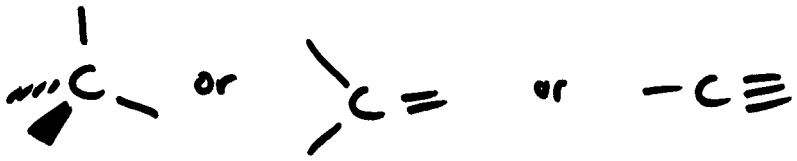
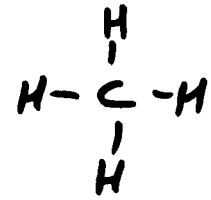
#100 Notes **Unit 12: Introduction to Organic and Biochemistry**
Ch. Organic/ Biochemistry

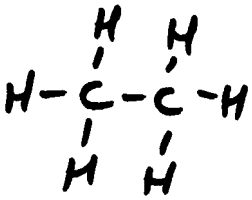
I. Alkanes, C_nH_{2n+2} (saturated hydrocarbons: no C=C or C≡C)



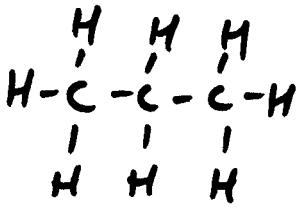
*always 4 bonds on carbon

# Carbons	parent chain name	
1	methane	CH_4



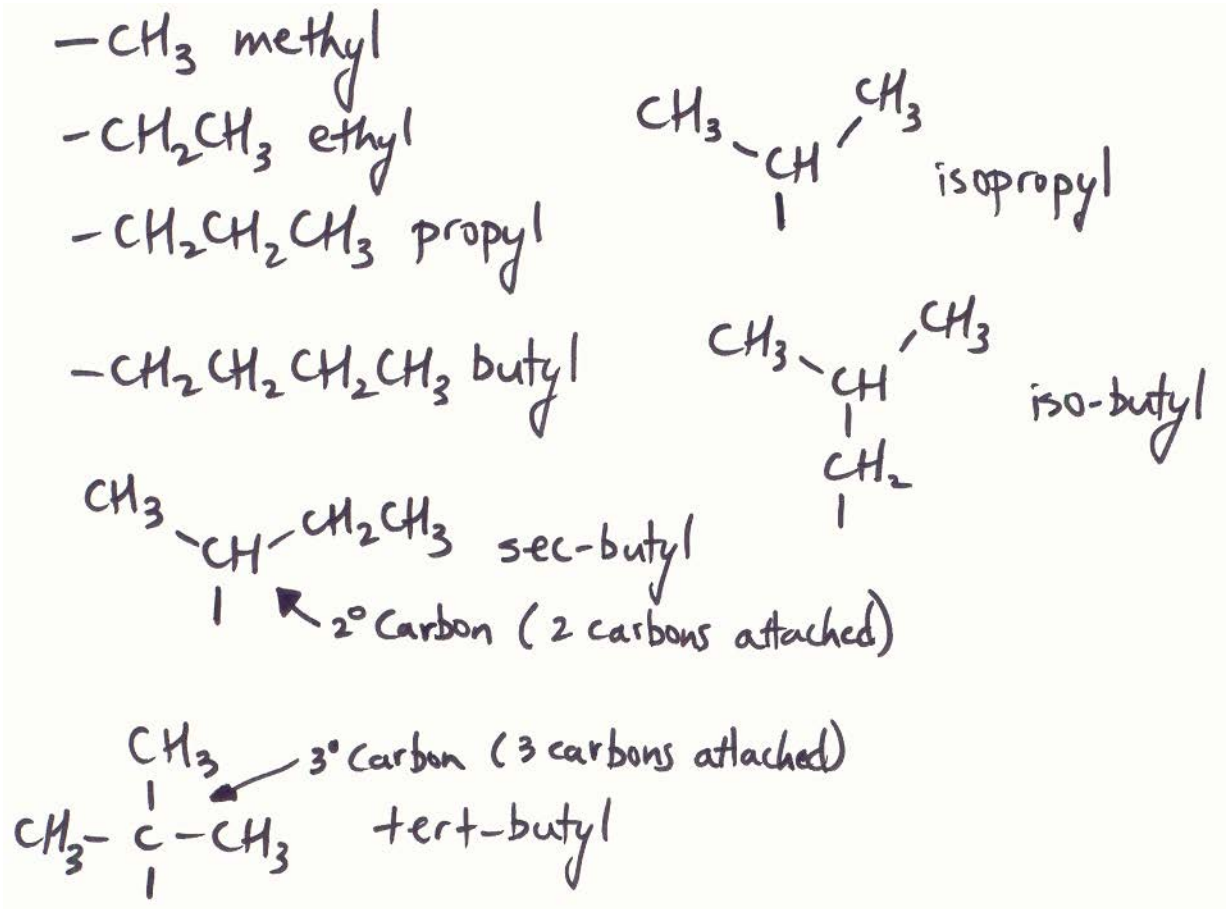


2	ethane	CH_3CH_3



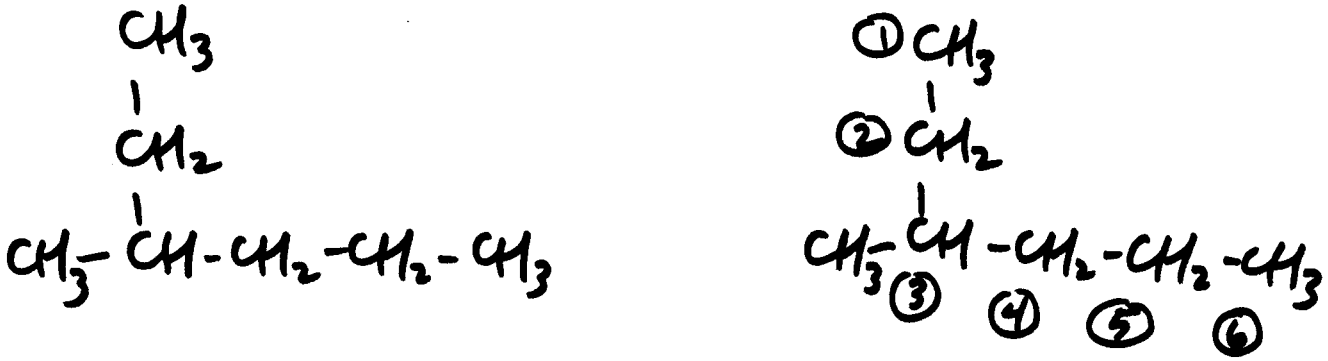
3	propane	$CH_3CH_2CH_3$
4	butane	$CH_3CH_2CH_2CH_3$
5	pentane	$CH_3CH_2CH_2CH_2CH_3$
6	hexane	
7	heptane	
8	octane	
9	nonane	
10	decane	

A) Substituents

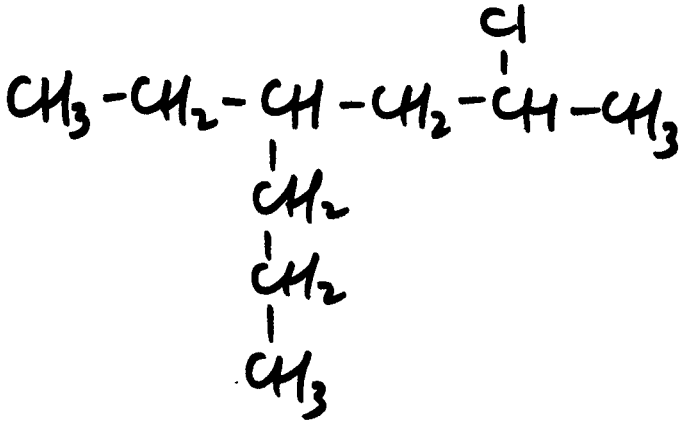


