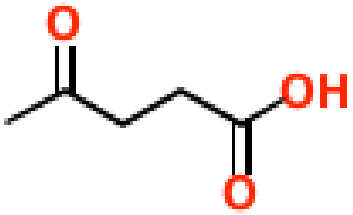
# Nomenclature of poly-functional group organic compounds

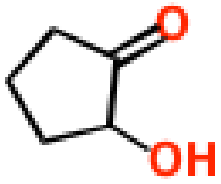
**A nomenclature dilemma: what do you do when there's MULTIPLE functional groups**

**Which suffix do we use?**




**ketone (-one)**
**or**
**carboxylic acid**
**(-oic acid) ?**


**alkyne (-yne)**
**or**
**alkyl halide**
**(-ide) ?**




**alcohol (-ol)**
**or**
**ketone (-one) ?**


**alkene (-ene)**
**or**
**alcohol (-ol) ?**

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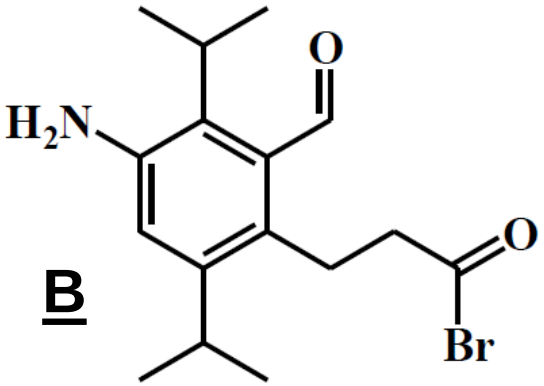
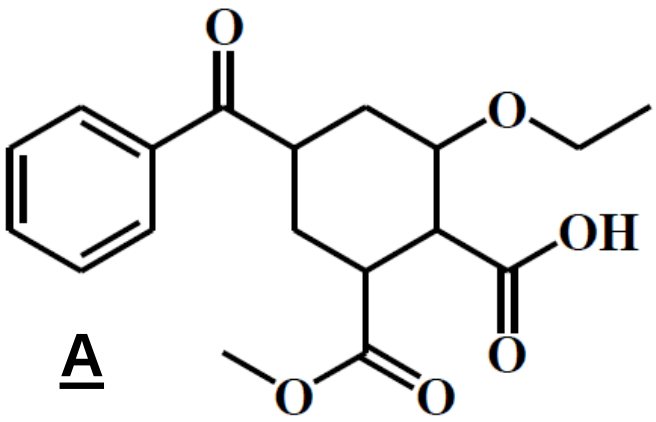
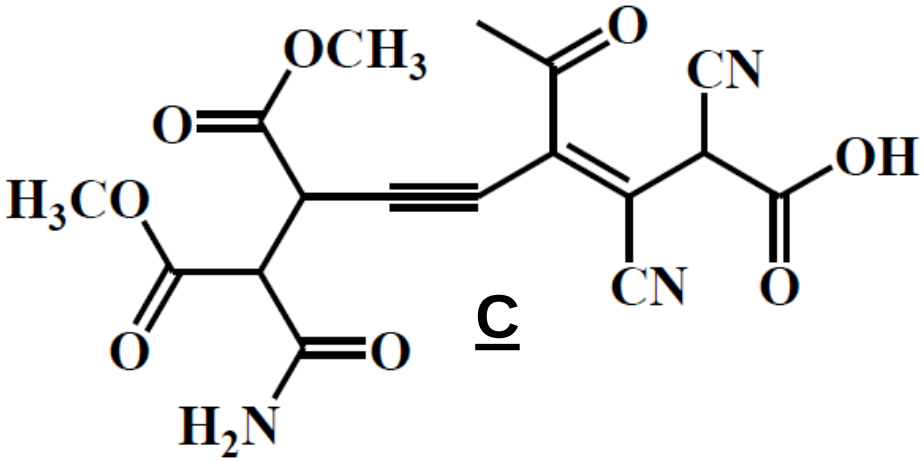

