# Lecture 6

# Organic Chemistry: Fundamentals and Applications (CSO201A)

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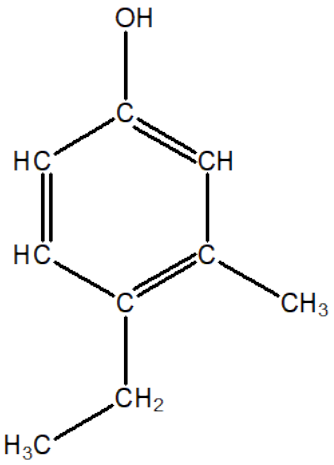
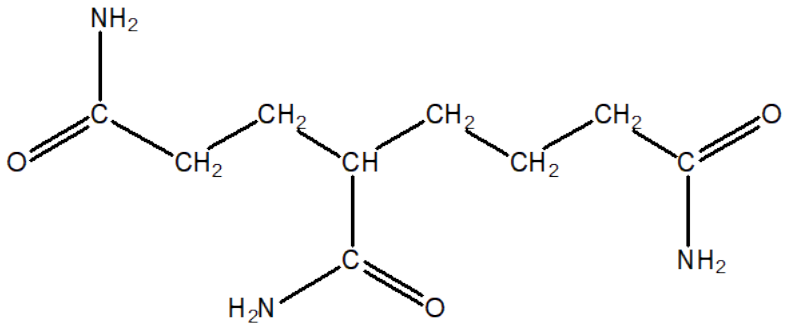
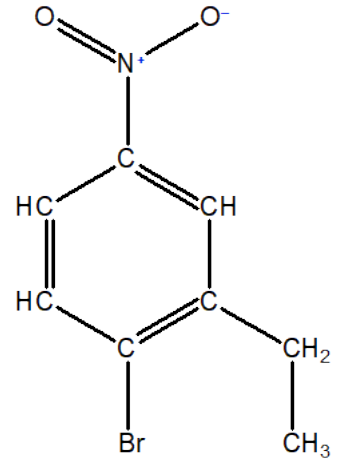
# IUPAC Nomenclature of Cyclic Compounds

You will be able to name any organic compound as per IUPAC rules



# Functional Group Containing Molecules

**Molecules with functional groups:**

1. Choose the longest carbon chain containing functional group (FG) as the parent chain.
2. The functional group (FG) must get a lowest number possible.
3. Remove 'e' from ane/ene/yne and add the name of the FG: → but-3-en-1-oicacid.
3. If a molecules contains more than one FG, one is chosen as principal FG and others as substituents.
4. If more than one identical FG present (except db/tb): full parent alkane's name+o-di/tri/tetra-FG suffix

**C11→ undec**
**C12→ dodec**
**C13→ tridec**
**C14→ tetradec**
**C15→ pentadec**
**C16→ hexadec**
**C17→ heptadec**
**C18→ octadec**
**C19→ nonadec**
**C20→ eicos**

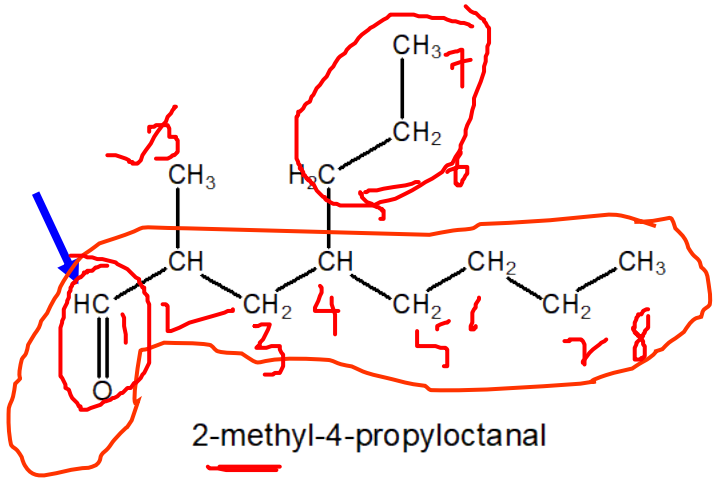
| Functional groups | prefix | suffix |
|---|---|---|
| 1. alkenes→ C-C: db | - | ene |
| 2. alkynes→ C-C: tb | - | yne |
| 1. Nitro→ $-NO_2$ | nitro | - |
| 2. Alkoxy→ -OR | alkoxy | - |
| 3. Halo→ -X (F, Cl , Br,I) | halo | - |

# Functional Group Containing Molecules

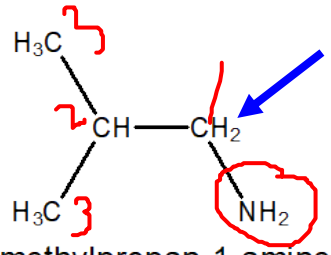
| functional groups | prefix | suffix |
|---|---|---|
| 1. Carboxylic acid → -COOH | carboxy | oic acid |
| 1a. Sulphonic acid → $-SO_3H$ | sulpho | sulphonic acid |
| 1b. Ester → -COOR | Alkoxy carbonyl | oate |
| 1c. Acid halide → -COX | halo carbonyl | oyl halide |
| 1d. Amide → -CONH2 | carbamoyl | amide |
| 1e. Nitrile → -CN | cyano | nitrile |
| 2. Aldehyde → -CHO | formyl/oxo | al |
| 3. Ketone → -CO- | oxo | one |
| 4. Alcohol → -OH | hydroxy | ol |
| 5. Amine → $-NH_2$ | amino | amine |

## Molecules with functional groups:

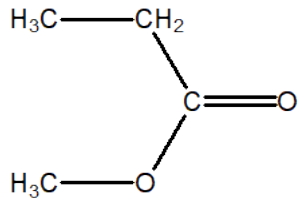
1. Choose the longest carbon chain containing functional group (FG) as the parent chain.
2. The functional group (FG) must get a lowest number possible (except –OH, -CO-, -$NH_2$).
3. If FG suffix starts with→(a,i,o,u,y), then remove "e" of ane/ene/yne: → but-3-en-1-oicacid.
4. If a molecule contains more than one FG, one is chosen as principal FG and others as substituents.