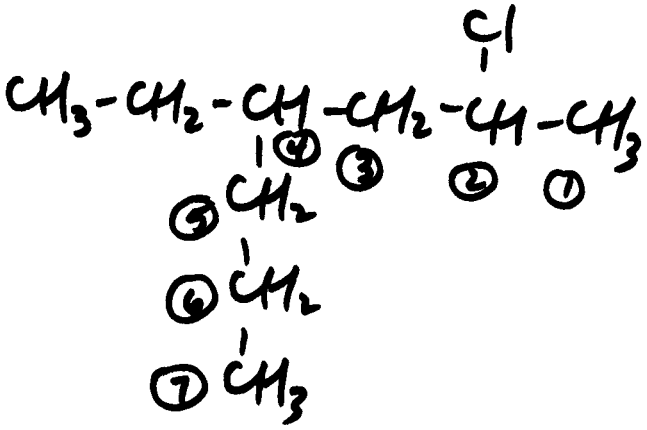
B) Other Groups: -F (fluoro), -Cl (chloro), -Br (bromo), -I (iodo), $-NO_2$ (nitro), $-NH_2$ (amino), -OH (hydroxyl).

C) Naming: 1) Find the longest connected chain of carbon atoms (=skeleton).
2) Number the chain from #1→ end, starting with the end having the most substituents. (Substituents should have the smallest number possible.)
3) Name:
(# of carbon)-(substituent) ….(parent chain)

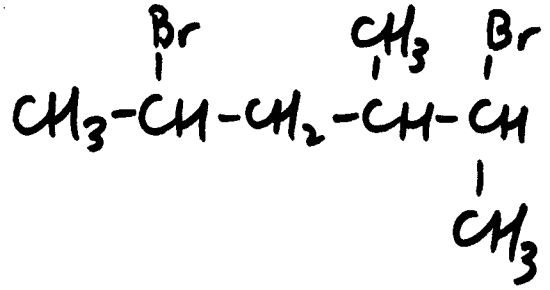


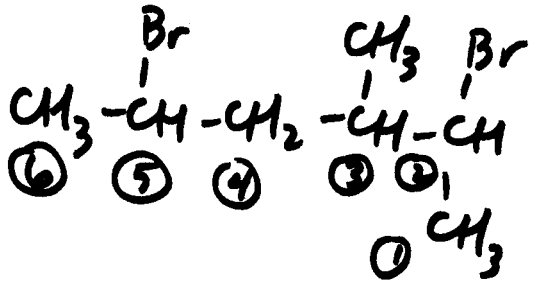
Ex. 1) **3-methyl hexane**



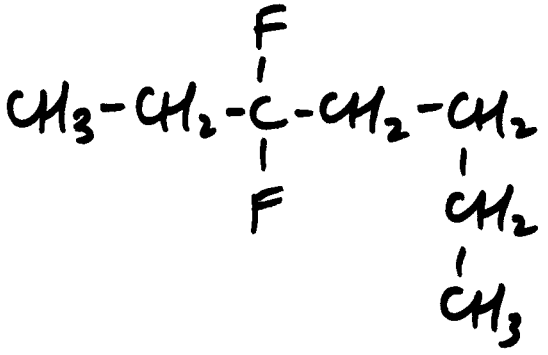


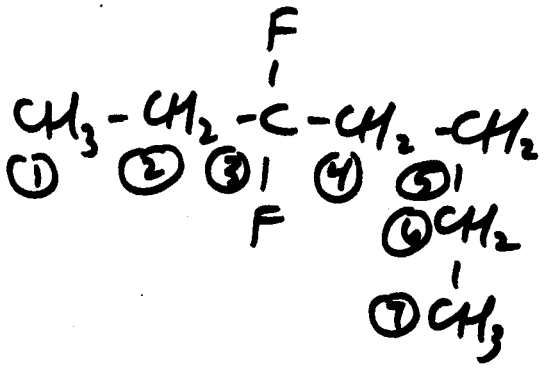
Ex. 2) **2-chloro-4-ethyl heptane**
*List substituents in alphabetical order, not in order of numbers.