H2N
O
O
Br

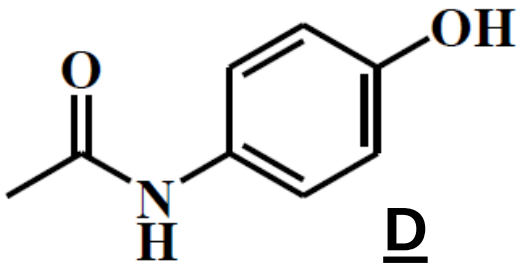
B


O
O
OH
O
O
O

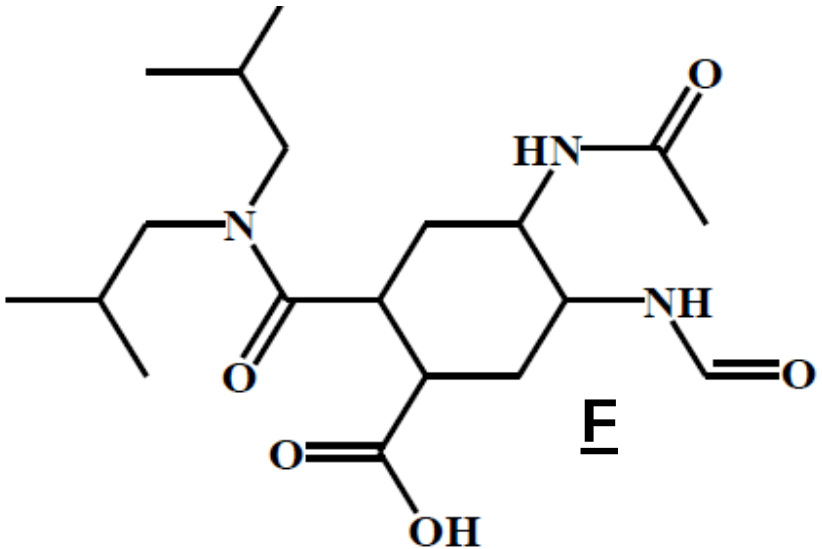
A


OCH3
O
O
CN
OH
H3CO
CN
O
O
O
H2N

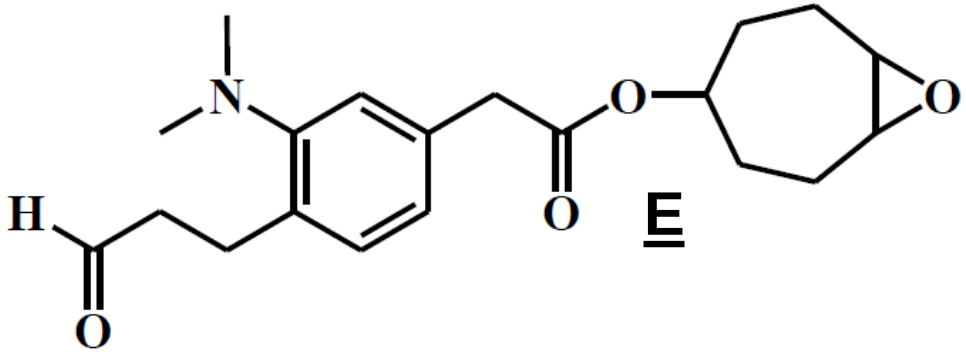
C


OH
O
N
H

D


HN
O
N
NH
O
O
O
OH

F


N
O
O
H
O

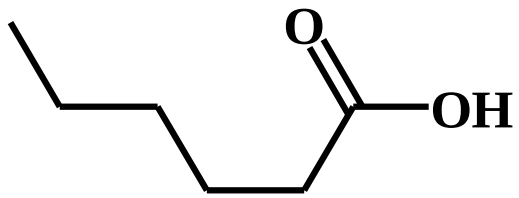
E

| Family | as Prefix | as Suffix |
|---|---|---|
| Carboxylic acid | carboxy- | -oic acid<br>-carboxylic acid |
| Acid anhydride | *alkanoyl*oxycarbonyl- | -oic anhydride<br>-carboxylic anhydride |
| Ester | *alk*oxycarbonyl- | *alk*yl -oate<br>*alk*yl -carboxylate |
| Acid halide | *halo*carbonyl- | -oyl *hal*ide<br>-carbonyl *hal*ide |
| Amide | carbamoyl- | -amide<br>-carboxamide |
| Nitrile | cyano- | -nitrile<br>-carbonitrile |
| Aldehyde | oxo-<br>formyl-<br>methanoyl- | -al<br>-carbaldehyde |
| Ketone | oxo-<br>*alkan*oyl- | -one |

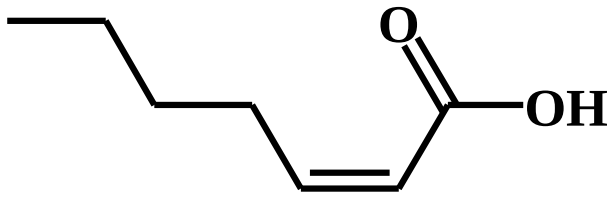
# 1] Carboxylic acid

## Case (I) Suffix "1“

**If the carbon of carboxyl group is being inclusive in the longest chain "main chain" numbering, then the letter e in alkane chain is replaced by oic acid**

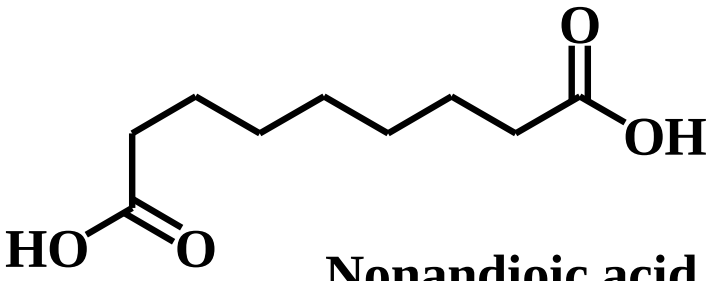



**Hexanoic acid**




**(*Z*)2-Heptenoic acid**

**How to name compound with two carboxy groups?**
**If the compound has two carboxylic groups then it is known as dioic acid and named as…dioic acid through replacing the letter e by dioic acid**




**Nonandioic acid**

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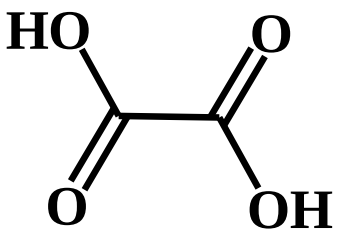
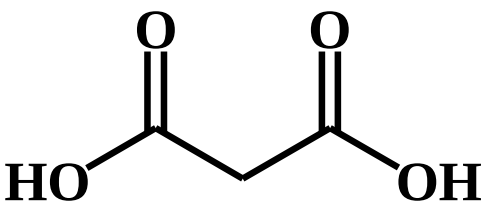
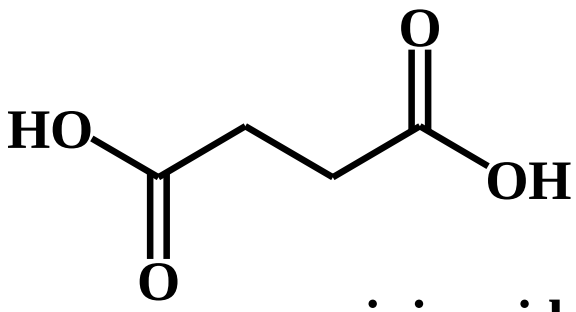
**Some common di carboxylic acids**