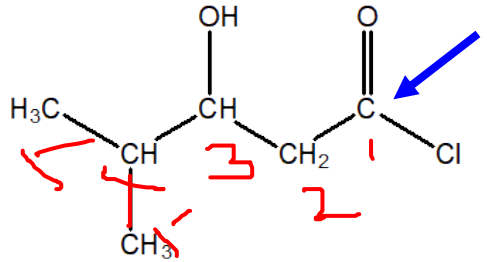
2-methyl-4-propyloctanal



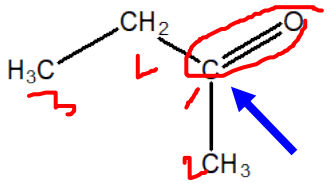
2-methylpropan-1-amine



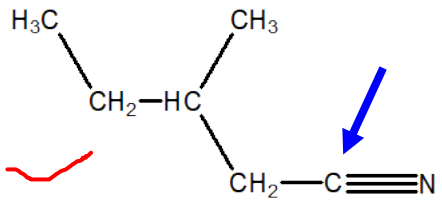
methyl propanoate



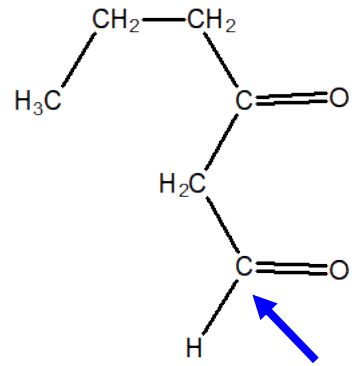
3-hydroxy-4-methylpentanoyl chloride



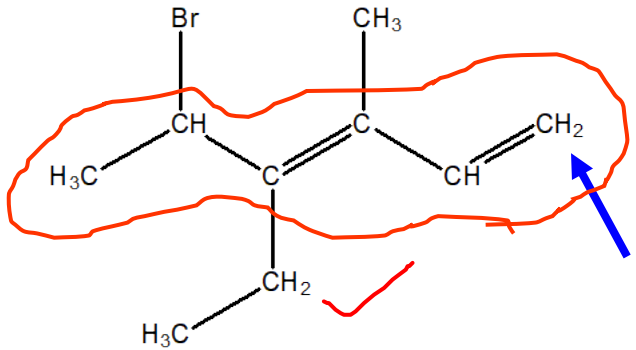
butan-2-one



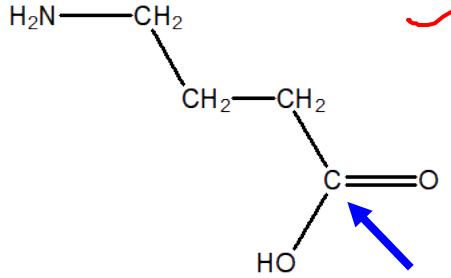
3-methylpentanenitrile



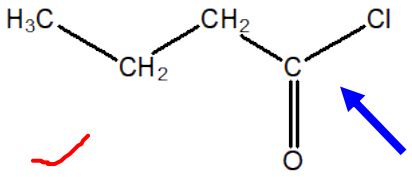
3-oxohexanal



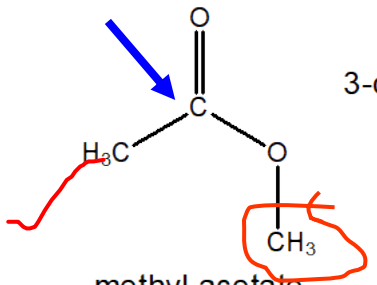
(3*E*)-5-bromo-4-ethyl-3-methylhexa-1,3-diene