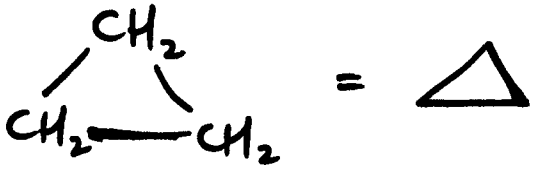


Ex. 3) **2,5-dibromo-3-methyl hexane**
*For identical: 2 = di, 3 = tri, 4 = tetra

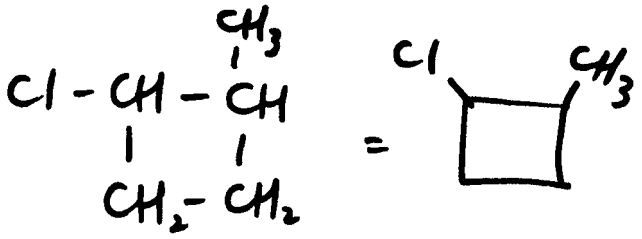




Ex. 4) **3,3-difluoro heptane**

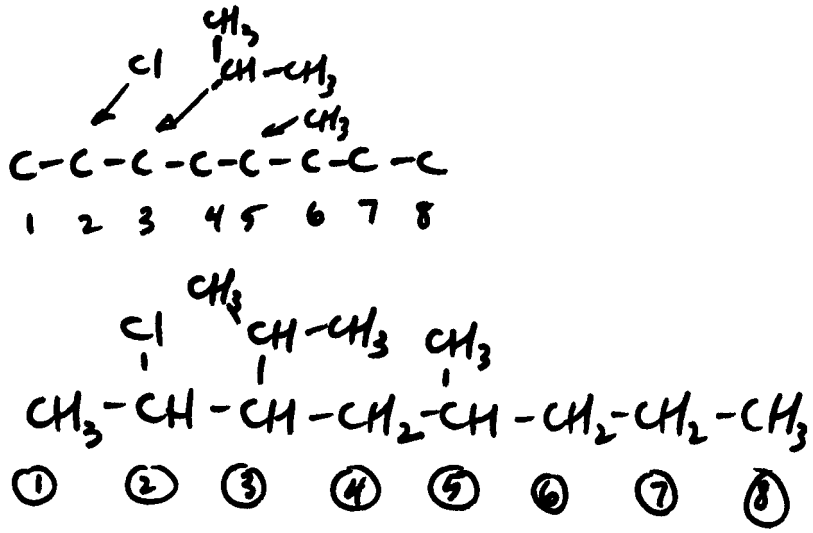


Ex. 5) **cyclopropane**

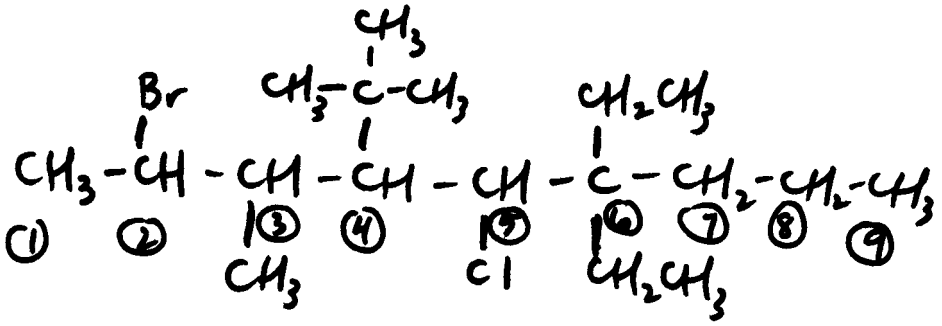


Ex. 6) **1-chloro-2-methyl cyclobutane**

Ex. 7) Draw 2-chloro-3-isopropyl-5-methyl octane



Ex. 8) Draw 2-bromo-5-chloro-6,6-diethyl-3-methyl-4-tert-butyl nonane



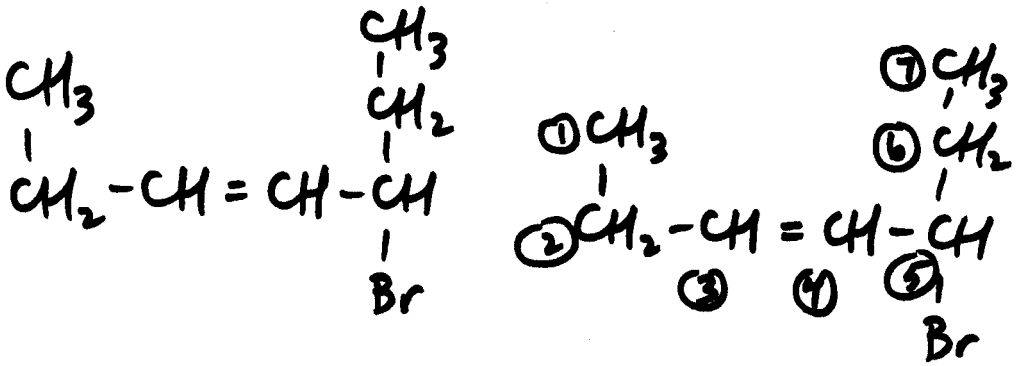
#101 Notes II. Alkenes, C_nH_{2n} (unsaturated hydrocarbons, C=C)