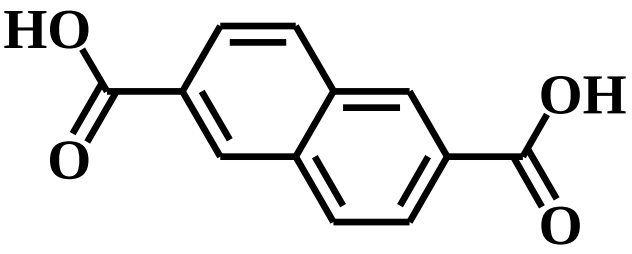

**Oxalic acid**
**"Ethandioic acid"**



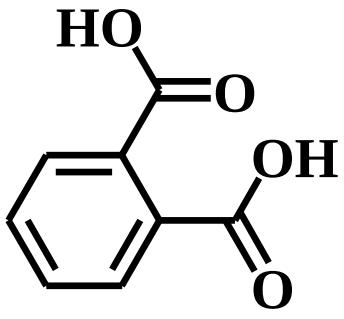

**malonic acid**
**"propandioic acid"**




**succinic acid**
**"butandioic acid"**




**2,6-Naphthalenedicarboxylic acid**

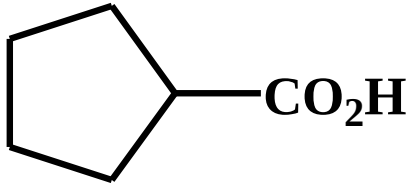



**Phthalic acid**

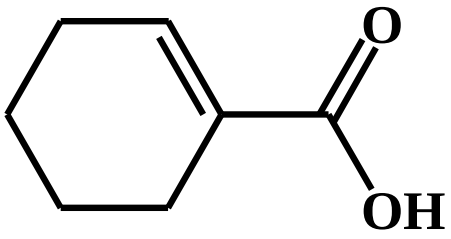
# Case (II) Suffix "2“

**If the carbon of the carboxyl group is not counted but still having the most priority, then it is named as cyclic system followed by carboxylic acid**

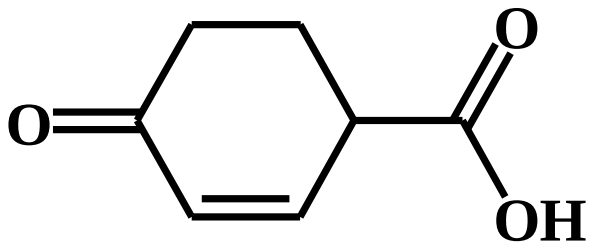
**Examples:-**



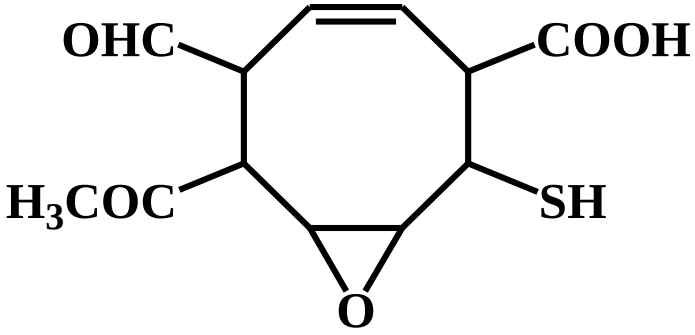

**cyclopentanecarboxylic acid**



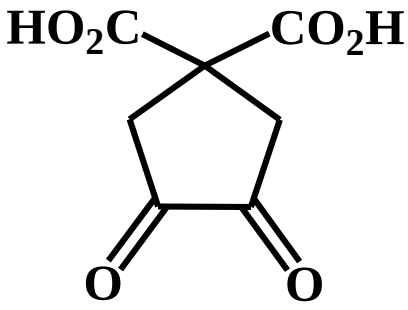

**1-cyclohexenecarboxylic acid**




**(Z)-4- Oxo-2- cyclohexenecarboxylic acid**

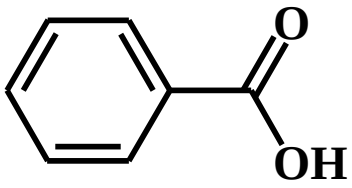



**(*Z*)-5-Acetyl-3,4-epoxy-6-formyl-2-mercapto-7-cyclooctenecarboxylic acid**

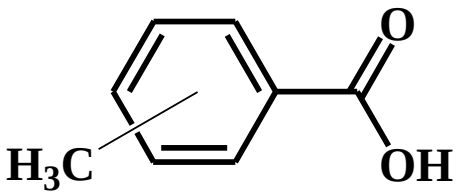



**3,4-dioxocyclopentane-1,1-dicarboxylic acid**

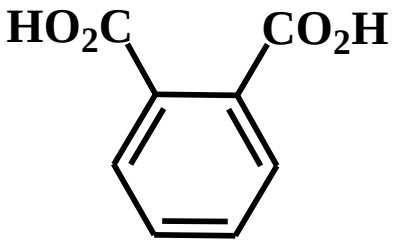
## Examples for some common carboxylic acids



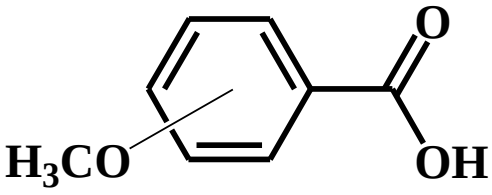

benzoic acid



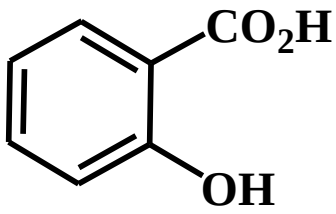

Toluic acid




o-phthalic acid




Anisic acid




Salicylic acid



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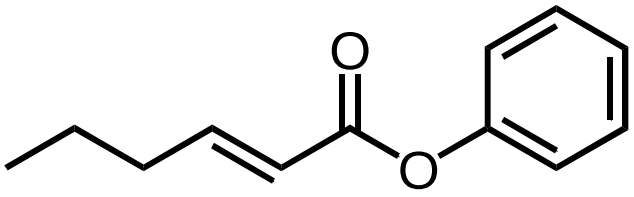
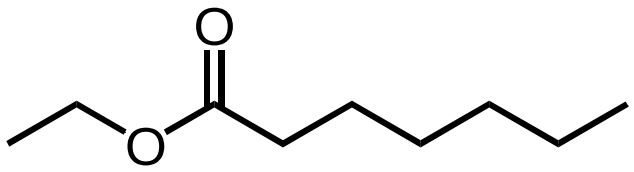
# 2] Ester

## Case (I) Suffix "1"

**If the carbon of carboxyl group is being inclusive in the longest chain "main chain" numbering, then the letter e in alkane chain is replaced by oate (N.B:- the group that is attached to oxygen atom forming the ester must come first before all substituents)**