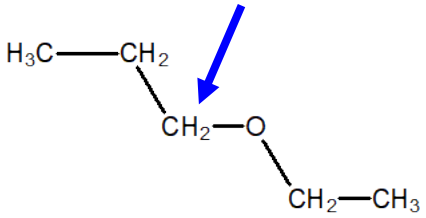
4-aminobutanoic acid



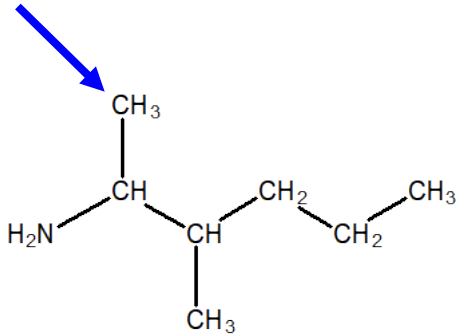
butanoyl chloride



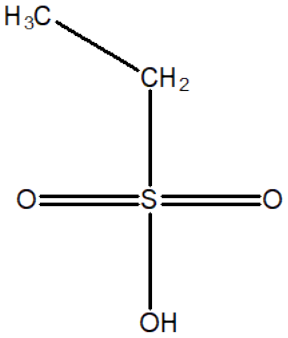
methyl acetate



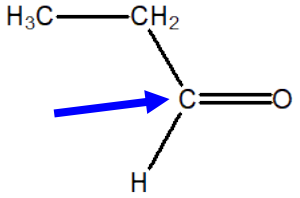
1-ethoxypropane



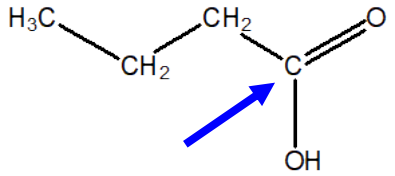
3-methylhexan-2-amine



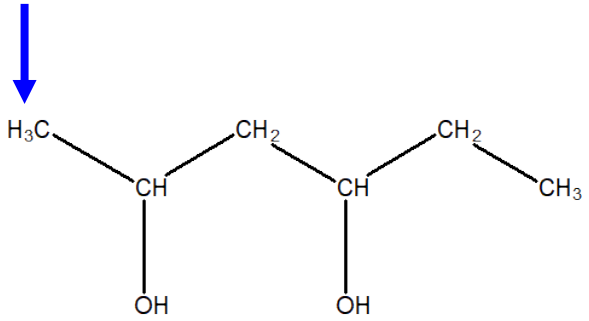
ethanesulfonic acid



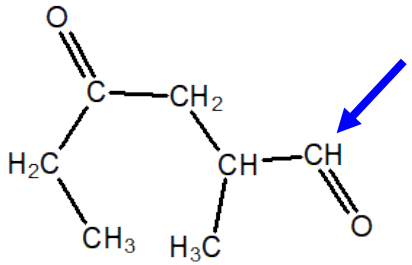
propanal



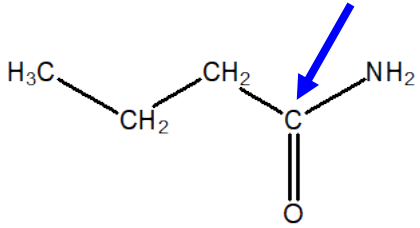
butanoic acid



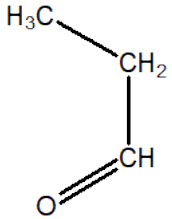
hexane-2,4-diol



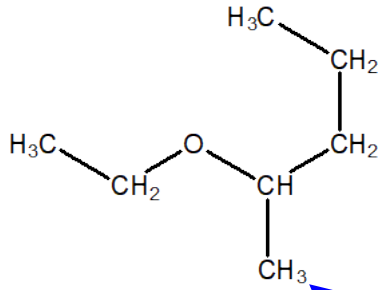
2-methyl-4-oxohexanal



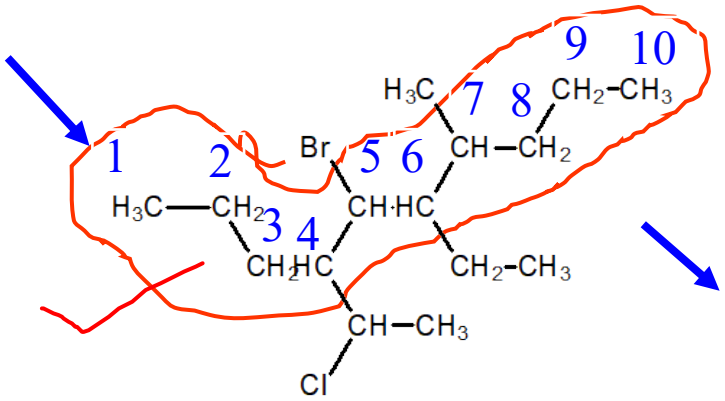
butanamide



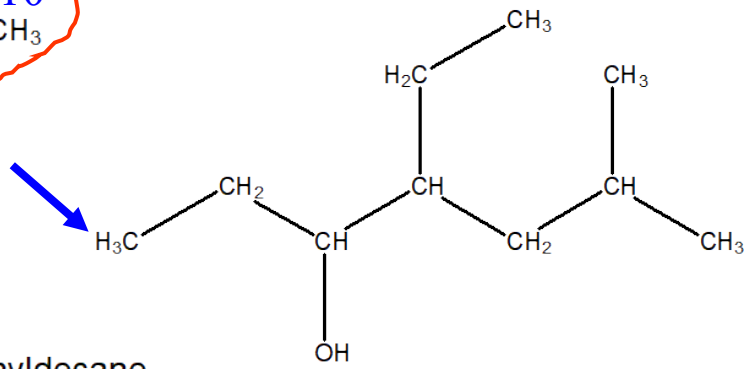
propanal



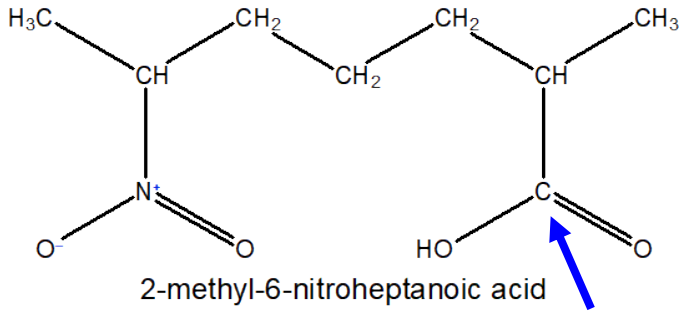
2-ethoxypentane



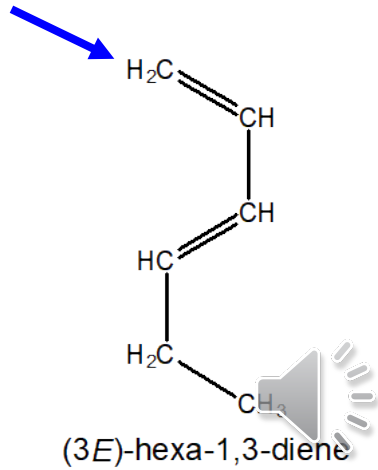
5-bromo-4-(1-chloroethyl)-6-ethyl-7-methyldecane



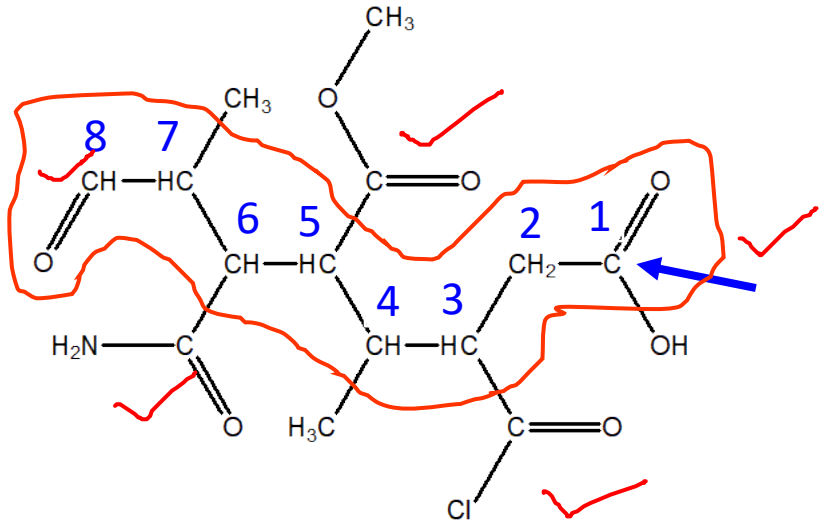
4-ethyl-6-methylheptan-3-ol



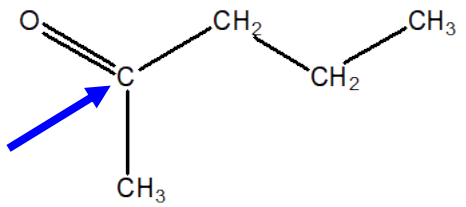
2-methyl-6-nitroheptanoic acid



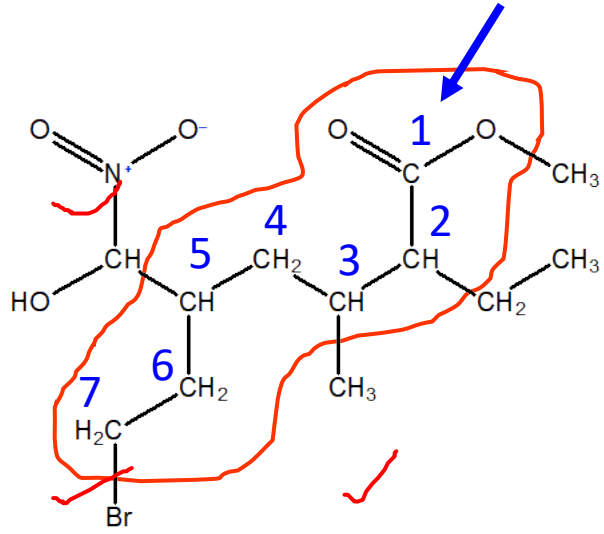
(3*E*)-hexa-1,3-diene



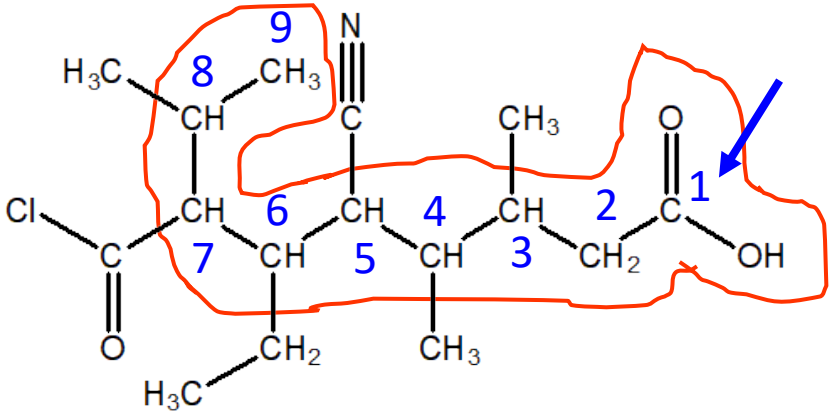
6-carbamoyl-3-(chlorocarbonyl)-5-(methoxycarbonyl)-4,7-dimethyl-8-oxooctanoic acid



