

The rest of the Semester

All of Chemistry

Today

Organic

Organic

You know more than you think already

What you will need
Lewis dot, VSEPR
VB, hybrid orbitals, MO
electronegativity
intermolecular forces

Step I

Nomenclature

prefix **parent** suffix

parent is the name of the longest carbon chain. Each length has a given name

1 carbon methane
2 carbons ethane
5 carbons pentane

Step I

Nomenclature

prefix parent suffix

prefix is the name of any substituent groups (sidechains)

1 carbon methyl
2 carbons ethyl
5 carbons pentyl

Step I

Nomenclature

prefix parent suffix

suffix is the name of the "functional group"

-ol alcohol
-one ketone
-ane alkane

Problem number I

Lots of carbon and hydrogen atoms
Pain to draw them all

(doc cam)

Names for parent groups

First lets look at alkanes
(essentially no functional group)

All single bonds

suffix is **ane**

meth**ane** but**ane** 5-methyloct**ane**

Name those carbon chains

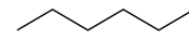
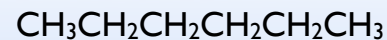
Number of Carbons	Prefix	Structure
1	<i>Methane</i>	CH ₄
2	<i>Ethane</i>	CH ₃ CH ₃
3	<i>Propane</i>	CH ₃ CH ₂ CH ₃
4	<i>Butane</i>	CH ₃ (CH ₂) ₂ CH ₃
5	<i>Pentane</i>	CH ₃ (CH ₂) ₃ CH ₃
6	<i>Hexane</i>	CH ₃ (CH ₂) ₄ CH ₃
7	<i>Heptane</i>	CH ₃ (CH ₂) ₅ CH ₃
8	<i>Octane</i>	CH ₃ (CH ₂) ₆ CH ₃
9	<i>Nonane</i>	CH ₃ (CH ₂) ₇ CH ₃
10	<i>Decane</i>	CH ₃ (CH ₂) ₈ CH ₃
11	<i>Undecane</i>	CH ₃ (CH ₂) ₉ CH ₃
12	<i>Dodecane</i>	CH ₃ (CH ₂) ₁₀ CH ₃

C₁₂H₂₆

Name those sidechains

Number of carbon atoms	Formula	Name of alkane	Name of alkyl group	Formula
1	CH ₄	methane	methyl	CH ₃ —
2	CH ₃ CH ₃	ethane	ethyl	CH ₃ CH ₂ —
3	CH ₃ CH ₂ CH ₃	propane	propyl	CH ₃ CH ₂ CH ₂ —
4	CH ₃ (CH ₂) ₂ CH ₃	butane	butyl	CH ₃ (CH ₂) ₂ CH ₂ —
5	CH ₃ (CH ₂) ₃ CH ₃	pentane	pentyl	CH ₃ (CH ₂) ₃ CH ₂ —
6	CH ₃ (CH ₂) ₄ CH ₃	hexane	hexyl	CH ₃ (CH ₂) ₄ CH ₂ —
7	CH ₃ (CH ₂) ₅ CH ₃	heptane	heptyl	CH ₃ (CH ₂) ₅ CH ₂ —
8	CH ₃ (CH ₂) ₆ CH ₃	octane	octyl	CH ₃ (CH ₂) ₆ CH ₂ —
9	CH ₃ (CH ₂) ₇ CH ₃	nonane	nonyl	CH ₃ (CH ₂) ₇ CH ₂ —
10	CH ₃ (CH ₂) ₈ CH ₃	decane	decyl	CH ₃ (CH ₂) ₈ CH ₂ —
11	CH ₃ (CH ₂) ₉ CH ₃	undecane	undecyl	CH ₃ (CH ₂) ₉ CH ₂ —
12	CH ₃ (CH ₂) ₁₀ CH ₃	dodecane	dodecyl	CH ₃ (CH ₂) ₁₀ CH ₂ —

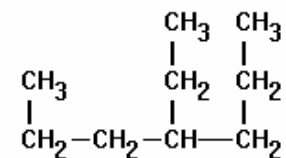
The following compound is



- A. butane
- B. isobutane
- C. pentane
- D. hexane
- E. heptane

What about sidechains?