(E) Phenyl-2-hexenoate




Ethyl heptanoate

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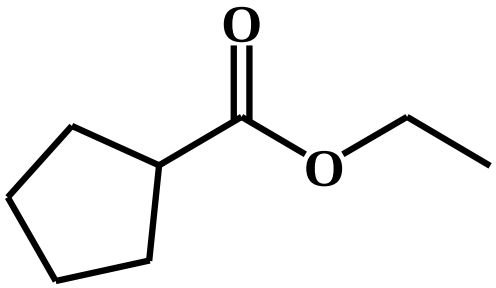
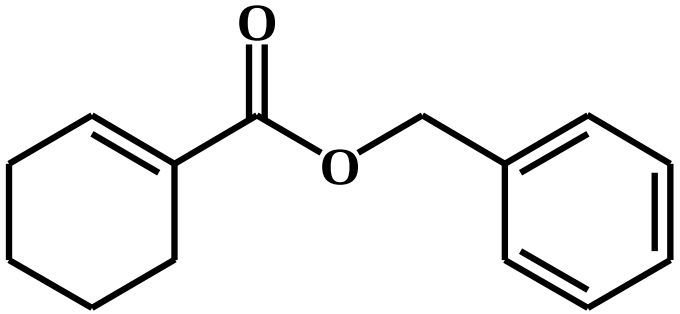
# Case (II) Suffix "2“

**If the carbon of the carboxy ester group is not counted but still having the most priority, then it is named as Name of cyclic system followed by carboxylate.**

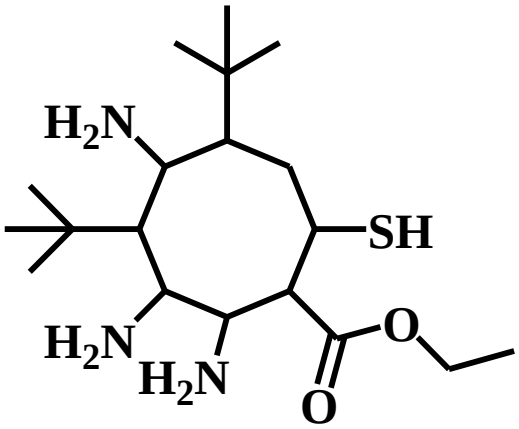
**Examples:-**




**Ethyl cyclopentanecarboxylate**




**Benzyl-1-cyclohexnecarboxylate**




**Ethyl 2,3,5-triamino-4,6-di-*tert*-butyl-8-mercaptocyclooctanecarboxylate**

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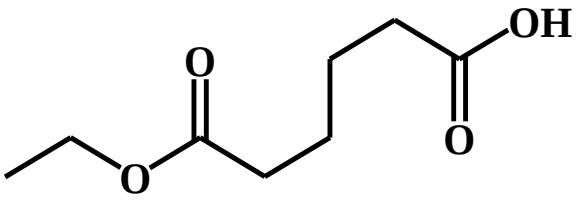
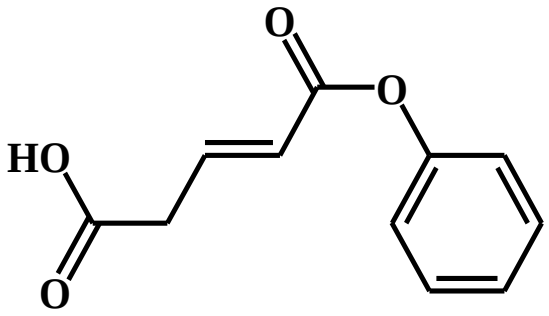
# Case III "Prefix“

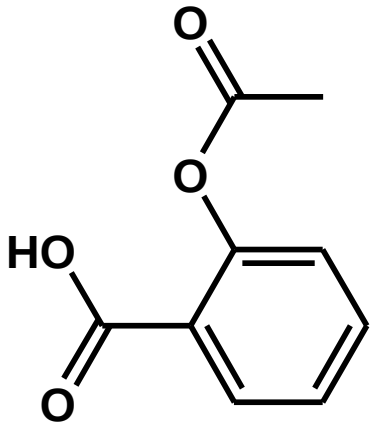
**If there is a functional group which has more priority than the ester; that means the ester is substituent. In this case the ester is named as alkoxycarbonyl or aroxycarbonyl taking into your account that the carbon of carboxylate is not inclusive in numbering the longest chain.**




**5-Ethoxycarbonylpentanoic acid**




**(*E*)-4-Phenoxycarbonyl-3-butenoic acid**




**Aspirin**
**Or**
**2-Acetoxybenzoic acid**
**Or**
**O-Acetyl salicylic acid**

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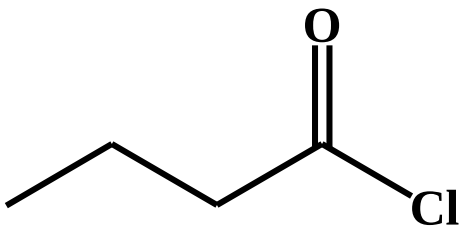
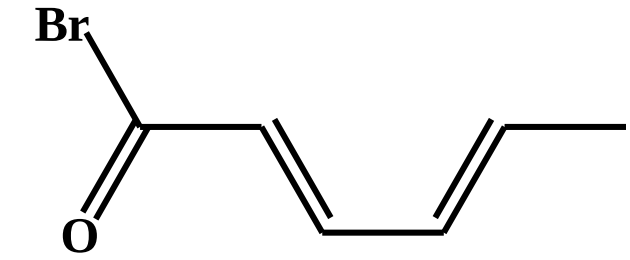
# 3] Acid Halide

## Case (I) Suffix "1"

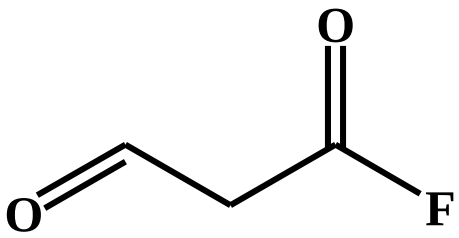
If the carbon of carbonyl group is being inclusive in the longest chain "main chain" numbering, then the letter e in
alkane chain is replaced by oyl halide.




