General Strategy For Naming Simple Organic Compounds (Bare bones summary sheets)

1. Find the highest priority group. These are listed in order of priority in the table of functional groups (next page).

2. Find the longest chain containing the highest priority group. You should know carbon chains of length C_1-C_{19} (listed in the table).

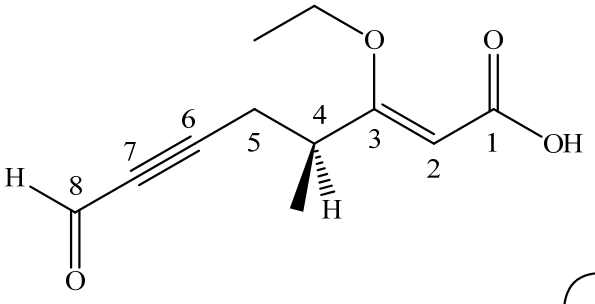
3. Number the longest chain containing the highest priority group to give the highest priority group the lowest number possible in numbering the longest chain. For the first seven functional groups, the functional group carbon will be number 1 (if it is the highest priority group) and the "1" can be omitted, since it is understood that it has to be this way.

4. Usually the highest priority group is named as a suffix at the end of alkane, alk-#-ene or alk-#-yne. The final e is dropped if the suffix begins with a vowel and it is retained if the suffix begins with a consonant (only two for us, "nitrile" and "thiol"). A number will be present in front of the suffix name unless its position is unambiguously clear (e.g. carboxyl groups, aldehydes, nitriles, etc. always = 1, if highest in priority). If there is a C/C pi functional group to identify (alkene or alkyne), the number in front of its part of the name describes its position (see rule 6 below). If both a pi bond and a high priority substituent are present, then two (or more) numbers may be necessary, one for each functionality.

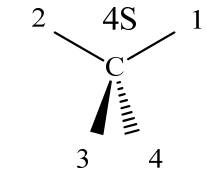
5. Lower priority groups are named with their prefix names and their location numbers based on the numbering of the parent chain (always true for substituents numbered 12 on the next page). The lower priority substituents should be listed in alphabetical order. Some parts of prefix names count in this regard and some don't. We will not emphasize this aspect in this course.

6. Double bonds and triple bonds are named as alk-#-ene or alk-#-yne, respectively. If both are present, name as alk-#-en-#-yne. Multiple pi bonds (or other substituents) use the prefixes di, tri, tetra, penta etc. with a number for each occurrence. In such cases, an "a" is added in front of the numerical prefix for better phonetics. (alka-#,#-diene or alka-#,#,#-triyne, alka-#,#-dien-#,#-diyne, etc.)

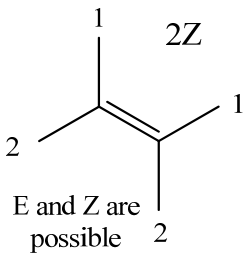
The essential functional groups to know (for our course) and their prefixes and suffixes are given in the next page. In this table the term "alkan-#-suffix" is a generic term for any alkane with a functional group suffix, and it must be replaced with the correct parent stem name based on the number of carbons in the longest chain (C_1-C_{19} for us). If there is a double bond, the name will change to "alk-#-en-#-suffix and if there is a triple bond, the name will change to "alk-#-yn-#-suffix.



(2Z,4S)-3-ethoxy-4-methyl-8-oxooct-2-en-6-ynoic acid

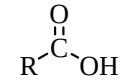
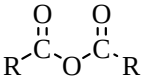
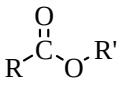
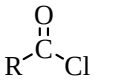
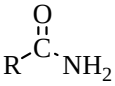
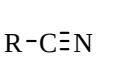
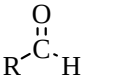
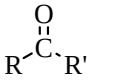
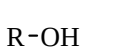
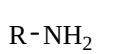
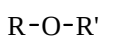
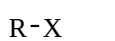
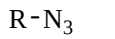
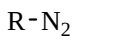
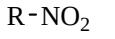
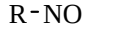
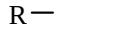


R and S are possible



E and Z are possible

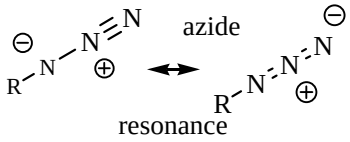
Notice that no "1" is used for the carboxylic acid group, because it has to be "1" in this structure.