The following compound is



- A. 3-ethylhexane
- B. 3-ethylpropane
- C. 4-propylhexane
- D. 4-ethylheptane
- E. 3-ethylcatne

Which numbers do I use?

The next simplest
add a functional group

$C=C$ Double bond

suffix -ene

$C\equiv C$ Triple bond

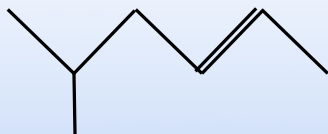
suffix -yne

The following compound is



- A. 2-hexene
- B. 3-hexene
- C. 4-heptene
- D. 4-hexene
- E. 2 methyl, butene

The following compound is



- A. 5-methyl 2-hexene
- B. 2-methyl 5-hexene

More Organic

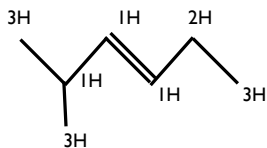
Today

Review hydrocarbons
Functional Groups
Condensation Reaction
Biopolymers

How many carbons and hydrogens in the following?



- A. 6 C, 14 H
- B. 6 C, 15 H
- C. 6 C, 16 H
- D. 7 C, 15 H
- E. 7 C, 14 H



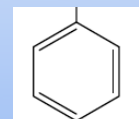
Other side-chains

Halogens
F Fluoro
Cl Chloro
Br Bromo
I Iodo

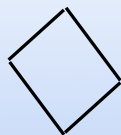
OH group
hydroxy

NH₂ group
amino

Benzene Ring
phenyl



Cyclic Hydrocarbons
the carbon chain connects back to itself



cyclobutane

Structural Isomers

hexane (C_6H_{14})

doc cam

Nomenclature with functional group

Put the number by before the functional group suffix



you'll be understood

1 butene

you'll be tested on this one

IUPAC name

but-1-ene

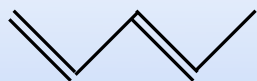
Name this compound



- A. 2-methyl pent-5-ene
- B. 2-methyl hex-3-ene
- C. 1,1-dimethyl pent-2-ene
- D. 5-methyl hex-3-ene
- E. 5-methyl hex-4-ene

Dienes

Two double bonds



5 carbon chain, parent
penta

no side chains

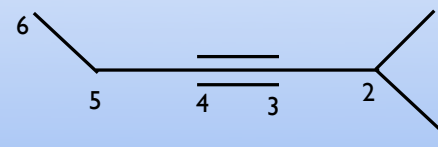
two double bonds diene
position 1 and 3

penta-1,3-diene

Alkyne

Carbon Carbon Triple Bond

Suffix **-yne**



2 methyl hex-3-yne

Other functional groups

Common
Ethanol

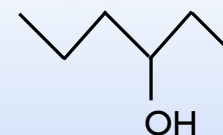


R = Generic representation
of the rest of the molecule

functional group

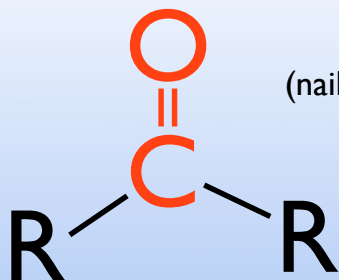
-OH group is an alcohol
suffix is **-ol**

Name this compound



- A. heptan-2-ol
- B. hexan-4-ol
- C. 2-ethylbutan-1-ol
- D. 2-ethylpentan-1-ol
- E. hexan-3-ol

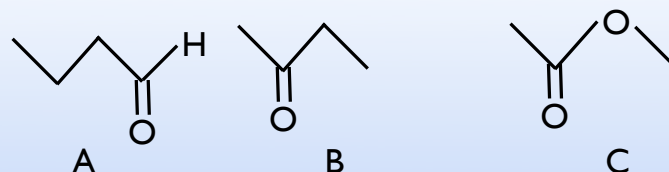
Ketone



Common
Acetone
(nail polish remover)

carbon double bonded to an oxygen
bonded to carbons on either side
suffix is **-one**