A) Naming:

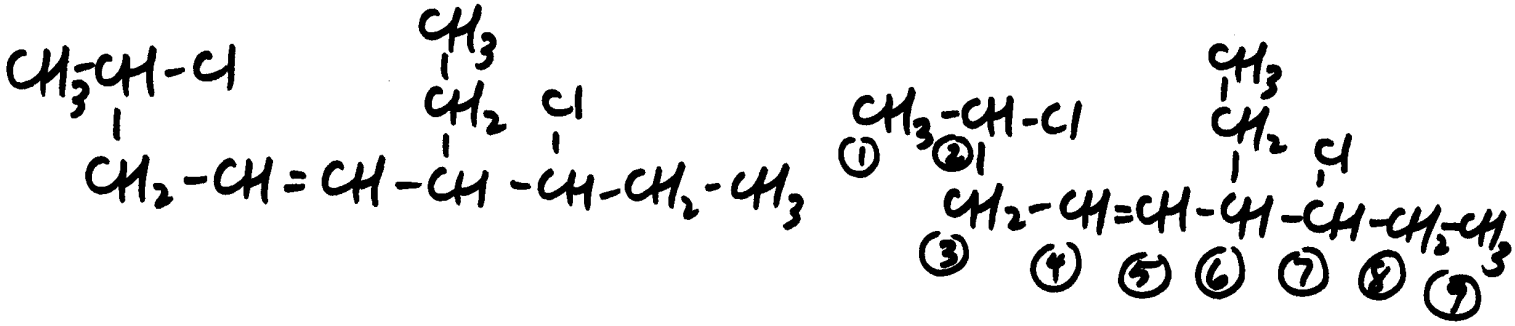
1) Find the longest carbon chain containing the double bond.
2) The double bond gets the smallest number possible.
   (other substituents don't matter)
3) The smallest number of the double bond goes in front of the parent name.

↑
replace –ane with -ene

4) Treat substituents as before.

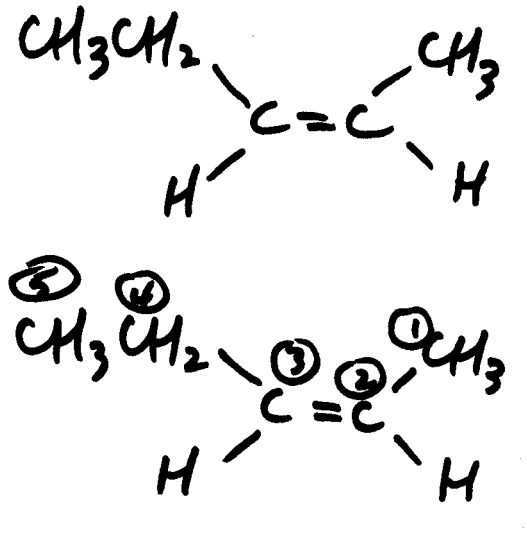


Ex. 1) **5-bromo-3-heptene**

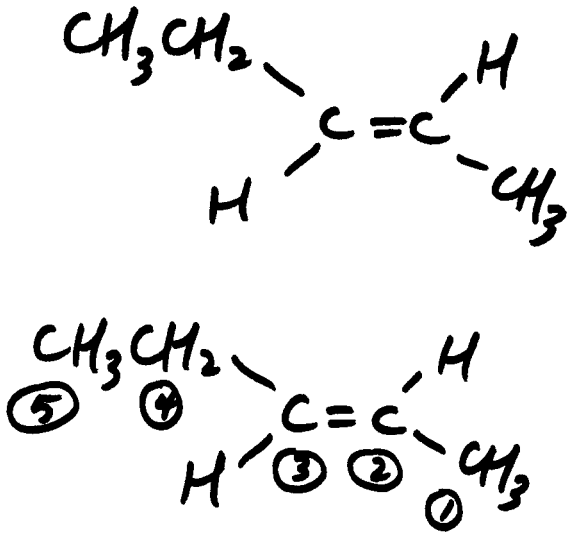


Ex. 2) **2,7-dichloro-6-ethyl-4-nonene**

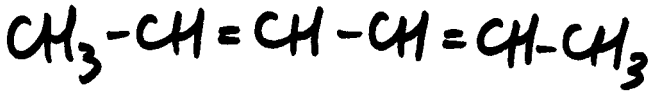
Ex. 3) Cis/Trans Isomers

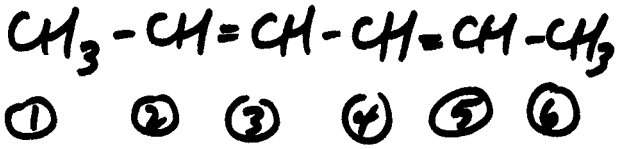


cis-2-pentene



trans-2-pentene

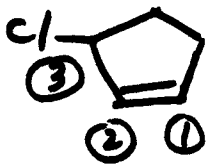




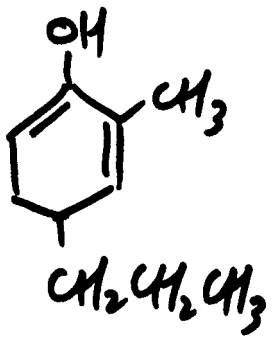
Ex.4) **2,4-hexa<u>di</u>ene**

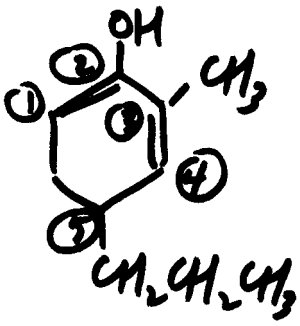
<u>Cycloalkenes:</u>

Start numbering at the double bond and go across it, so that the nearest substituent has the lowest number possible.