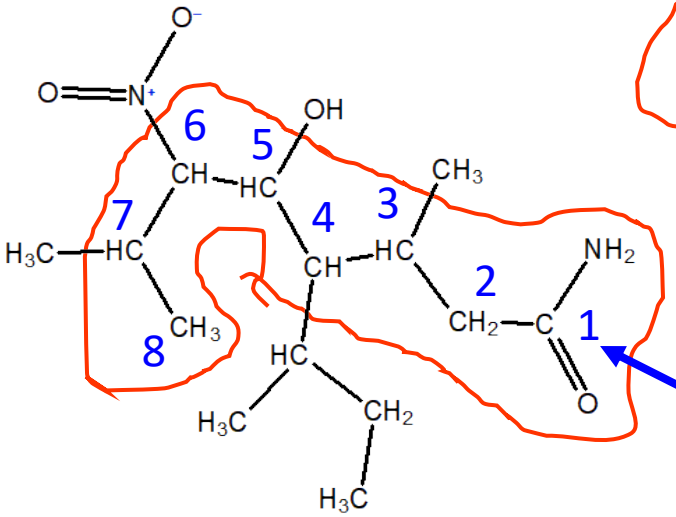
pentan-2-one



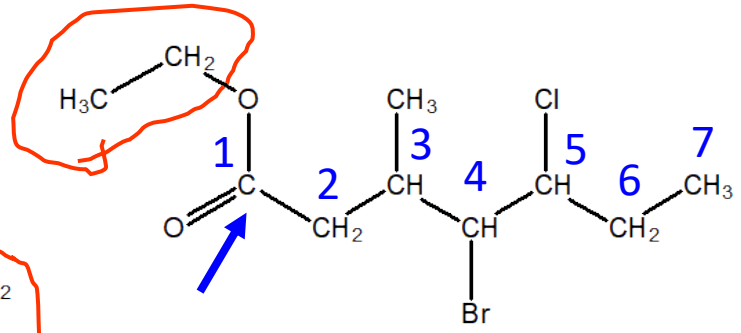
methyl 7-bromo-2-ethyl-5-[hydroxy(nitro)methyl]-3-methylheptanoate



7-(chlorocarbonyl)-5-cyano-6-ethyl-3,4,8-trimethylnonanoic acid



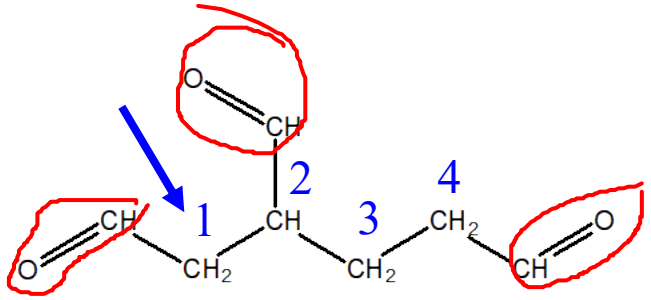
4-(butan-2-yl)-5-hydroxy-3,7-dimethyl-6-nitrooctanamide



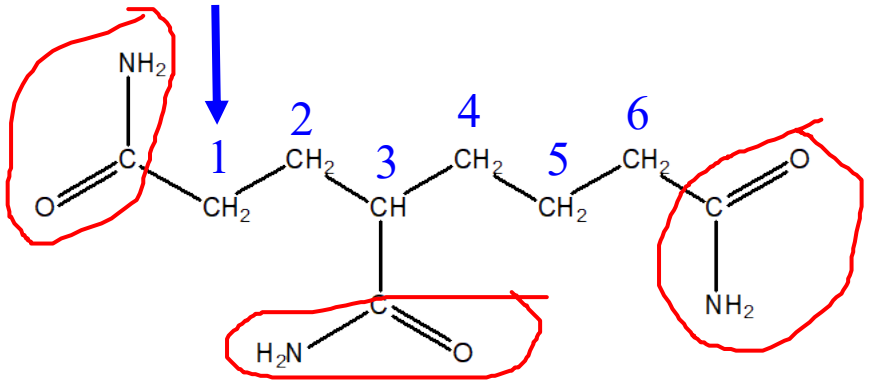
ethyl 4-bromo-5-chloro-3-methylheptanoate

## Molecules with functional groups:

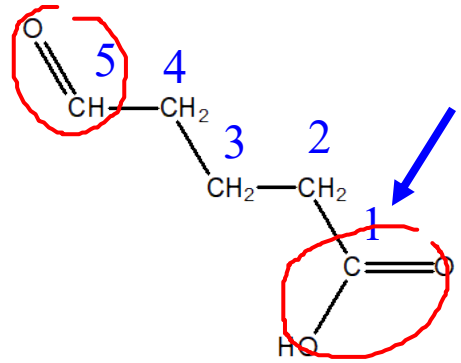
5. Unbranched chain with 3/more same FGs→hexane-1,3,6-tricarboxylic acid.
6. Branched chain with 3/more same FG: Parent chain includes 2FG and 1FG as substituent.
7. If substituent is oxygen derivative of $CH_3$/$CH_2$: its carbon is also becoming part of parent chain.