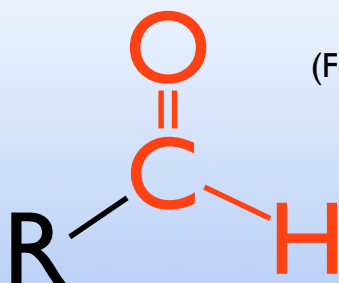
Which of the following is a ketone?



- A. A
- B. B**
- C. C
- D. A & B
- E. all three

butan-3-one

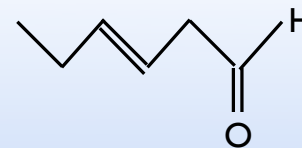
Aldehyde



Common
Formaldehyde
(Fetal Pig Storage)

carbon double bonded to an oxygen
bonded to carbon on one side
(like a ketone at the end of a chain)
suffix is **-al**

Name this compound



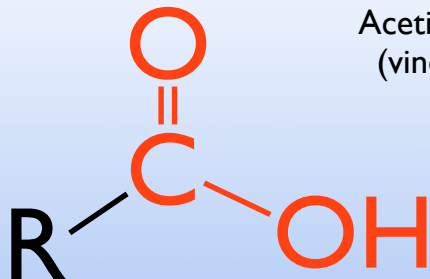
- A. hex-3-enal**
- B. hex-3-en-1-al
- C. hex-3-en-6-al
- D. hex-6-al-3-ene
- E. hexene6-3-al

No need to number aldehyde
its always at the end

H shown to emphasize the
functional group

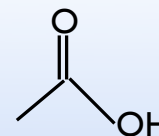
Carboxylic Acid

Common
Acetic Acid
(vinegar)



carbon double bonded to an oxygen
bonded to carbon on one side
OH on the other side
suffix is -oic acid

Name this compound



A. methanoic acid

B. ethanoic acid

C. propanoic acid

D. 3 hydroxy propan-2-one

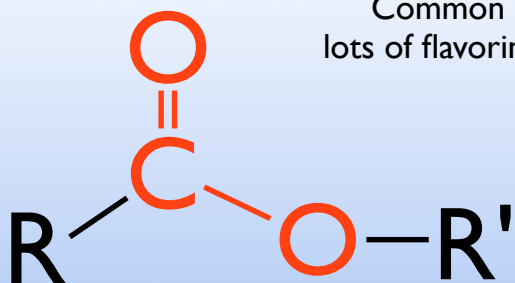
E. propanol

No need to number carboxylic acid
its always at the end

this compound is also
commonly known as acetic acid

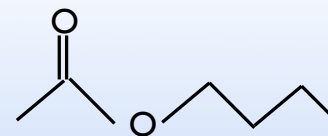
Ester

Common
lots of flavorings



carbon double bonded to an oxygen
bonded to carbon on one side
OR on the other side
suffix is -oic acid

Name this compound



A. ethyl butanoate

B. butyl methanoate

C. methyl heptanoate

D. butyl ethanoate

E. pentyl ethanoate

No need to number ester
name the two sides

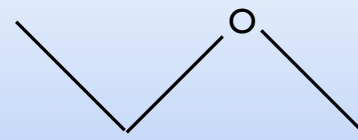
part with the carboxyl (C=O)
is the parent
other part is like the side chain

Ether

Diethyl Ether
(knocks you out)



carbon oxygen in the middle of the chain
suffix is **-ether**



Treat as two "side chains"