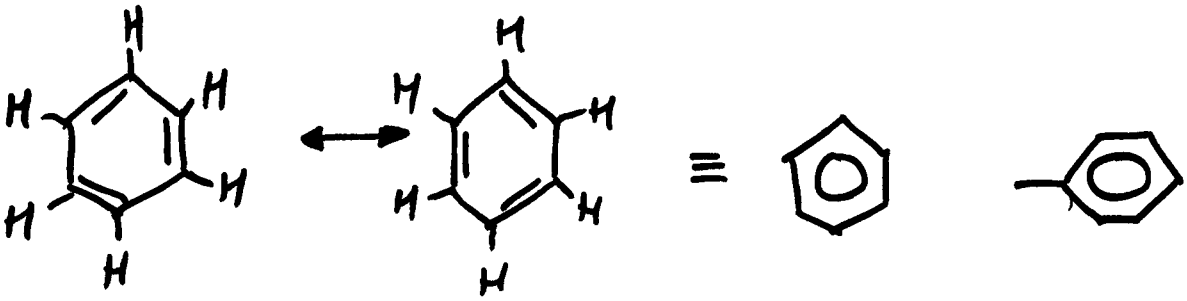
Ex. 1) **3-chloro cyclopentene**
{3-chloro-1-cyclopentene (1 is understood, if not written)}





Ex. 2) **2-hydroxyl-3-methyl-5- propyl-1,3-cyclohexa<u>di</u>ene**

<u>III. Aromatic Compounds</u>, C_nH_n
-6 member ring with alternating double bonds

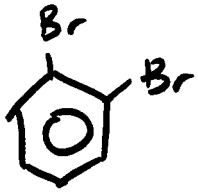


benzene

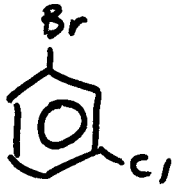
phenyl
(as substituent)

**Each bond is 1 ½ bonds!

Ex. 1)

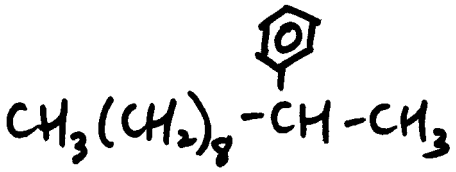


1,2-dibromo benzene
<u>ortho</u>-dibromo benzene
<u>o</u>-dibromo benzene



1-bromo-3-chloro benzene
<u>meta</u>-bromochloro benzene
<u>m</u>-bromochloro benzene

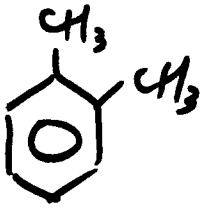
1-fluoro-4-iodo benzene
<u>para</u>-fluoroiodo benzene
<u>p</u>-fluoroiodo benzene



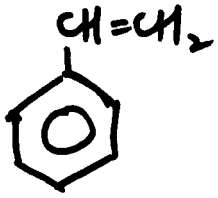
Ex. 2) **2-phenyl-undecane**

toluene

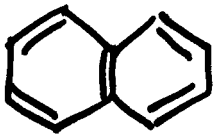
phenol



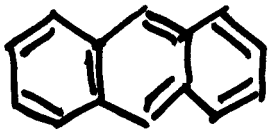
ortho-xylene
(2 methyls)



styrene



naphthalene

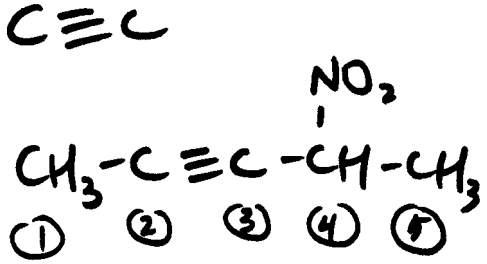


anthracene

#102 Notes IV. Functional Groups

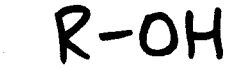
-alkenes from before (C=C)

A) Alkynes

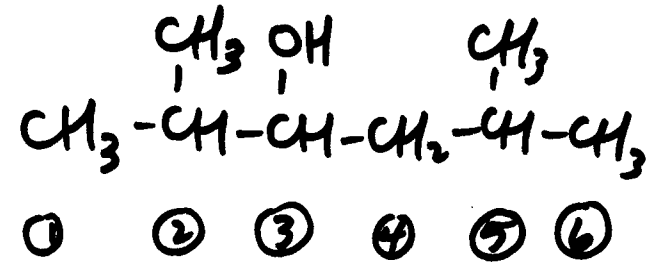


Ex. 1) **4-nitro-2-pentyne**

B) Alcohols



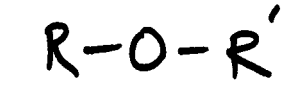
← **R equals the carbon/hydrogen chain**