Functional Group		**prefix**	**suffix**
1. Carboxylic acid		not considered	alkan**oic acid**
2. Anhydride		not considered	alkan**oic anhydride** (if symmetrical)
3. Ester		**#-alkoxycarbonyl**	**alkyl** (R') alkan**oate** (RCO_2)
4. Acid halide		#-**chlorocarbonyl**	alkan**oyl chloride**
5. Amide		#-**carbamoyl (or #-amido)**	alkan**amide**
6. Nitrile		#-**cyano**	alkane**nitrile**
7. Aldehyde		#-**oxo**	alkan**al**
8. Ketone		#-**oxo** (older = #-**keto**)	alkan-#-**one**
9. Alcohol		#-**hydroxy**	alkan-#-**ol**
10. Thiol		#-**mercapto (or #-sulfanyl)**	alkane-#-**thiol**
11. Amine		#-**amino**	#-alkyl**amine** #-alkan**amine**
12. Ether		#-alk**oxy** (if more than 5C's, then #-alkyloxy) (can also use "#-oxa" prefix and count as carbon in longest chain)	
12. Halogen		#-**fluoro**, #-**chloro**, #-**bromo**, #-**iodo**	
12. Azide*		#-**azido**	
12. Diazo*		#-**diazo**	
12. Nitro*		#-**nitro**	
12. Nitroso		#-**nitroso**	
12. Carbon branches		#-alkyl, #-(alk-#-enyl), #-(alk-#-ynyl)	

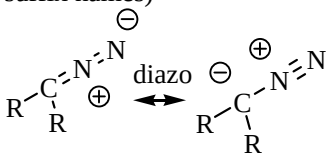
The part of each name specific to the functional group is in **bold** and underlined to help you see those features. They are not part of the names.

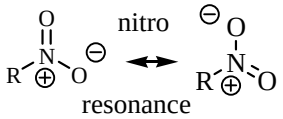
"R" = carbon chains

# carbons	alkane chain name	alkyl branch name
1	methane	methyl
2	ethane	ethyl
3	propane	propyl
4	butane	butyl
5	pentane	pentyl
6	hexane	hexyl
7	heptane	heptyl
8	octane	octyl
9	nonane	nonyl
10	decane	decyl
11	undecane	undecyl
12	dodecane	dodecyl
13	tridecane	tridecyl
14	tetradecane	tetradecyl
15	pentadecane	pentadecyl
16	hexadecane	hexadecyl
17	heptadecane	heptadecyl
18	octadecane	octadecyl
19	nonadecane	nonadecyl



always prefixes (no suffix names)





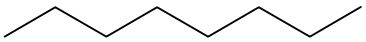
* = formal charge is necessary in these Lewis structures and there are two reasonable resonance structures

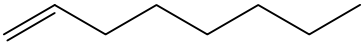
stereoisomerism	prefixes	parent stem	C/C pi bonds	high priority suffix
R/S and E/Z	branches and low priority functional groups	see box above	-ene -yne	see list above

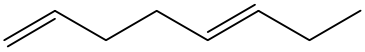
Practice problems

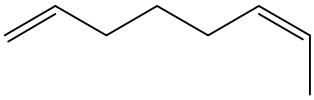
alkanes, alkenes, alkyne, alka-#,#-dienes alka-#,#-diynes, alk-#-en-#-yne

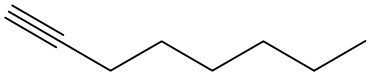
Problems

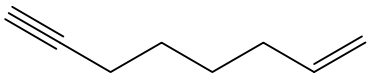
a 

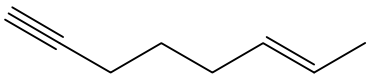
b 

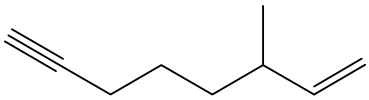
c 

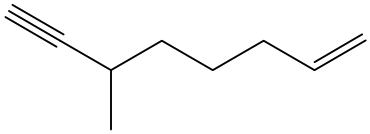
d 

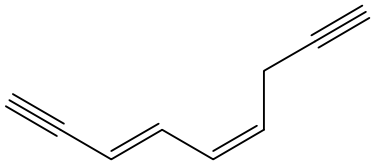
e 

f 

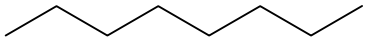
g 

h 

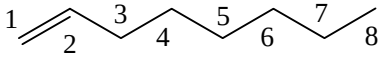
i 

j 

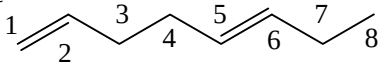
Answers Alkene/alkyne priority: If tie, alkene > alkyne, otherwise lowest number at first point of difference.