**Butanoyl chloride**




**(2*E*,4*E*)--2,4-Hexadienoyl bromide**




**3-oxopropanoyl fluoride**

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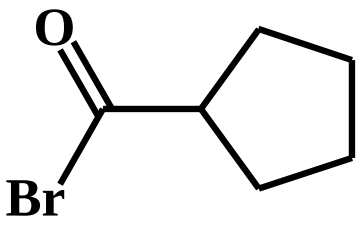
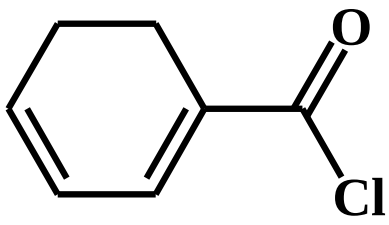
# Case (II) Suffix "2“

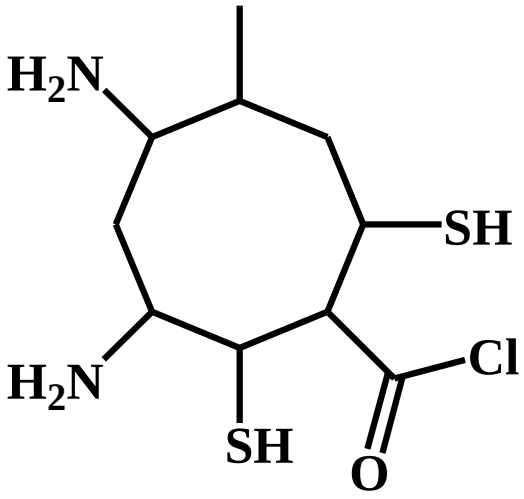
**If the carbon of the carbonyl halide group is not counted but still having the most priority, then it is named as Name of cyclic system followed by carbonylhalide**
**Examples:-**




**Cyclopentanecarbonyl bromide**



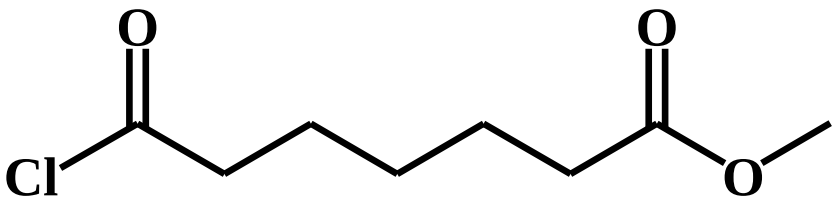

**1,3-Cyclohexadienecarbonyl chloride**



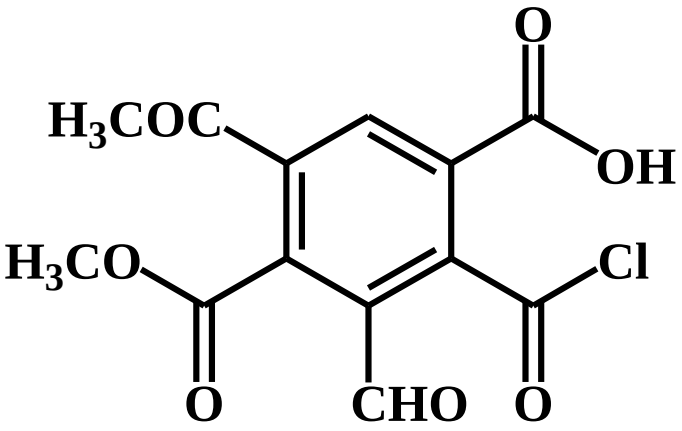

**3,5-diamino-2,8-dimercapto-6-methylcyclooctanecarbonyl chloride**

# Case III "Prefix“

**If there is a functional group which has more priority than the acid halid; that means the acid halide is a substituent. In this case the acid halide is named as halo carbonyl taking into your account that the carbon of carbonyl halide is not inclusive in numbering the longest chain.**




**Methyl 6-chlorocarbonylhexanoate**




**5-Acetyl-2-Chlorocarbonyl-3-formyl-4-methoxycarbonyl-benzoic acid**

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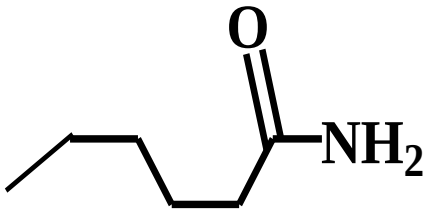
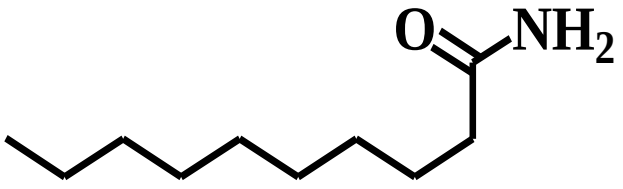
# 4-Amides

## Case (I) Suffix "1“

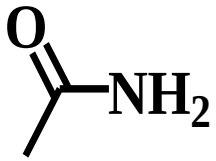
**If the carbon of amido group is being inclusive in the longest chain "main chain" numbering, then the letter e in alkane chain is replaced by amide.**




**hexanamide**

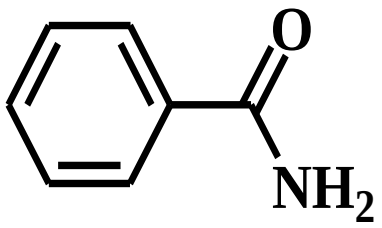



**decanamide**




**Aetamide**

**Or Ethanamide**




**Benzamide**

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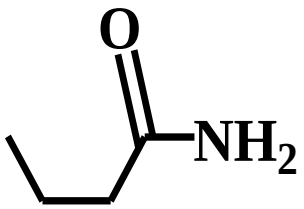
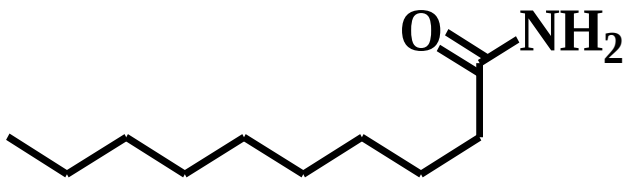
# Primary amides

**are named by changing the name of the acid by dropping the -oic acid endings and adding –amide ( or e is replaced by amide). The carbonyl carbon is given the #1 location number. It is not necessary to include the location number in the name because it is assumed that the functional group will be on the end of the parent chain.**




**Butanamide**




**decanamide**

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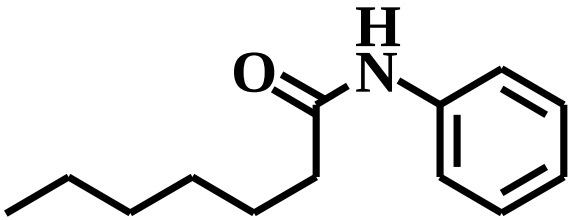
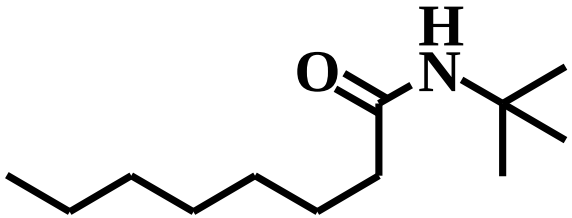
## Secondary amides