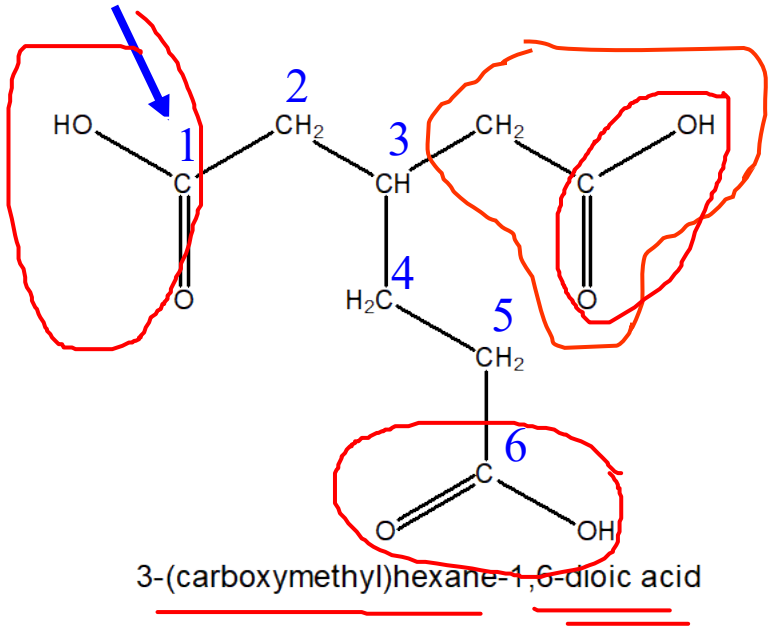
butane-1,2,4-tricarbaldehyde



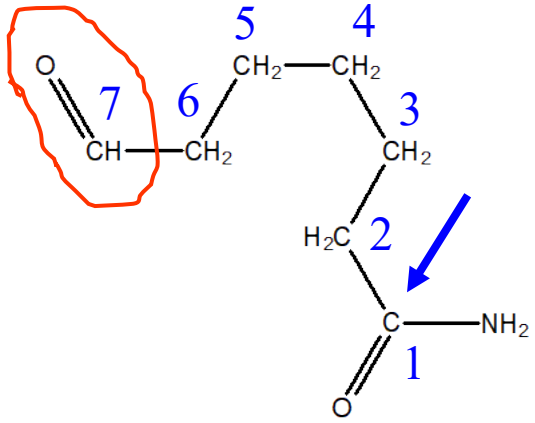
hexane-1,3,6-tricarboxamide



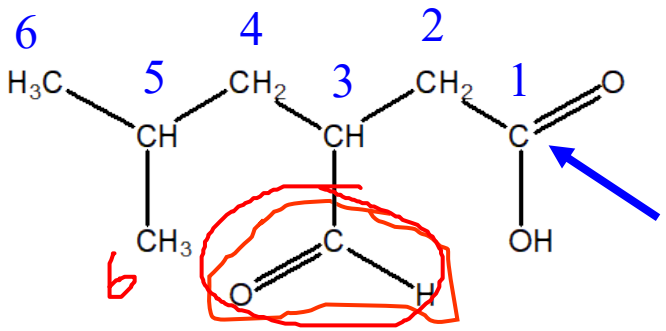
5-oxopentanoic acid



3-(carboxymethyl)hexane-1,6-dioic acid



7-oxoheptanamide

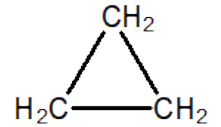


3-formyl-5-methylhexanoic acid

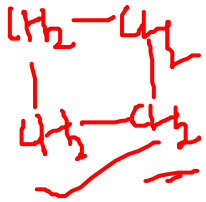
# 5. Alicyclic Compounds

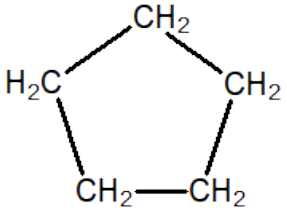
**Carbocyclic Compounds:**

1. Add prefix "cyclo" before the equivalent alkane/alkene/alkyne chain.
2. Substituents numbering: priority to alphabetical order (ethyl>methyl)→ alkylcycloalkanes
3. C-Numbering: priority to carbon with more branched>carbon with less branches
4. Lowest set of locant rule

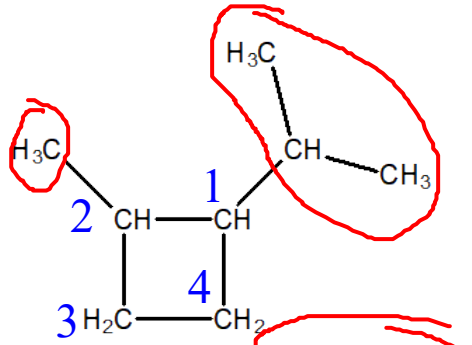


cyclopropane

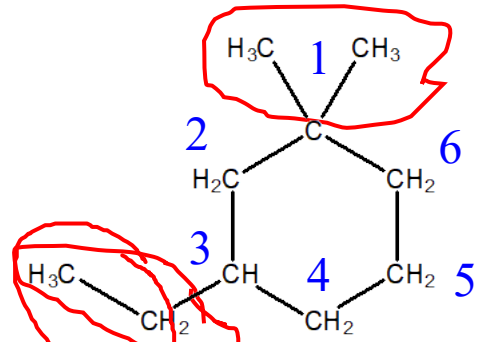




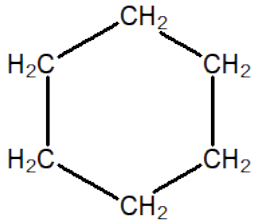
cyclopentane



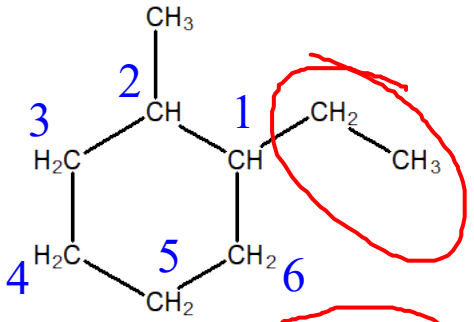
1-isopropyl-2-methylcyclobutane



3-ethyl-1,1-dimethylcyclohexane



cyclohexane



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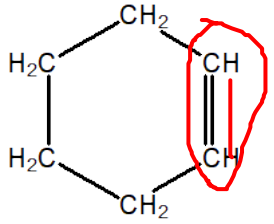
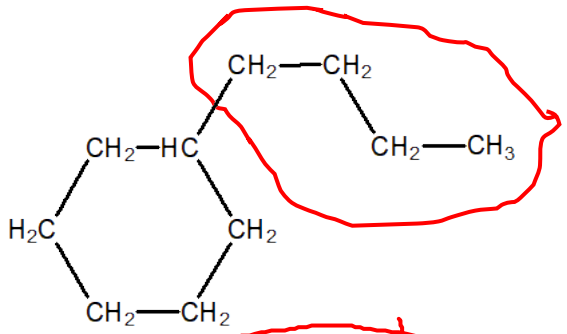


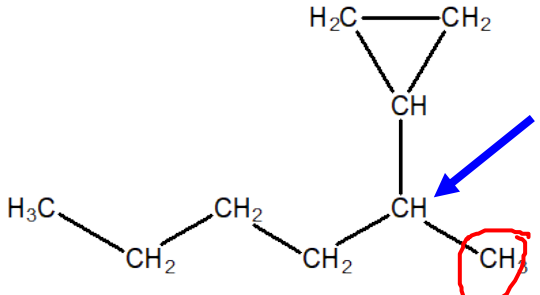
cyclohexene

## Carbocyclic Compounds:

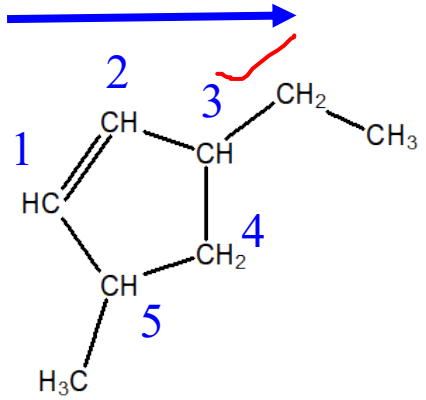
5. Cycloalkane: attached alkyl group contains equal or a lower number of carbons than the cycloalkane.
6. Alkane: attached alkyl group contains more number of carbons than the cycloalkane (Ring→Sub).
7. Alkane: If the side chain consists of a functional group/multiple bonds (Ring→Sub).
8. Cycloalkenes/ynes: 1,2 number to the multiple bond, path→substituent gets lower number possible.



