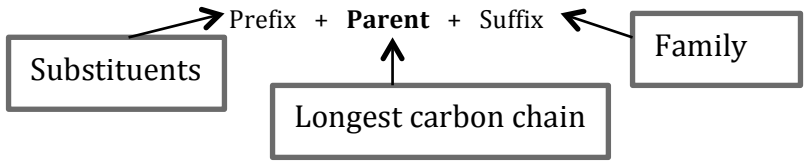
Handout: Naming Organic Compounds

A. IUPAC Naming

General Rules:



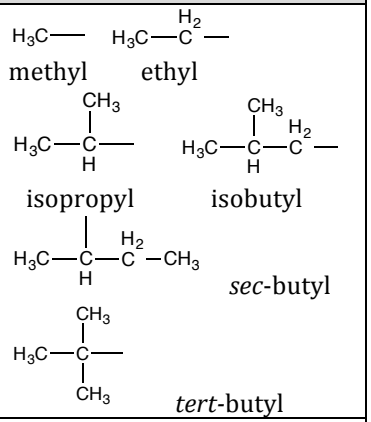
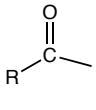
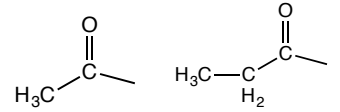
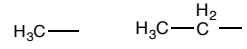
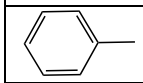
1. Name parent+suffix: longest carbon chain + family suffix.
2. Number carbons in parent chain: Begin numbering from end that meets specified criteria (*See Nomenclature Chart).
3. Name prefix: substituent position #s and names (grouping repeated substituents together using di-, tri-, etc).
4. Write full name, listing substituents in alphabetical order (ignoring di-, tetra- in alphabetizing).

Name Format: #–substituent–#–substituent**parent**suffix

Some Parent Alkane Names

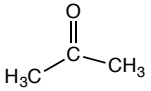
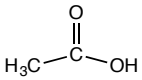
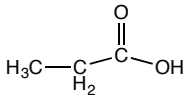
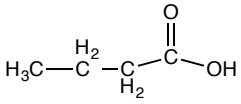
No. of Carbons	Structure	Name
1	CH_4	Methane
2	CH_3CH_3	Ethane
3	$CH_3CH_2CH_3$	Propane
4	$CH_3\ CH_2CH_2CH_3$	Butane
5	$CH_3\ CH_2CH_2CH_2CH_3$	Pentane
6	$CH_3\ CH_2CH_2CH_2CH_2CH_3$	Hexane
7	$CH_3CH_2CH_2CH_2CH_2CH_2CH_3$	Heptane
8	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	Octane
9	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	Nonane
10	$CH_3CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_2CH_3$	Decane

Some Substituent Names

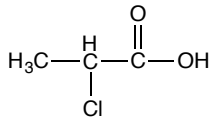
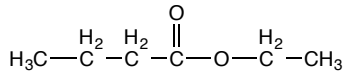
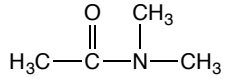
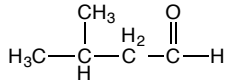
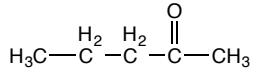
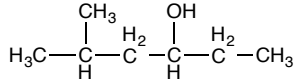
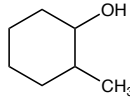
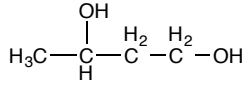
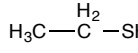
Substituent Group	Substituent Name	Specific Examples
Hydrocarbon with single bonds only	alkyl	 methyl ethyl isopropyl isobutyl *sec*-butyl *tert*-butyl
	acyl (Ends with –oyl, except for acetyl)	 acetyl propanoyl
–OR	alkoxy	 methoxy ethoxy
	formyl	
	keto	
–OH	hydroxy	
$-NO_2$	nitro	
$-NH_2$	amino	
-X (halogen)	halo	-Cl chloro -Br bromo -I iodo
	phenyl	

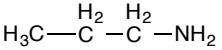
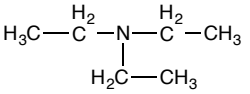
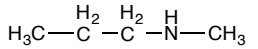
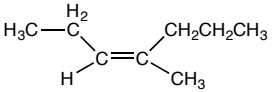
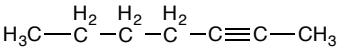
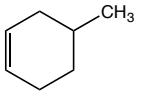
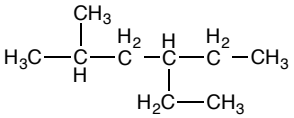
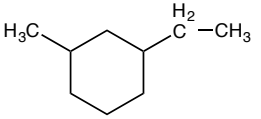
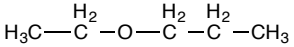
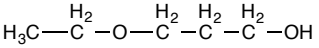
B. Common Names

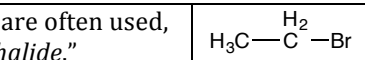
Some Widely-Used Common Names

Compound	Common Name	IUPAC Name
$CH_2=CH_2$	ethylene	1-ethene
$CH_3CH=CH_2$	propylene	1-propene
$HC\equiv CH$	acetylene	1-ethyne
	acetone	2-propanone
	formaldehyde	methanal
	acetaldehyde	ethanal
	formic acid	methanoic acid
	acetic acid	ethanoic acid
	propionic acid	propanoic acid
	butyric acid	butanoic acid