**are named by using an upper case N to designate that the alkyl group is on the nitrogen atom. Alkyl groups attached to the nitrogen are named as substituents. The letter N is used to indicate they are attached to the nitrogen.**



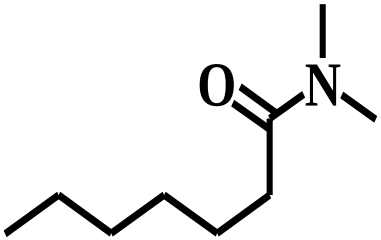

*N*-Phenylheptanamide



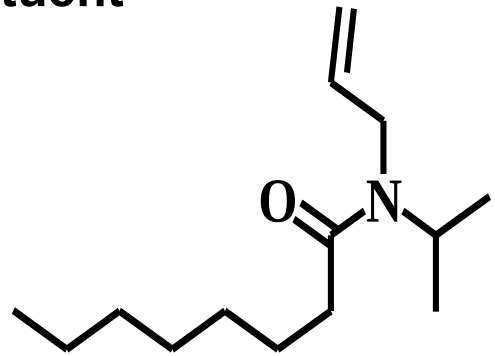

*N*-Tertbutyloctanamide

## Tertiary amides

**are named in the same way as secondary amides, but with two N's or *N,N*-Di…….if N is bonded to similar group or substituent**




*N,N*-dimethylheptanamide

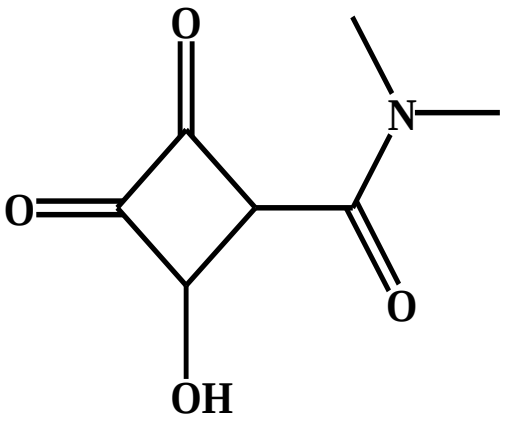



*N*-Allyl-*N*-isopropyloctanamide

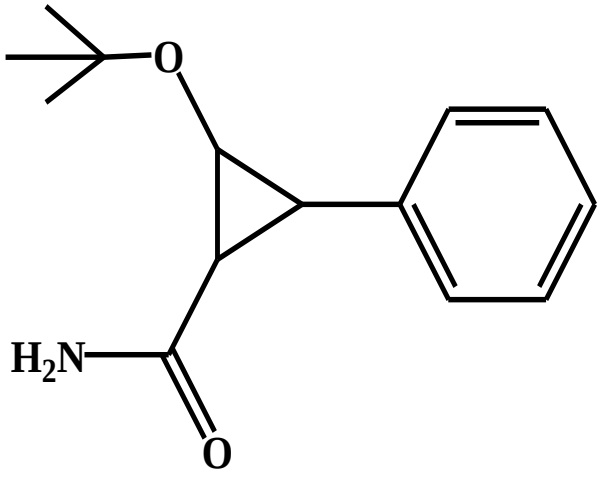
# Case (II) Suffix "2“

**If the carbon of the amido group is not counted but still having the most priority, then it is named as Name of cyclic system followed by carboxamide.**

**Examples:-**



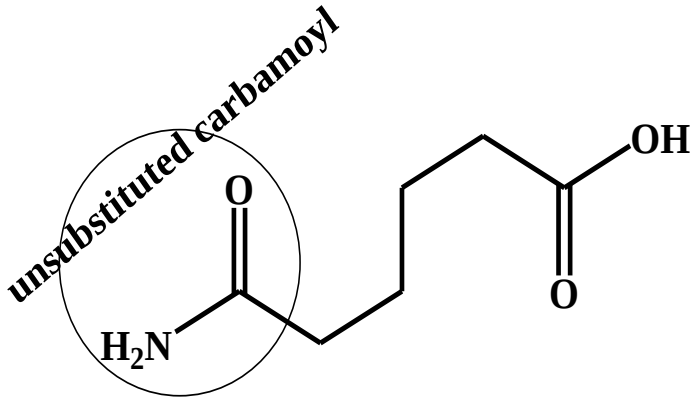

**2-Hydroxy--3,4-dioxo *N,N*-dimethylcyclobutanecarboxamide**



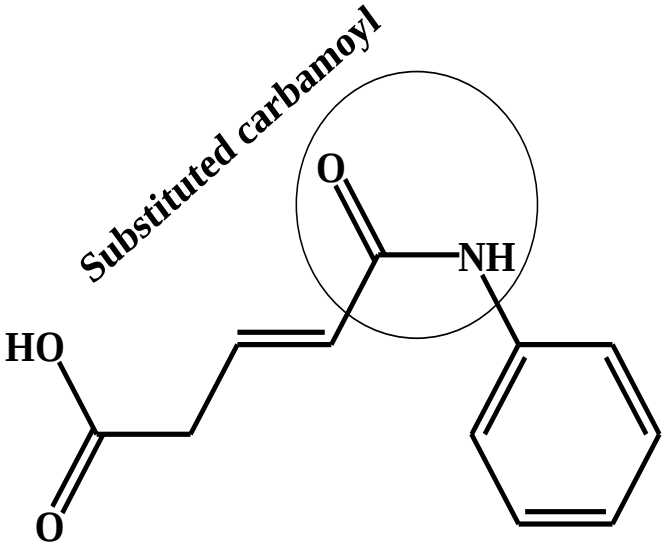

**2-*Tert*-butoxy-3-phenylcyclopropane carboxamide**

# Case III "Prefix“

**If there is a functional group which has more priority than the amide; that means the amide is substituent and the carbonyl of amide is directly bonded to the main longest chain; in this case it is named as carbamoyl.**