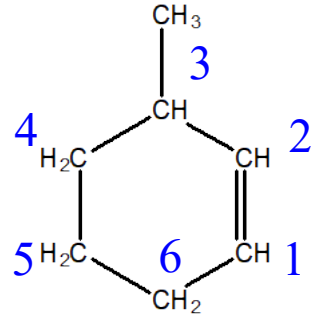
butylcyclohexane



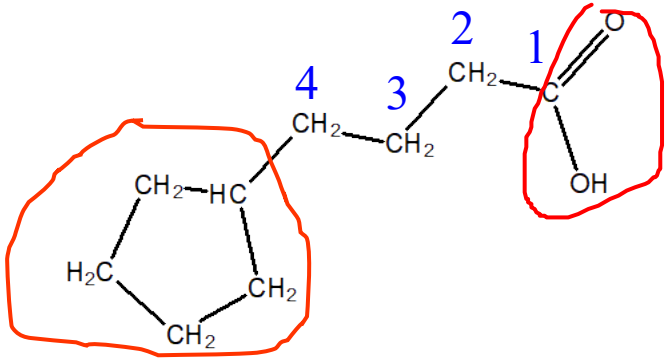
2-cyclopropylhexane



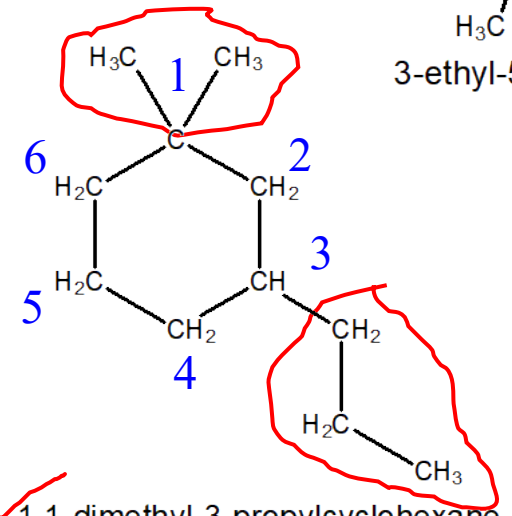
3-ethyl-5-methylcyclopent-1-ene



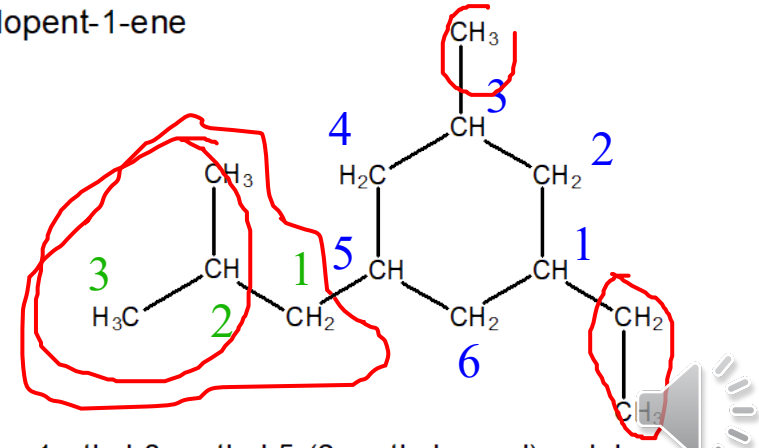
3-methylcyclohex-1-ene



4-cyclopentylbutanoic acid



1,1-dimethyl-3-propylcyclohexane

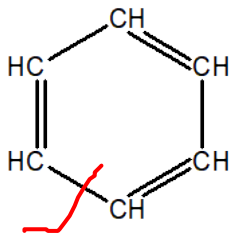


1-ethyl-3-methyl-5-(2-methylpropyl)cyclohexane

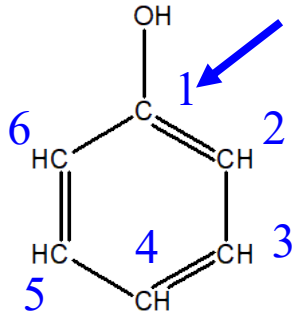
# 6. Benzene Aromatic Compounds

**Aromatic Benzenoid Compounds:**

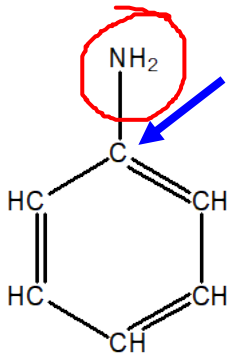
1. Base name is 'benzene' and "Sub+benzene".
2. Lowest number to the substituent and is a prefix to the 'benzene'.
3. If 2/more substituents: "lowest set of locant rule"
4. Assign numbers to substituents in alphabetical order.