a 

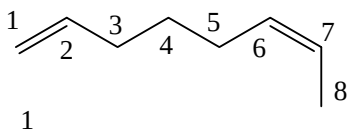
octane

b 

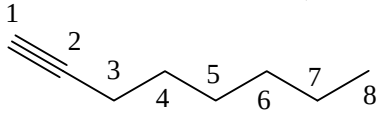
oct-1-ene

c 

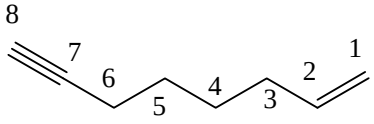
octa-1,5E-diene

d 

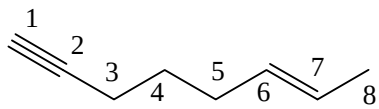
octa-1,6Z-diene

e 

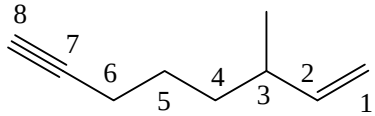
oct-1-yne

f 

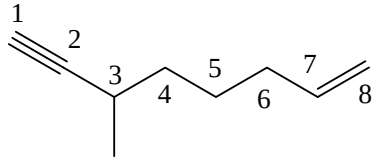
oct-1-en-7-yne

g 

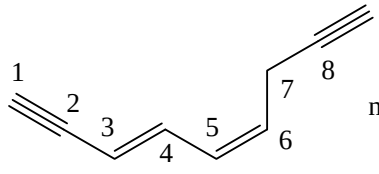
oct-6E-en-1-yne

h 

3-methyloct-1-en-7-yne

i 

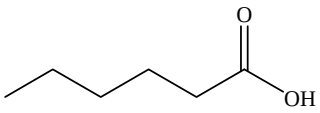
3-methyloct-7-en-1-yne

j 

nona-3E,5Z-dien-1,8-diyne

Functional group examples (high priority group gets suffix, all others named as prefixes)

functional group:



suffix:

prefix:

name:

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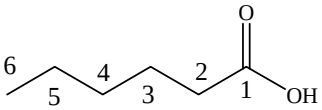
functional group: carboxylic acid



suffix: -oic acid

prefix? #-carboxy (not used in our course)

name: hexanoic acid

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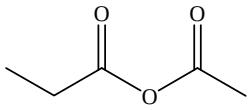
functional group:



suffix:

prefix:

name:

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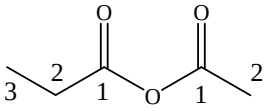
functional group: anhydride



suffix: -oic anhydride

prefix? #-acyloxyalkanecarbonyl
(not used in our course)

name: ethanoic propanoic anhydride

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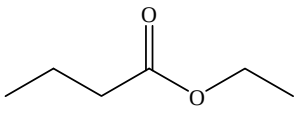
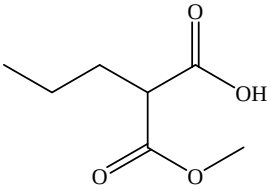
functional group:



suffix:

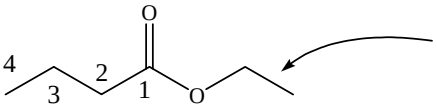
prefix:



name:

---

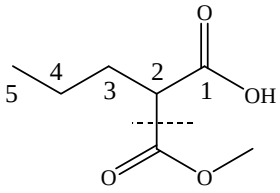
functional group: ester



suffix: -oate

alkyl branch on oxygen
named in front (as a branch)

prefix: alkoxycarbonyl

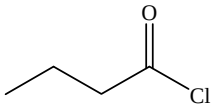


name: ethyl butanoate

name: 2-methoxycarbonylpentanoic acid

---

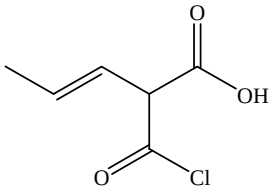
functional group:



name:

suffix:

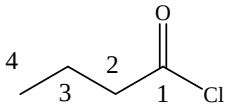
prefix:



name:

---

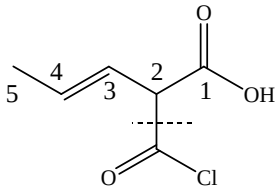
functional group: acid chloride



name: butanoyl chloride

suffix: -oyl chloride

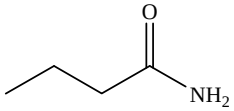
prefix: chlorocarbonyl



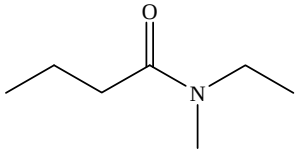
name: 2-chlorocarbonylpent-3E-noic acid

---

functional group:



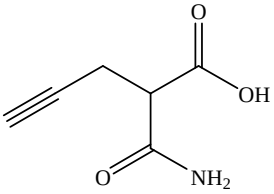
name:



name:

suffix:

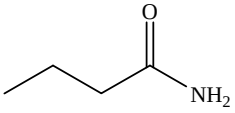
prefix:



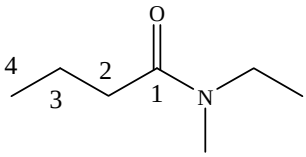
name:

---

functional group: amide (1^o, 2^o, 3^o)



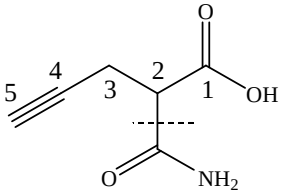
name: butanamide



name: N-ethyl-N-methylbutanamide

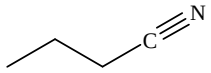
suffix: -amide

prefix: amido or carbamoyl



name: 2-amidopent-4-ynoic acid
2-carbamoylpent-4-ynoic acid

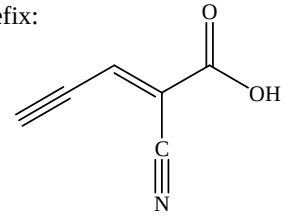
functional group:



name:

suffix:

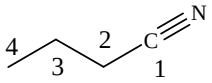
prefix:



name:

---

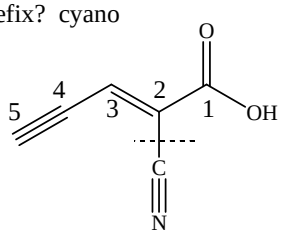
functional group: nitrile



name: butanenitrile

suffix: -nitrile

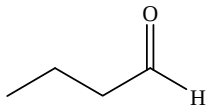
prefix? cyano



name: 2-cyanopent-2E-en-4-ynoic acid

---

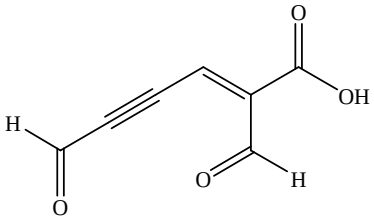
functional group:



name:

suffix:

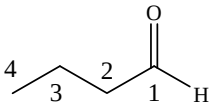
prefix:



name:

---

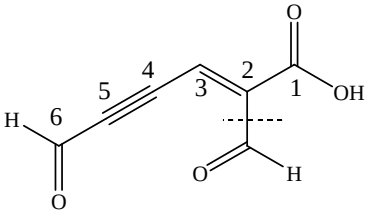
functional group: aldehyde



name: butanal

suffix: -al

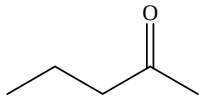
prefix: oxo (when part of the longest chain at the end)
formyl (when a branch off of the longest chain)



name: 2-formyl-6-oxohex-2E-en-4-ynoic acid

---

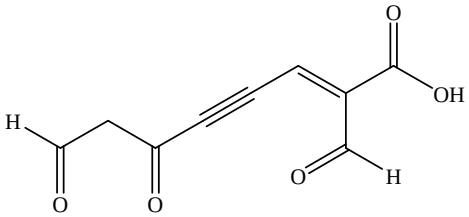
functional group:



name:

suffix:

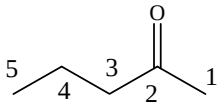
prefix:



name:

---

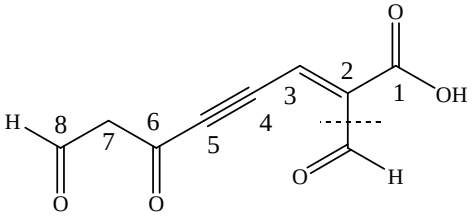
functional group: ketone



name: pent-2-one

suffix: -one
(sounds like "cone")

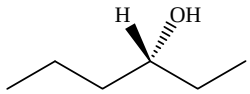
prefix: oxo (an older prefix was "keto")



name: 2-formyl-6,8-dioxooct-2E-en-4-ynoic acid

---

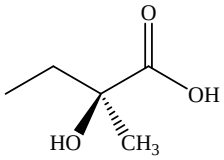
functional group:



name:

suffix:

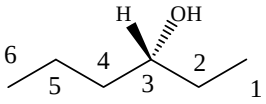
prefix:



name:

---

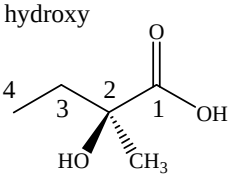
functional group:alcohol



name: (3R)-hexan-3-ol

suffix: -ol

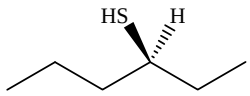
prefix: hydroxy



name: 2S-hydroxy-2-methylbutanoic acid

---

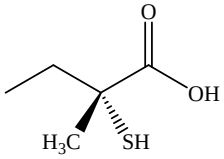
functional group:



name:

suffix:

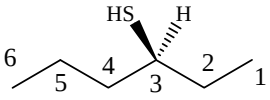
prefix:



name:

---

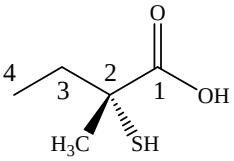
functional group:thiol



name: (3S)-hexane-3-thiol

suffix: -thiol
retain "e", starts with a consonant

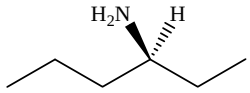
prefix: mercapto or sulfanyl



name: 2R-mercapto-2-methylbutanoic acid
name: 2R-sulfanyl-2-methylbutanoic acid

---

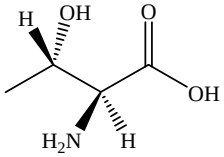
functional group:



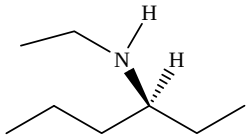
name:

suffix:

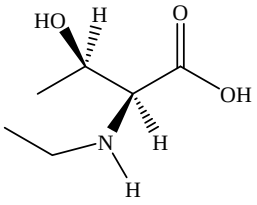
prefix:



name:



name:

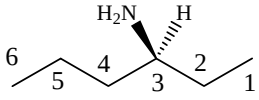


name:

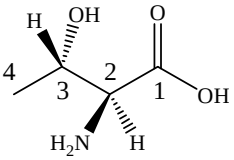
functional group:amine

suffix: -amine

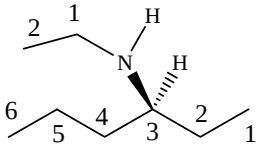
prefix: amino



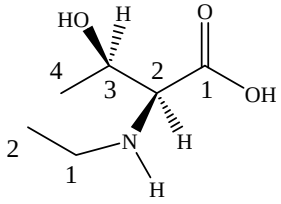
name: (3S)-hexane-3-amine
(3S-hexylamine)



name: (2S,3S)-2-amino-3-hydroxybutanoic acid



name: (3S)-N-ethylhexane-3-amine
(3S--N-ethylhexylamine)



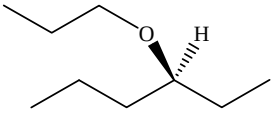
name: (2S,3R)-2-(N-ethylamino)-3-hydroxybutanoic acid

---

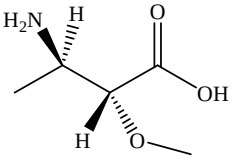
functional group:

suffix:

prefix:



name:



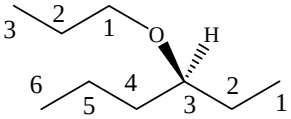
name:

---

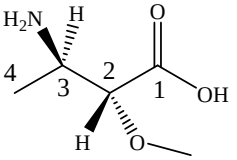
functional group: ether

suffix: no suffix name

prefix: alkoxy (depends on carbon part)



name: (3S)-propoxyhexane



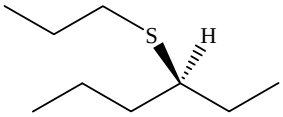
name: (2R,3R)-2-methoxy-3-aminobutanoic acid

---

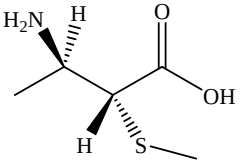
functional group:

suffix:

prefix:



name:



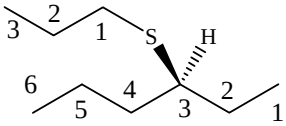
name:

---

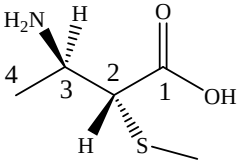
functional group: thioether / sulfide

suffix: no suffix name

prefix: alkylthio (depends on carbons)

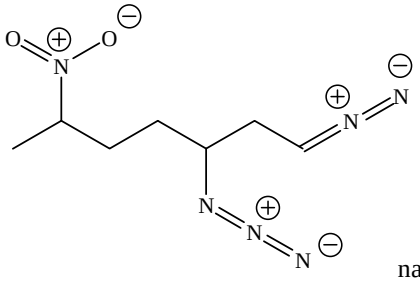


name: (3S)-propylthiohexane



name: (2R,3R)-2-methylthio-3-aminobutanoic acid

Miscellaneous nitrogen functional groups (3 have formal charge, all named as prefixes)



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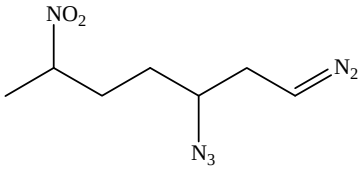


name:

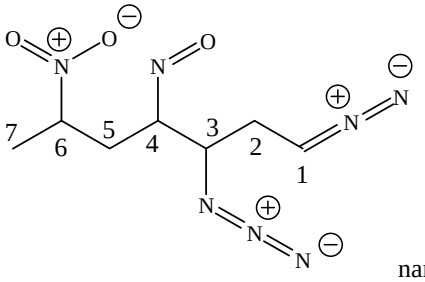
RNO_2 =

RNO =

RN_3 =

RN_2 =

Miscellaneous nitrogen functional groups (3 have formal charge, all named as prefixes)