*OH gets the smallest number

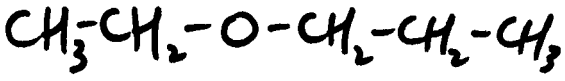
Ex. 1) **2,5-dimethyl-3-hexanol**

C) Ethers

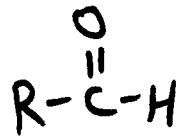


short chain, **oxy**, then long chain

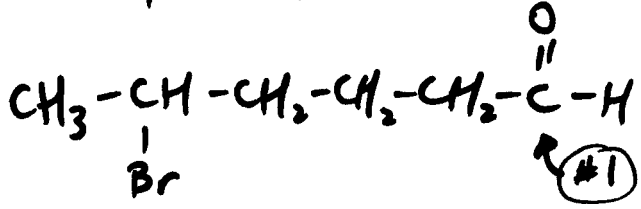
Ex. 1) **ethoxypropane**



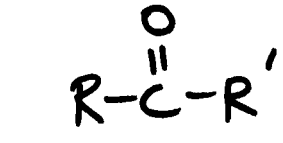
D) Aldehydes



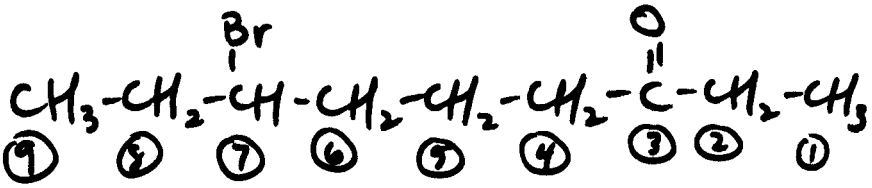
Ex. 1) **5-bromo hexanal**



E) Ketones

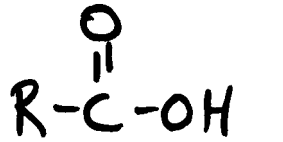


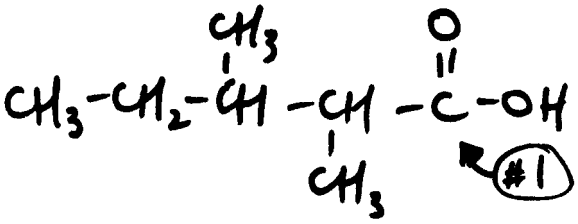
C=O gets the smallest # possible



Ex. 1) **7-bromo-3-nonan<u>one</u>**

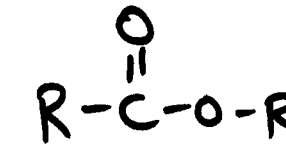
F) Carboxylic Acids

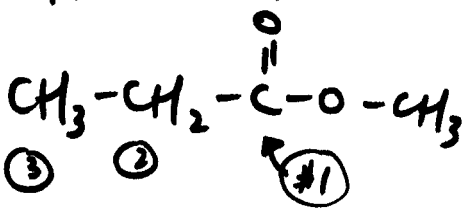




Ex. 1) **2,3-dimethyl pentan<u>oic acid</u>**

G) Esters

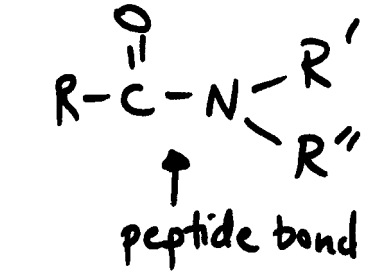




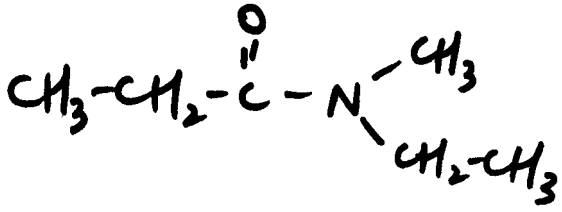
Ex. 1) **methyl propan<u>oate</u>**

↑
substituent

H) Amides

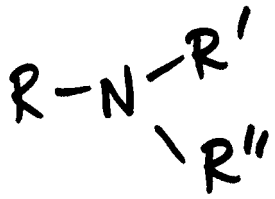


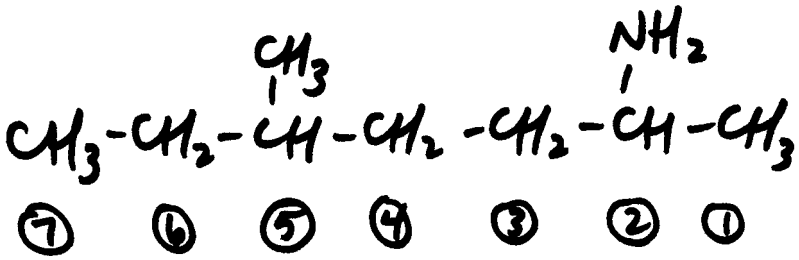
←(bond between amino acids in proteins)



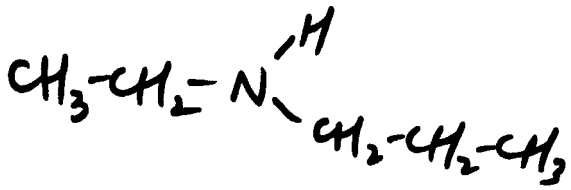
Ex. 1) **N,N-methyl ethyl propan<u>amide</u>**

