituents in a 1,3 relationship; and a para-disubstituted benzene has its substituents in a 1,4 relationship.



ortho-Dichlorobenzene
1,2 disubstituted

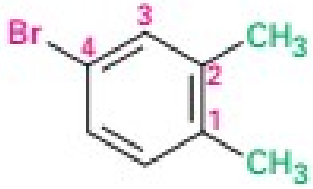


meta-Dimethylbenzene
(*meta*-xylene)
1,3 disubstituted

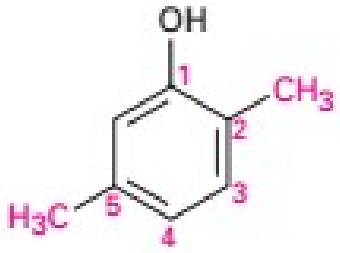


para-Chlorobenzaldehyde
1,4 disubstituted

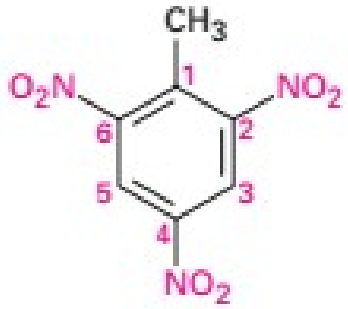
- Benzenes with more than two substituents are named by choosing a point of attachment as carbon 1 and numbering the substituents on the ring so that the second substituent has as low a number as possible.
- The substituents are listed alphabetically



4-Bromo-1,2-dimethylbenzene

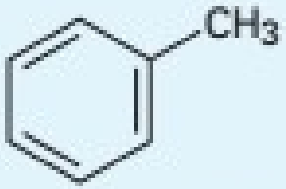
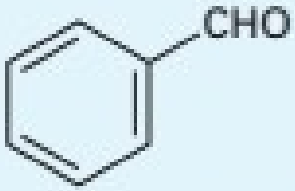
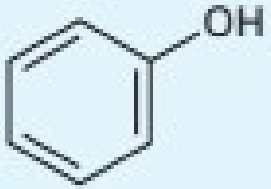
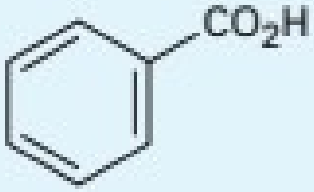
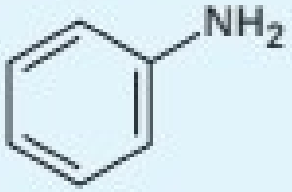
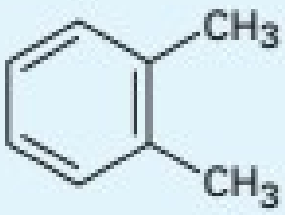
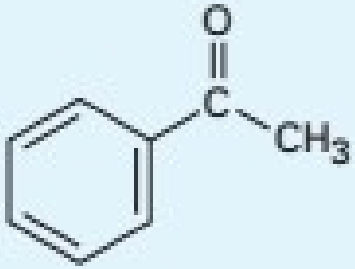
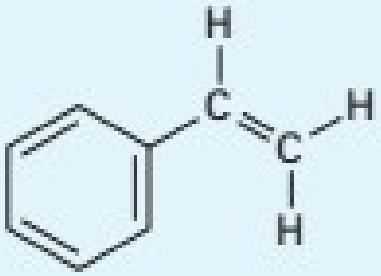


2,5-Dimethylphenol



2,4,6-Trinitrotoluene (TNT)

Table 5.1 Common Names of Some Aromatic Compounds

Structure	Name	Structure	Name
	Toluene (bp 111 °C)		Benzaldehyde (bp 178 °C)
	Phenol (mp 43 °C)		Benzoic acid (mp 122 °C)
	Aniline (bp 184 °C)		*ortho*-Xylene (bp 144 °C)
	Acetophenone (mp 21 °C)		Styrene (bp 145 °C)