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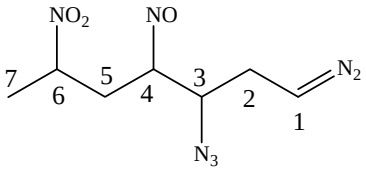


name: 1-diazo-3-azido-4-nitroso-6-nitroheptane

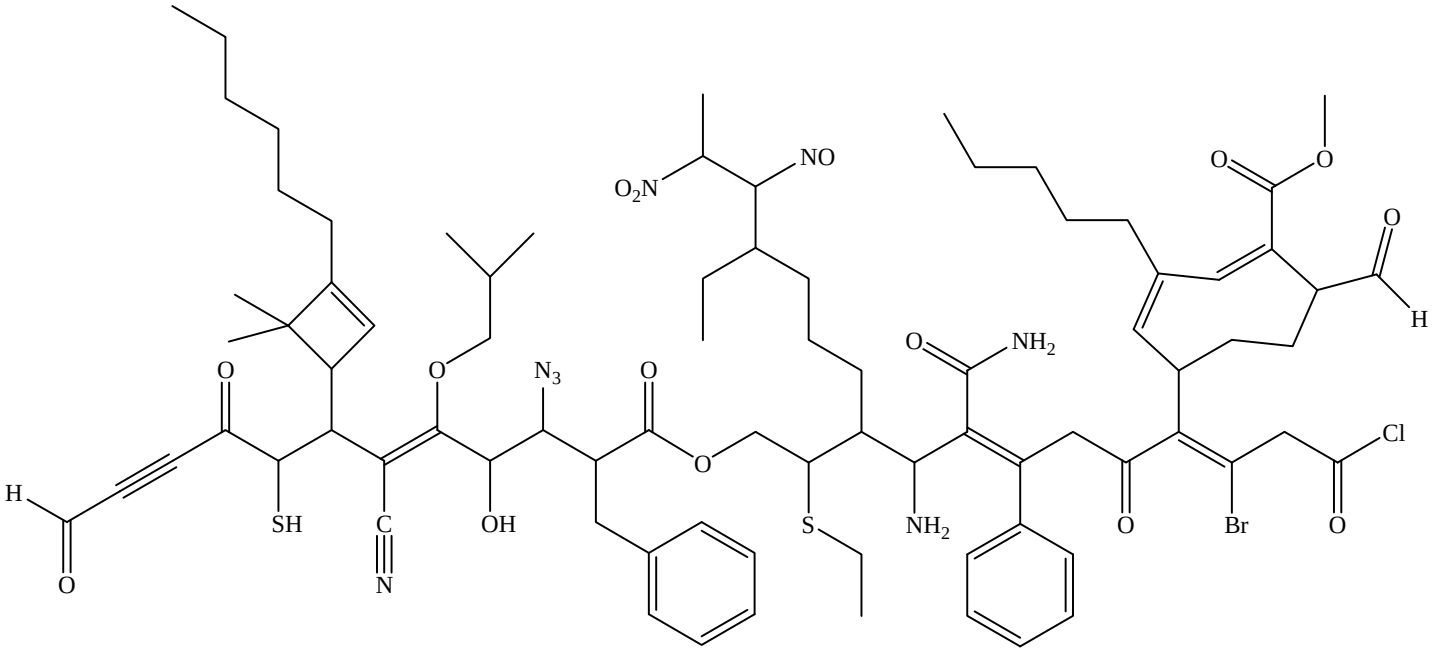
RNO_2 = nitro