I) Amines

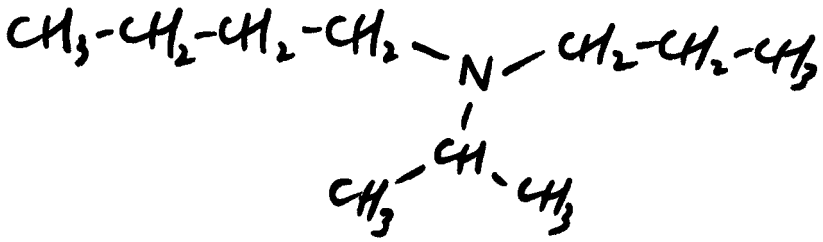




Ex. 1) **2-<u>amino</u>-5-methyl heptane**
1^o (primary) amine



Ex. 2) **N-ethyl propan<u>amine</u>**
2^o (secondary) amine

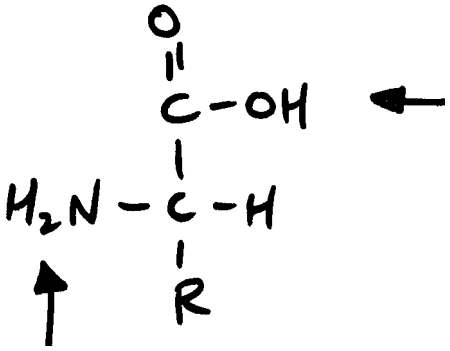


Ex. 3) **N-propyl, N-isopropyl butan<u>amine</u>**
3^o (tertiary) amine

#103 Notes Ch. Biochemistry

I. Proteins

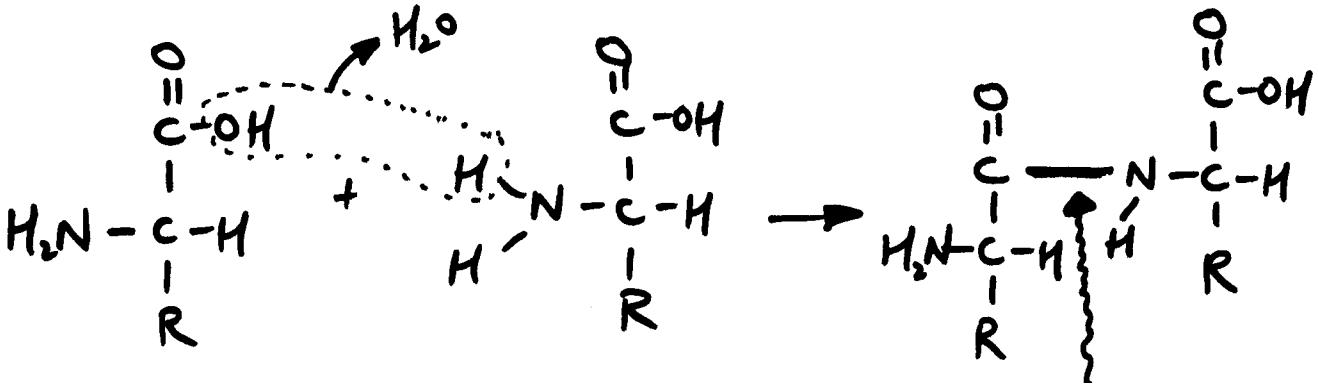
The 20 amino acids are the building blocks of all proteins.



carboxylic acid

amino acid

R = H, CH_3, etc. (see textbook for amino acids)



peptide linkage
(amide)

This molecule is a dipeptide,
a natural polymer.

Collagen is 3 protein chains twisted together to form a super helix.
(H-bonding occurs between the chains.)

The amino acid cystein, R = CH_2SH can form links between chains too.
a.a.$-CH_2-S-S-CH_2-$a.a. (The disulfide linkage is a true bond, unlike a H-bond.)

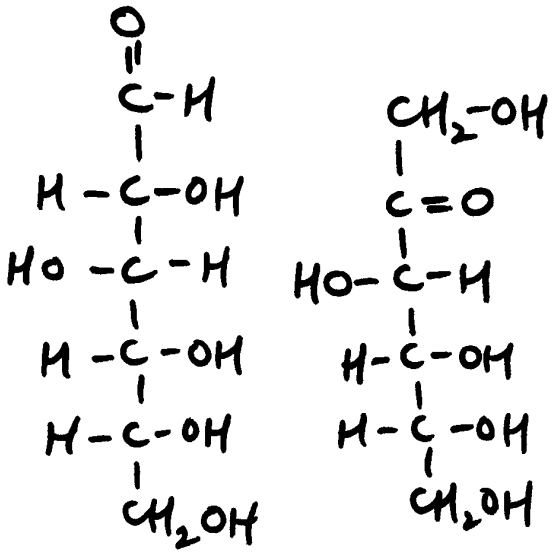
Proteins: Include collagen (tendons, muscles), hemoglobin (carries O_2 in blood),
antibodies, enzymes, some hormones etc.

II. Carbohydrates

such as starch and cellulose are polymers of simple sugars (monosaccharides).