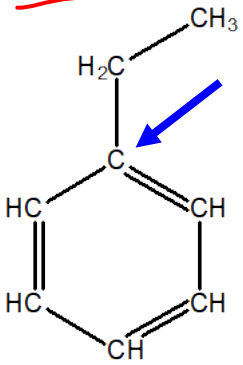
benzene



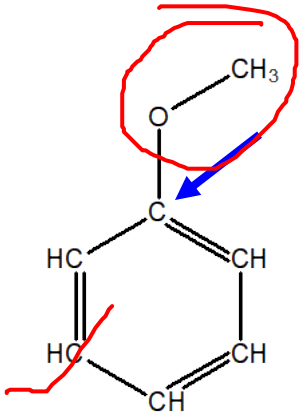
benzenol



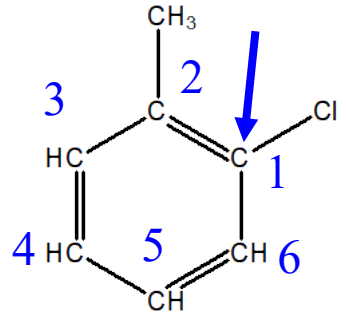
benzenamine



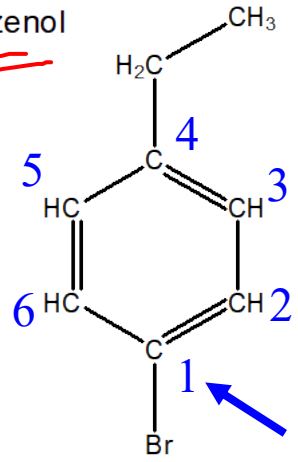
ethylbenzene



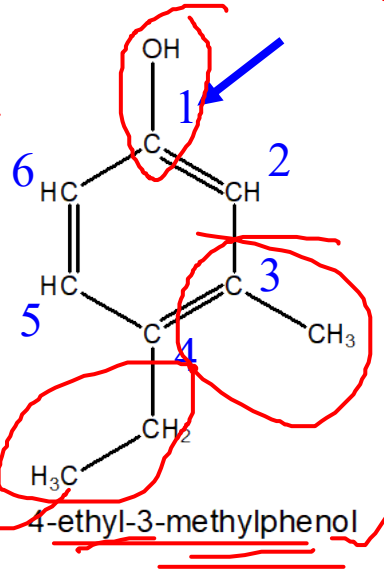
methoxybenzene



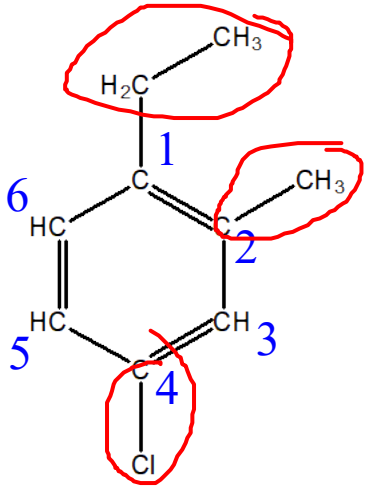
1-chloro-2-methylbenzene



1-bromo-4-ethylbenzene



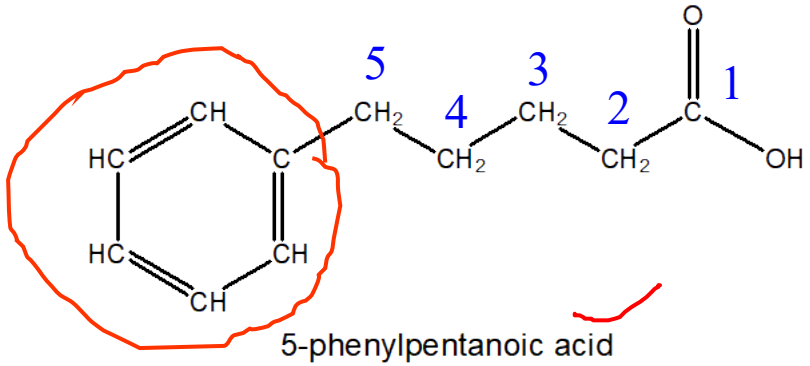
4-ethyl-3-methylphenol



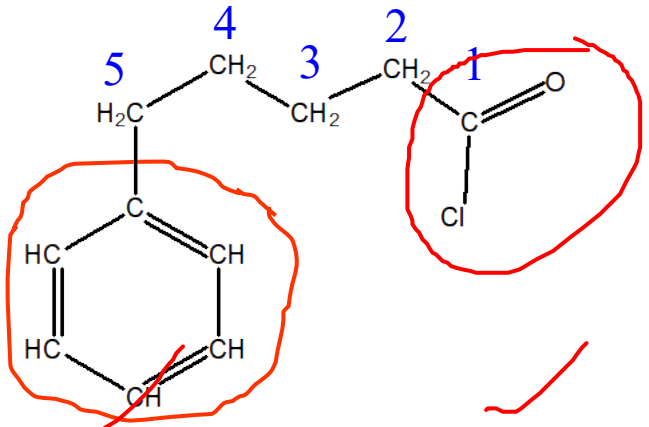
4-chloro-1-ethyl-2-methylbenzene

## Aromatic Benzenoid Compounds:

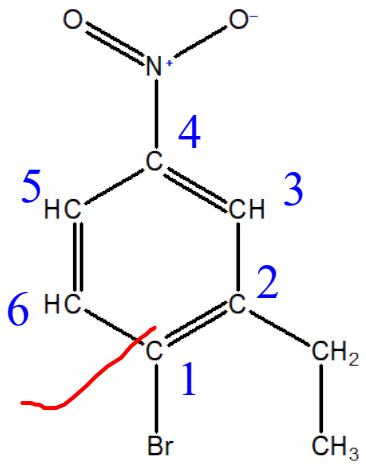
5. If FG is present in the branch, benzene becomes substituent (phenyl).
6. Subs/branches locants to be written same as in alphabetical order before.



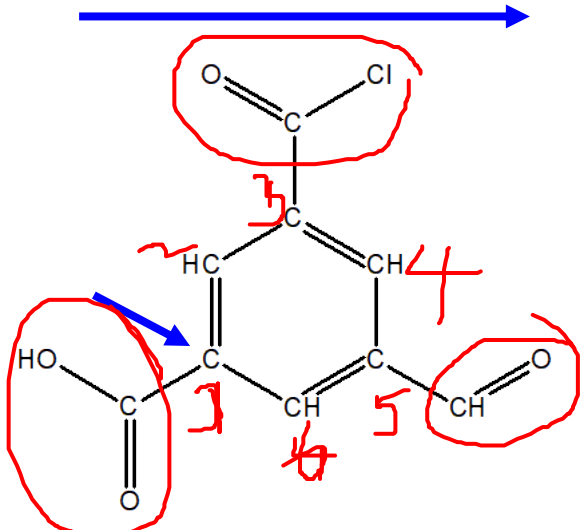
5-phenylpentanoic acid



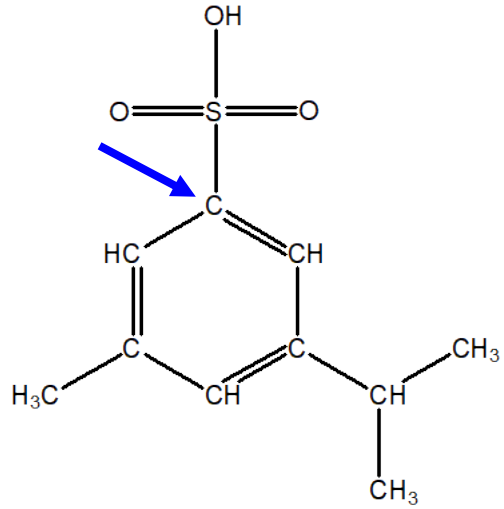
5-phenylpentanoyl chloride



1-bromo-2-ethyl-4-nitrobenzene



3-(chlorocarbonyl)-5-formylbenzoic acid



3-isopropyl-5-methylbenzene-1-sulfonic acid

# IUPAC Advanced Course: Review

## Molecules with Functional Groups:

1. Choose the longest carbon chain containing functional group (FG) as parent chain.
2. The functional group (FG) must get a lowest number possible (except –OH, -CO-, -$NH_2$).
3. If FG suffix starts with→(a,i,o,u,y), then remove "e" of ane/ene/yne: → → but-3-en-1-oicacid.
4. If a molecules contains more than one FG, one is chosen as principal FG and others as substituents.
5. Unbranched chain with 2/more same FG→ alkane-1,3,6-hexane tricarboxylic acid.
6. Branched chain with 2/more same FG: Parent chain includes 2FG and 1FG as substituent.
7. If substituent is oxygen derivative of $CH_3$/$CH_2$: its carbon is also becoming part of parent chain.

## Carbocyclic Compounds (Alicyclic):

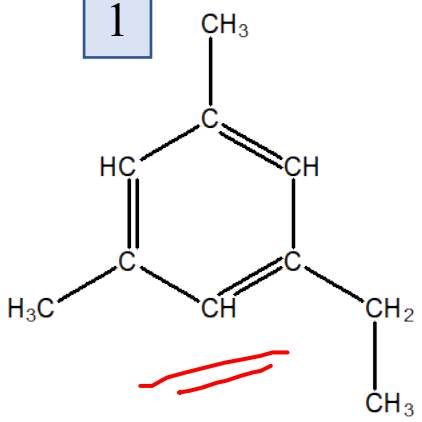
1. Add prefix "cyclo" before the equivalent alkane/alkene/alkyne chain.
2. Substituents numbering: priority to alphabetical order (ethyl>methyl)→ alkylcycloalkanes
3. C-Numbering: priority to carbon with more branched>carbon with less branches
4. Lowest set of locant rule
5. Cycloalkane: attached alkyl group contains equal or a lower number of carbons than the cycloalkane.
6. Linear Alkane: attached alkyl group contains more number of carbons than the cycloalkane (Ring→S).
7. Linear Alkane: If the side chain consists of a functional group/multiple bonds (Ring→S)
8. Cycloalkenes/ynes: 1,2 number to the multiple bond, substituent gets lower number possible.

## Aromatic Benzenoid Compounds:

1. Base name is 'benzene'
2. Lowest number to the substituent/FG and is a prefix to the 'benzene'.
3. If 2/more substituents: "lowest set of locant rule"
4. Assign numbers to substituents in alphabetical order.
5. If FG is present in the branch, benzene becomes substituent (phenyl).

# PRACTICE

1



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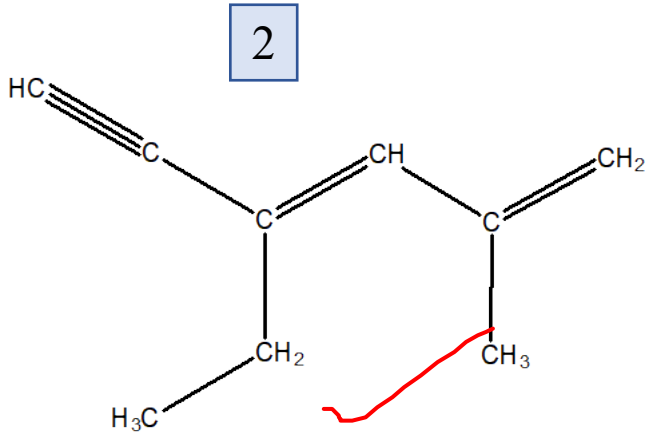