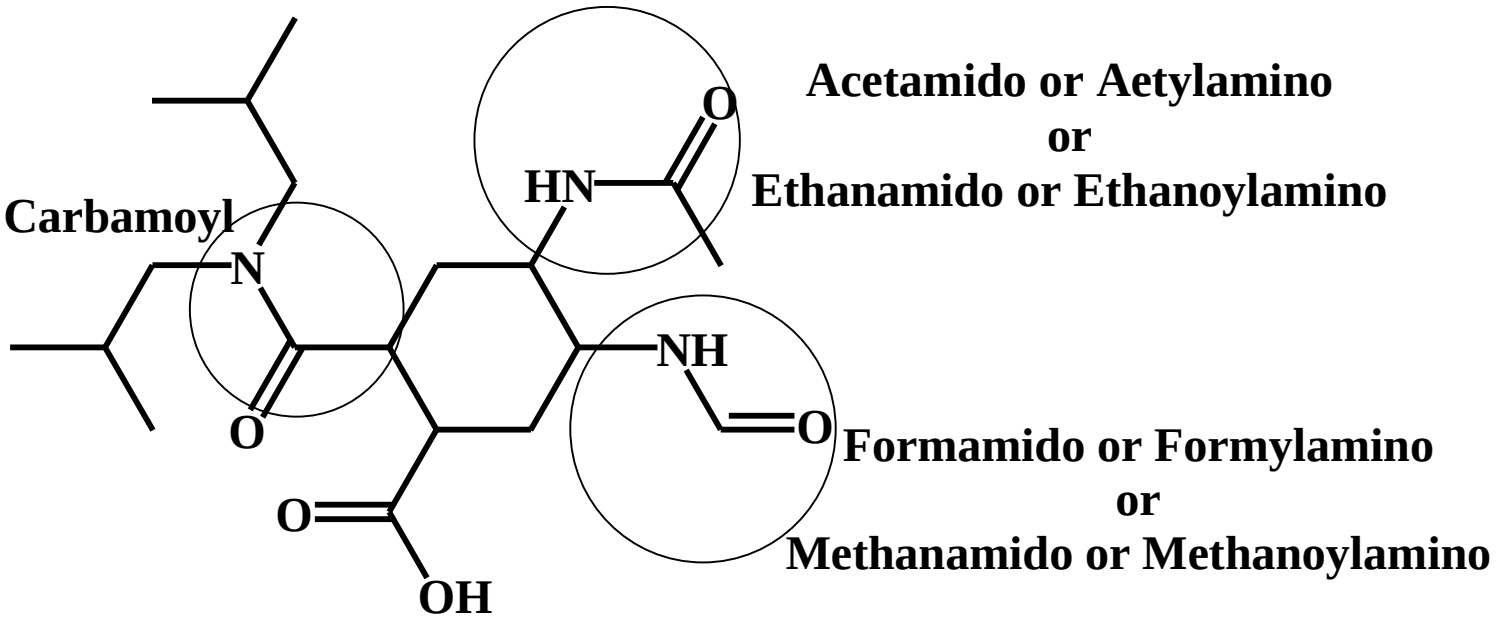



**5-Carbmoylpentanoic acid**




**(E)4-Phenylcarbamoyl-but-3-enoic acid**

**While if the amide group is bonded to the main chain by nitrogen atom; then it is named as alkanoylamino or alkanamido.**




**4-Acetylamino-2-diisobutylcarbamoyl-5-formylamino-cyclohexanecarboxylic acid**

**OR**

**4-Acetamido-2-diisobutylcarbamoyl-5-formamido-cyclohexanecarboxylic acid**

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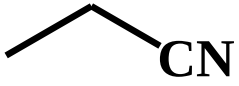
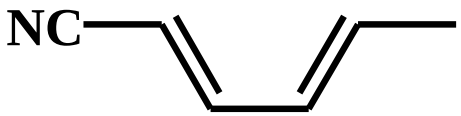
# 5] Nitrile

## Case (I) Suffix "1“

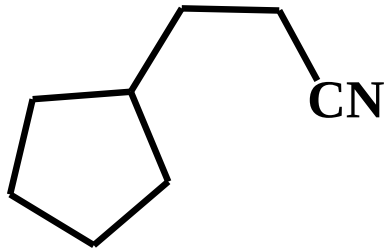
**If the carbon of nitrile group is being inclusive in the longest chain "main chain" numbering, then after the alkane just add the word nitrile (alkane nitrile)**




**Propanenitrile**




**(2*E*,4*E*)--2,4-Hexadienenitrile**

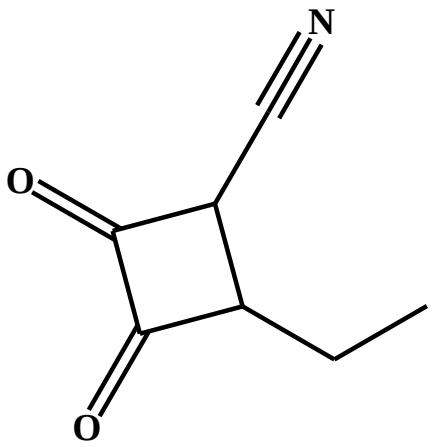



**3-cyclopentylpropanenitrile**

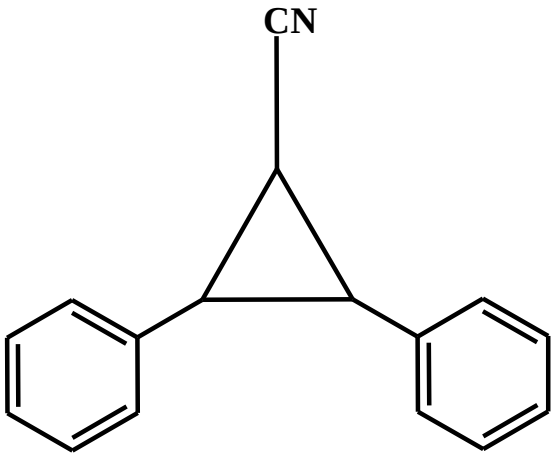
# Case (II) Suffix "2“

**If the carbon of the nitrile group is not counted but still having the most priority, then it is named as Name of cyclic system followed by carbonitrile**