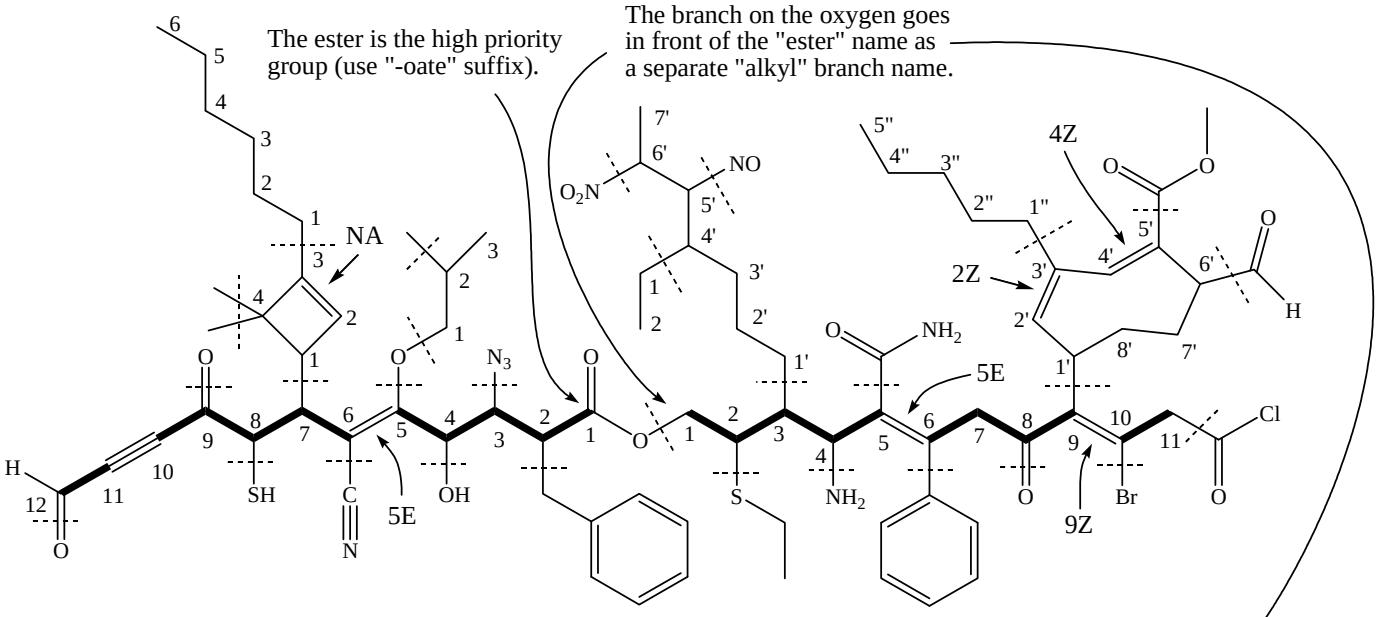
RNO = nitroso

RN_3 = azido

RN_2 = diazo

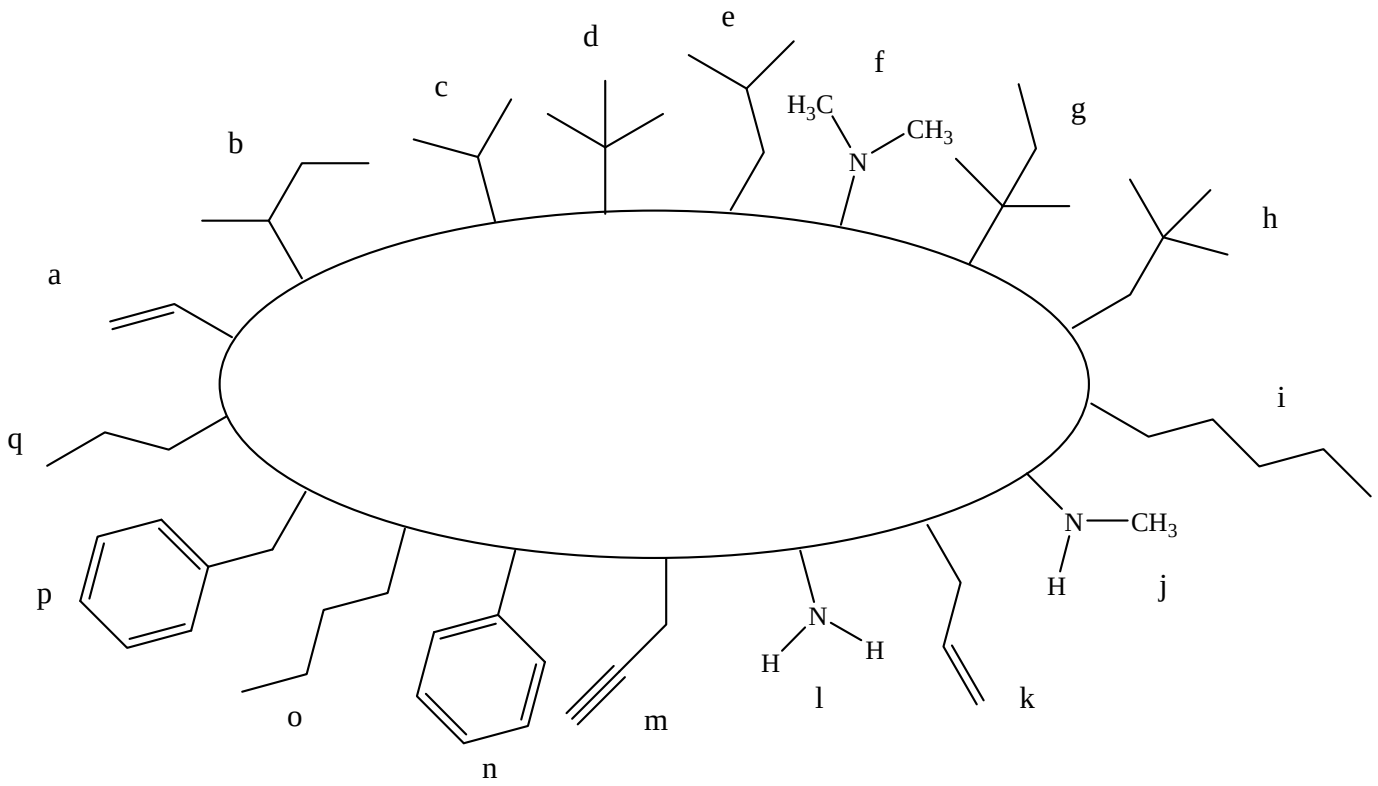
Provide an acceptable name for the following compound. It has 'almost' all of our functional groups