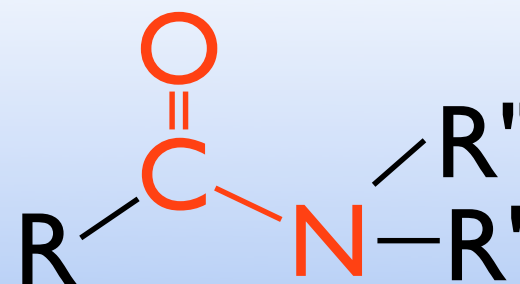
methyl ethyl ether

Primary Amine



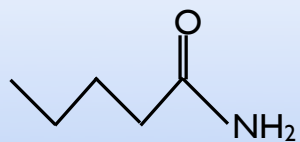
-NH₂ group is an amine
suffix is **-amine**

Amide

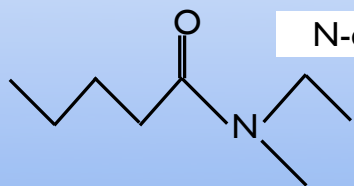


carbon double bonded to an oxygen
bonded to carbon on one side
N on the other side
suffix is **-amide**

Naming amide
Treat part with C=O as parent
parts on the N as sidechains



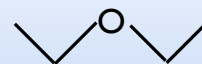
pentanamide



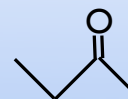
N-ethyl-N-methylpentanamide



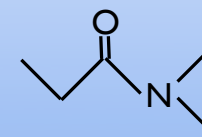
Amine



Ether



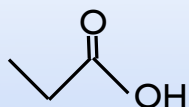
Ketone



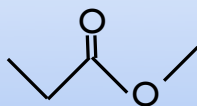
Amide



Alcohol



Carboxylic Acid



Ester



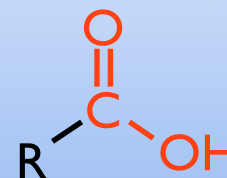
Alkene

Important Reaction for Biochemistry

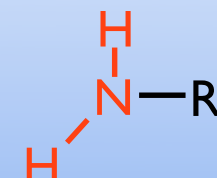
Formation of an Amide

The don't call them functional groups for nothing

Carboxylic Acid

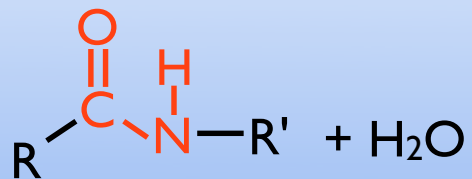
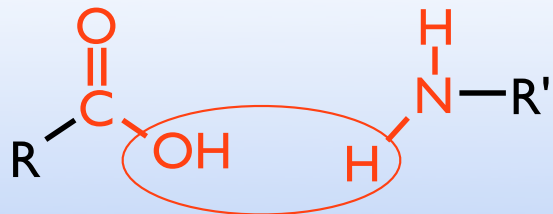


Primary Amine



Carboxylic Acid

Primary Amine

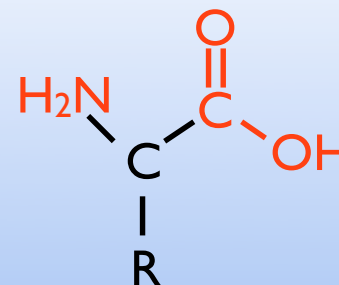


Amide + Water

Principles of Chemistry II

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Amino Acid

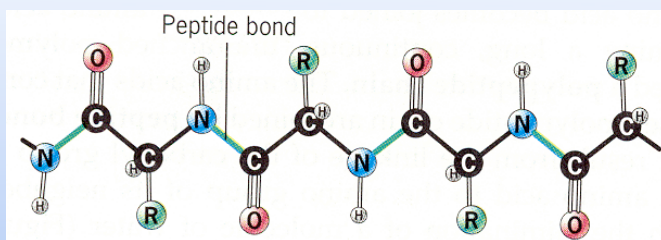


Carboxylic End and Amine End
Can react with itself
(or similar molecules) in a chain