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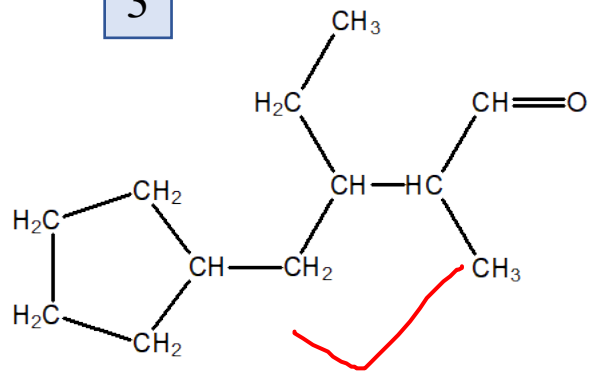

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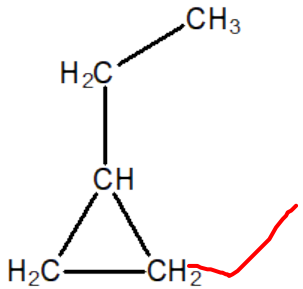

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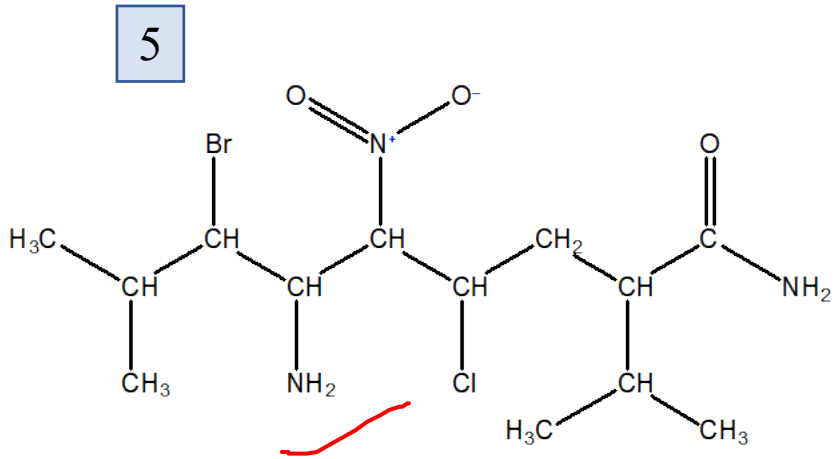

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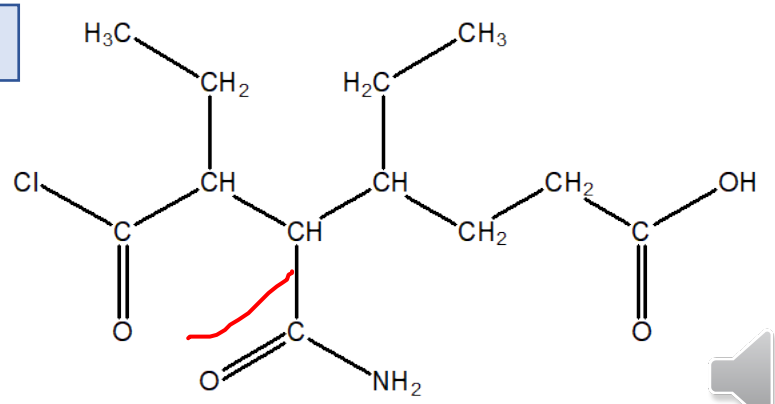
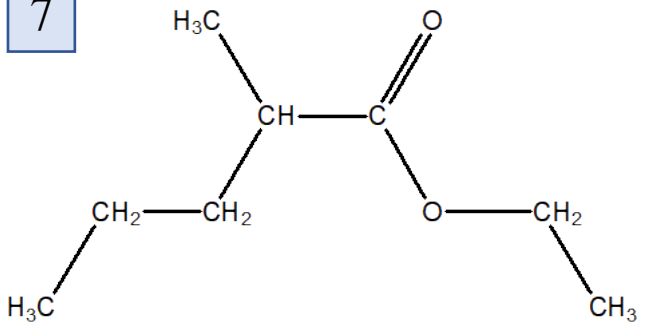


# PRACTICE

7



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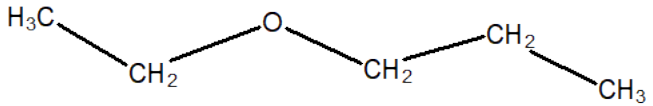

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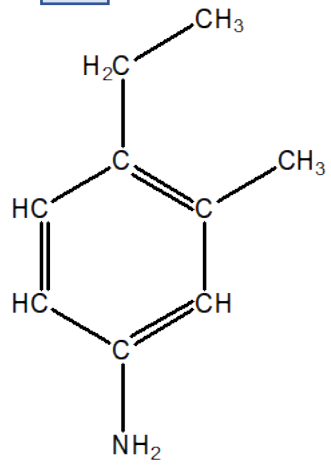

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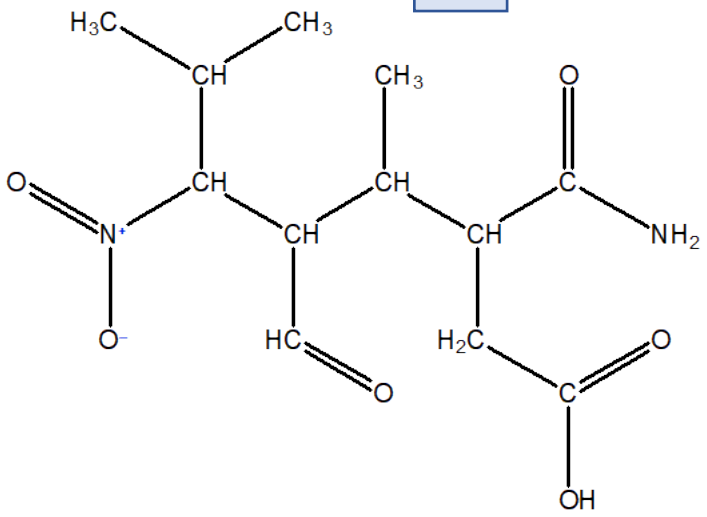

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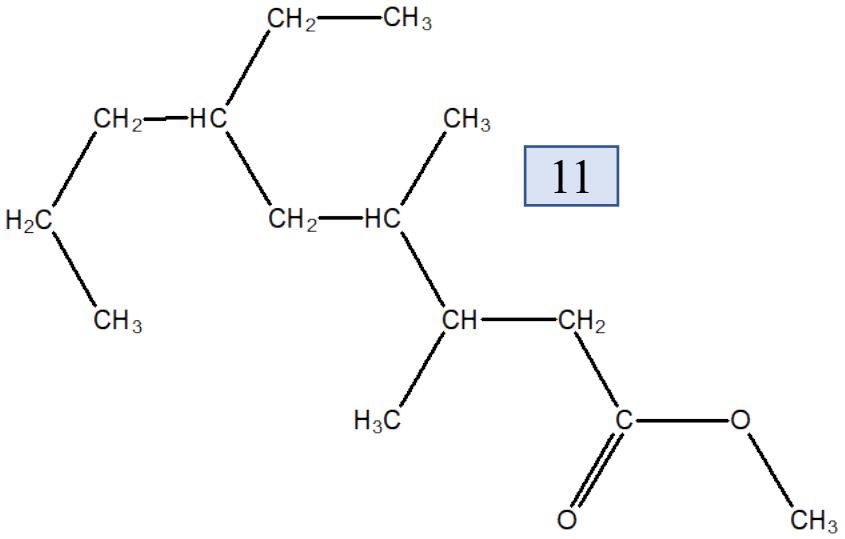

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