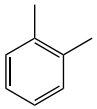
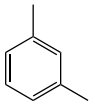
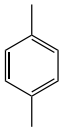
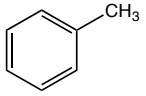
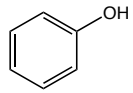
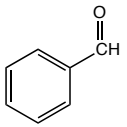
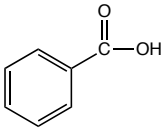
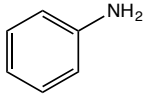
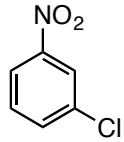
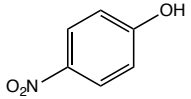
Nomenclature Chart for Organic Compounds (From **HIGHEST TO LOWEST** naming priority)

FAMILY	PARENT	SUFFIX	NUMBERING	NOTES	EXAMPLES
Carboxylic acid	Parent is longest carbon chain containing carboxylic acid. Derive name from parent alkane.	*–oic acid* *(-dioic acid for dicarbox-ylic acid; -enoic acid for unsatur-ated acid)*	Begin at carbonyl C.	Common names are often used (C next to COOH group is designated as "α"). [Salts: cation + name derived from parent acid, replacing *–ic acid* with *–ate*]	 2-chloropropanoic acid or α-chloropropionic acid (common)
Ester	Name of alkyl group that replaced -H in -COOH + name derived from parent acid, replacing *–ic acid* with *–ate*	*–ate*	Begin at carbonyl C.	Common names are often used: name of alkyl group that replaced -H in -COOH + name derived from common name of parent acid, replacing *–ic acid* with *–ate*	 ethyl butanoate or ethyl butyrate (common)
Amides	Derive name from parent carboxylic acid, replacing *–oic acid* with *–amide*.	*–amide*	Begin at carbonyl C.	Alkyl substituents on nitrogen start with "N-."	 N,N-dimethylacetamide
Aldehydes	Derive name from parent alkane.	*–al*	Begin at carbonyl C.	Common names are often used for simplest aldehydes, ending with *"–aldehyde*."	 3-methylbutanal or β-methylbutyraldehyde (common)
Ketones	Derive name from parent alkane. Parent name starts with position # of carbonyl C.	*–one*	Begin at end nearer to carbonyl C.	Common names are often used for simple ketones: names of two alkyl groups + "*ketone*."	 2-pentanone or methyl propyl ketone (common)
Alcohol	Parent is longest carbon chain containing OH. Parent name starts with position # of the C with OH.	*–ol* *(-diol, -triol, etc.)*	Begin at end nearer to OH group.	Cyclic alcohols: Parent name begins with "cyclo" (no need to start parent name with "1"). Begin numbering at C with OH, and number to give substituents lowest numbers.	 5-methyl-3-hexanol  2-methylcyclohexanol  1,3-butanediol
Thiols		*–thiol*		Name in same way as alcohols, except end with "-thiol."	 ethanethiol

FAMILY	PARENT	SUFFIX	NUMBERING	NOTES	EXAMPLES
Amines		*–amine*		1° amines, and 2°, 3° amines with same R groups on N: Treat alkyl groups attached to nitrogen as substituents. For same substituents, use "di" and "tri." 2°, 3° amines with different R groups on N: Parent amine is the one with largest R group; name other groups as substituents, starting with *N*-. [Ions derived from amines: Replace *–amine* with *–ammonium*.]	 (1°) propylamine  (3° with same R groups) triethylamine  (2° with diff't R groups) N-methylpropanamine
Alkenes **Alkynes**	Parent is longest carbon chain containing the double or triple bond. Parent name starts with position number of multiple bond. May need *cis/trans* designation.	*–ene* *–yne* *(-diene, -triene, etc.)*	Begin at end closer to multiple bond. (If multiple bonds are equidistant, give smaller number to first branch point). Then give smallest numbers possible to substituents.	Cyclic alkenes: Parent name begins with "cyclo" (no need to start parent name with "1"). Number multiple bonds 1 and 2, in direction to give first substituent the next smaller possible number.	 *cis*-4-methyl-3-heptene  2-heptyne  4-methylcyclohexene
Alkanes	Parent is longest carbon chain.	*–ane*	Begin at end nearer to branch point. Then give smallest numbers possible to substituents.	Cyclic alkanes: Parent name begins with "cyclo." Give smallest number to substituent that comes first in alphabetical order. Number in direction to give second substituent the smaller possible number. (If single substituent, don't need "1-.")	 4-ethyl-2-methylhexane  1-ethyl-3-methylcyclohexane
Ethers	The alkoxy group –OR is treated as the substituent (Alkane or another functional group is the parent).			Common names are often used for simple ethers: two R groups + "*ether*." Common names are used for cyclic ether compounds.	 1-ethoxypropane or ethyl propyl ether (common)  3-ethoxypropanol

Haloalkanes (or Alkyl Halides)	Halogen atom is treated as substituent (Alkane or another functional group is the parent).			Common names are often used, in format "*alkyl halide*."	 1-bromoethane or ethyl bromide (common)

Aromatic Nomenclature (*Functional group priority is same in aromatic and aliphatic nomenclature.)

FAMILY	PARENT	SUFFIX	NUMBERING	NOTES	EXAMPLES
Benzene	"benzene" or common name for substituted benzene		For di-substituted benzenes, *o, m, p* typically used for positions of substituents.  *o-*  *m-*  *p-*	Common names for substituted benzenes are often used (accepted by IUPAC):   Toluene Phenol   Benzaldehyde Benzoic acid  Aniline	 *m*-chloronitrobenzene  *p*-nitrophenol