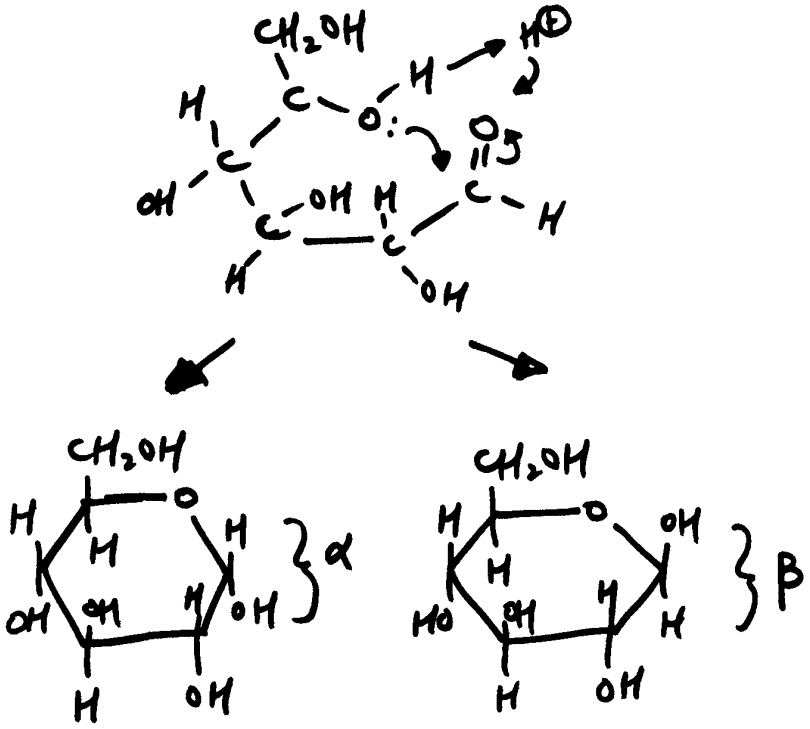
↑

fructose (honey, fruit), glucose, ribose, galactose



D-glucose D-fructose

sucrose (table sugar) is a disaccharide of glucose and fructose.



The orientation of the attack determines α or β.

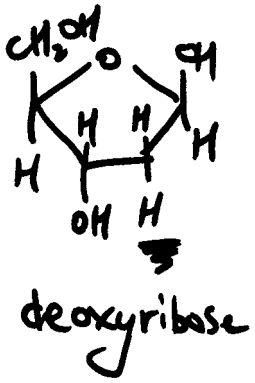
Starch (plant carbohydrate reservoir) is a polymer of α-D-glucose.
Cellulose (plant fiber, cotton) is a polymer of β-D-glucose.

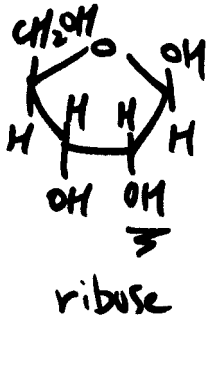
III. Lipids (Fats, Fatty Acids) $CH_3(CH_2)_nCO_2H$

n = 16	stearic acid	**saturated fats (alkanes- full of hydrogen)
n = 2 & 4	butter	**unsaturated fats (alkenes- hydrogen can add on C==C)
n = 18	peanut oil	
n = 10	coconut oil	

IV. Nucleic Acids

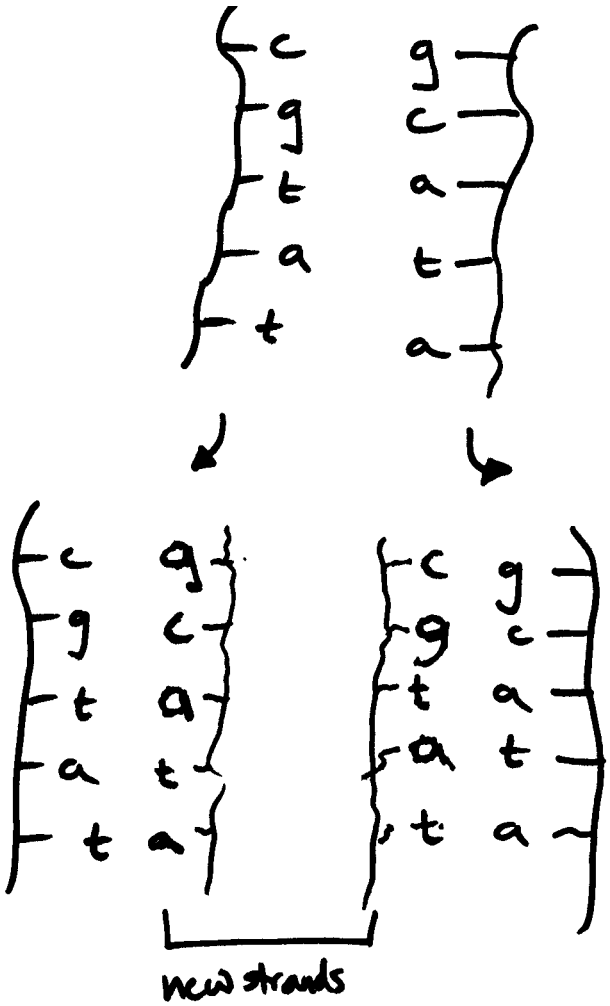
DNA	deoxyribonucleic acid (molecular masses = several billion g/mol)
RNA	ribonucleic acid (20,000 – 40,000 g/mol





←These sugars are bonded together with phosphate linkages to bases and the bases stick together to make a double helix.

For cell division:



1) DNA has a double helix with complementary bases on the two strands.
(cysteine – guanine, and thymine – adenine)

2) The DNA unwinds and each half gets new partners, thus the DNA is replicated to transfer the genetic code when the cell divides.

Protein Synthesis:
1) Part of the DNA, a gene, holds the codes for a specific protein.
2) A complementary m-RNA (messenger) strand is copied and transferred to the cytoplasm. A t-RNA (transfer) finds bases and makes a protein complementary to the m-RNA. (It makes a copy of the part of the DNA that was copied, like a copying machine.)

End of Notes