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Polypeptide



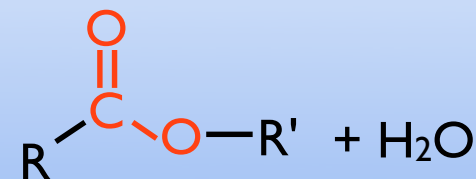
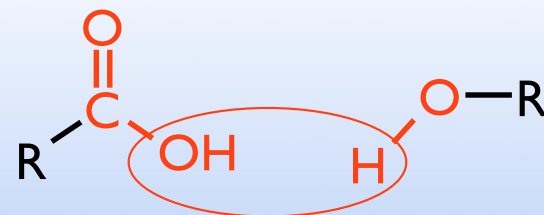
Two distinct ends
N-terminus is an amine
C-terminus is a carboxylic acid

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Carboxylic Acid

Alcohol

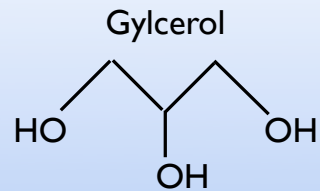


Ester + Water

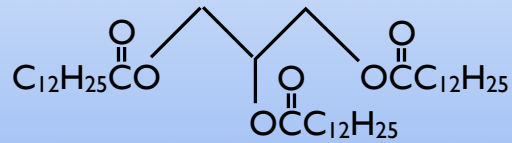
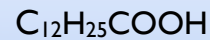
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Triglycerides



Fatty Acid
(carboxylic acid with long chain)



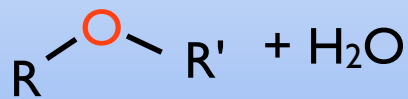
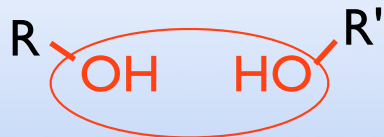
Makes Triglyceride

The three fatty acids can
all be the same or different

High levels of triglycerides is linked to
build up of plaque in the arteries
= heart disease

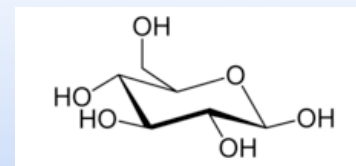
Alcohol

Alcohol



Ether + Water

Sugars

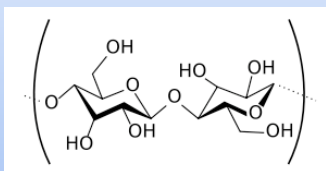
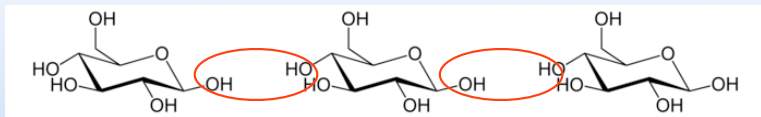


Glucose

(key factor for sugars lots of hydroxyls)

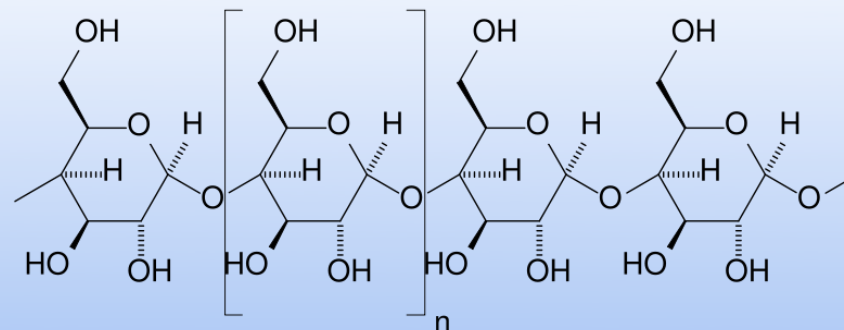
They can react to form chains of sugars
polysaccharide

Cellulose



Very long ether chain
(pretty much all plant material)

Polysaccharide (Starch)



Sugars, Carbohydrates
monosaccharides (one)
disaccharides (two)
polysaccharides (many)

Condensation Reactions
(two molecules make one + water)

Carboxylic Acid + Amine = Amide + water

Carboxylic Acid + Alcohol = Ester + water

Alcohol + Alcohol = Ether + water