2-ethylthio-3-(4-ethyl-5-nitroso-6-nitroheptyl)-4-amino-5-amido-6-phenyl-8-oxo-9-(3-pentyl-5-methoxycarbonyl-6-formylcycloocta-2Z,4E-dienyl)-10-bromo-11-chlorocarbonylundeca-5E,9Z-dienyl 2-benzyl-3-azido-4-hydroxy-5-(2-methylpropoxy)-6-cyano-7-(3-hexyl-4,4-dimethylcyclobut-2-enyl)-8-mercapto-9,12-dioxododec-5E-en-10-ynoate

Problem – Identify each of the substituent patterns below by its common name. Point out an example of a 1^o, 2^o, 3^o and 4^o carbon atoms and1^o, 2^o and 3^o nitrogen atoms (amines) in the side chains. Also, point out an example of a methyl, methylene and methine (methylidene) position.



a

b

c

d

e

f

g

h

i

j

k

l

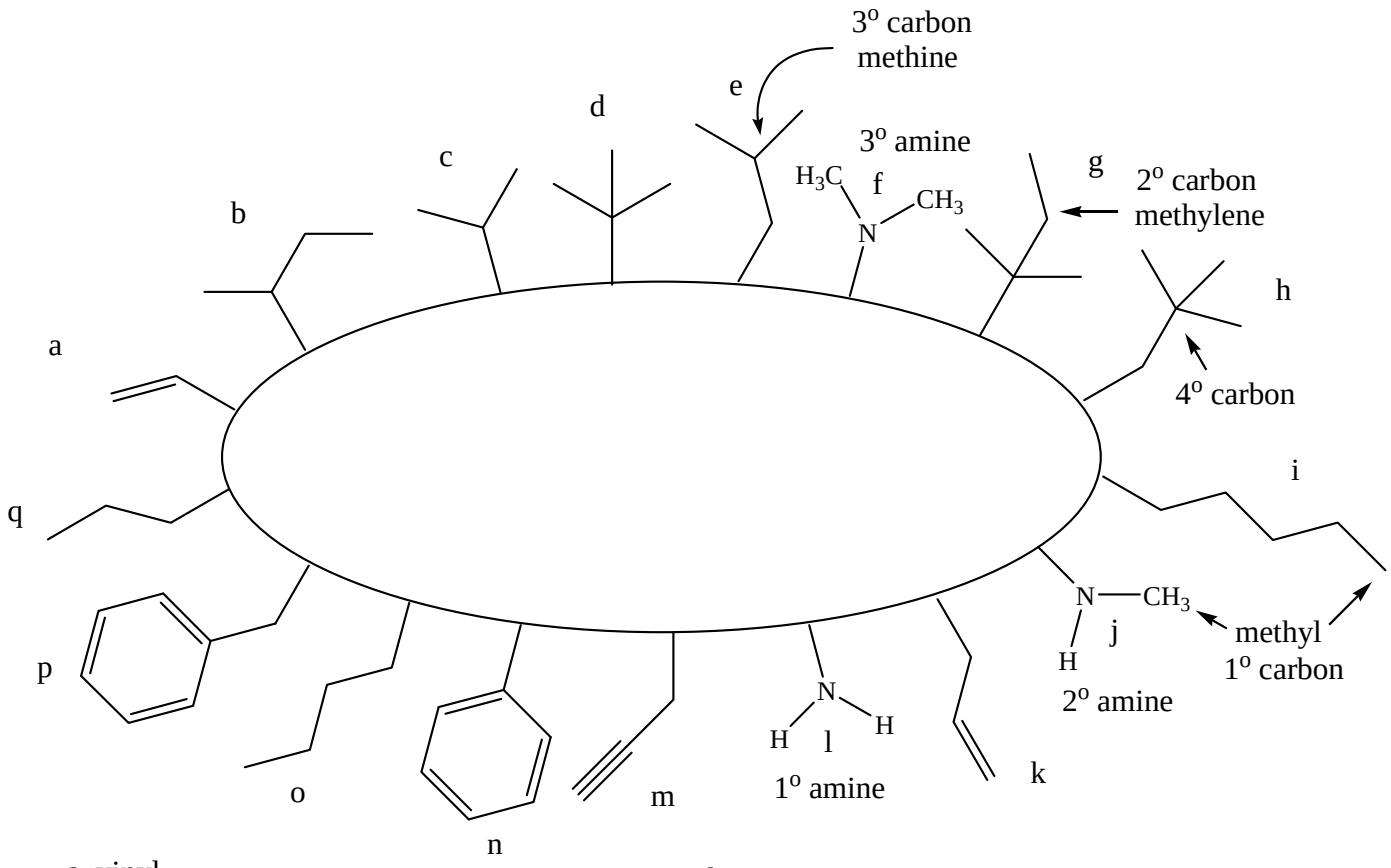
m

n

o

p

q



a vinyl

b sec-butyl

c isopropyl

d t-butyl

e isobutyl

f N,N-dimethylamino

g t-pentyl

h neopentyl

i n-pentyl

j N-methylamino

k allyl

l amino

m propargyl

n phenyl

o n-butyl

p benzyl

q n-propyl