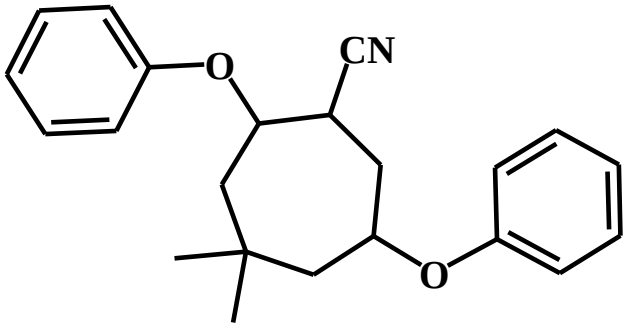
**Examples**:-




**2-Ethyl-3,4-dioxocyclobutanecarbonitrile**



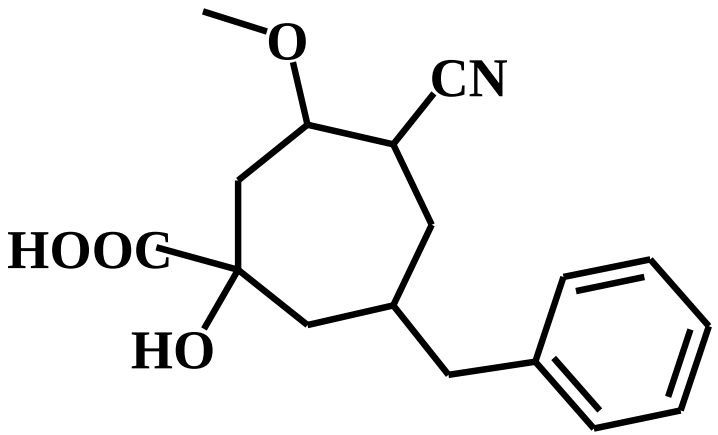

**2,3-Diphenylcyclo propanecarbonitrile**




**4,4-Dimethyl-2,6-diphenoxycycloheptanecarbonitrile**

**Case III "Prefix"**

**If there is a functional group which has more priority than the nitrile; that means the nitrile is substituent. In this case the nitrile is named as cyano taking into your account that the carbon of CN group is not inclusive in numbering the longest chain.**




**6-Benzyl-4-cyano-1-hydroxy-3- methoxycycloheptanecarboxylic acid**

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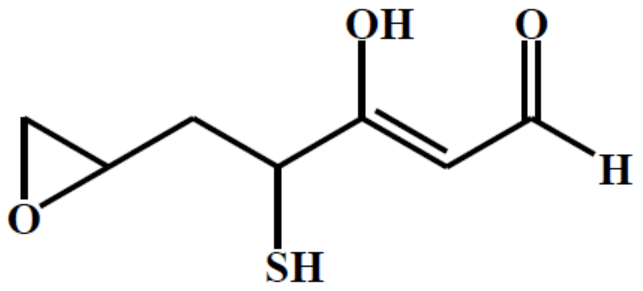
# 6-Aldehydes

## Case (I) Suffix "1“

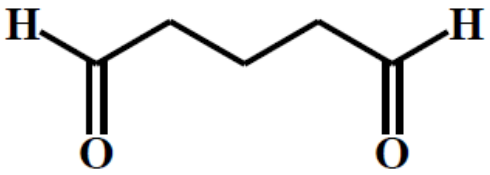
**If the carbon of carbonyl group is being inclusive in the longest chain, then , then the letter "e" of alkane chain is replaced by al. Example;**



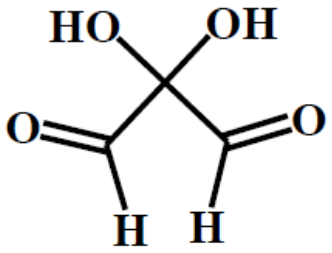

6,7-Epoxy-3-hydroxy-4- mercapto-2- heptenal

**Note:-If there are two aldehyde groups in the compound; then it is Known as dial.**

**Examples;**



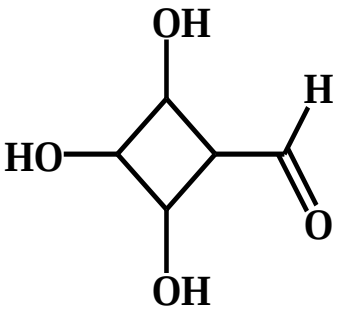

Pentandial



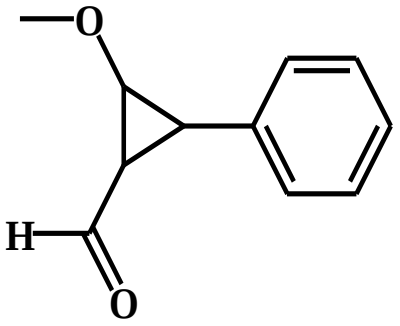

2,2-DihydroxyPropandial

# Case (II) Suffix”

**If the carbon of the carbaldehyde group is not counted but still having the most priority, then it is named as Name of cyclic system followed by the word carbaldehyde. Examples;**




**2,3,4-Trihydroxy cyclobutane carbaldehyde**




**2-Methoxy-3-phenylcyclopropane carbaldehyde**

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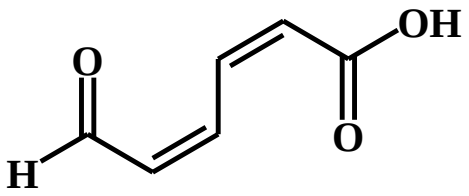
# Case III “Prefix”

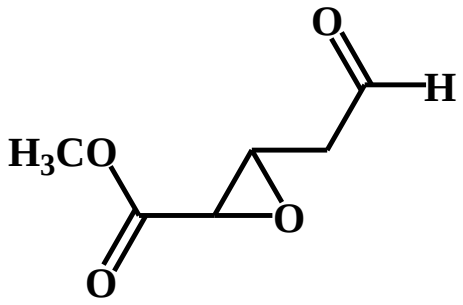
**If there is a functional group which has more priority than the aldehyde; that means the aldehyde is a substituent. In this case, the aldehyde is named as:-**

## 1] Oxo :-

**taking into your account that the carbon of carbaldehyde is counted and being inclusive in numbering of the longest chain.**




**(2Z,4Z)6-Oxo-2,4-hexadienoic acid**




**Methyl-2,3-epoxy-5-oxopentanoate**

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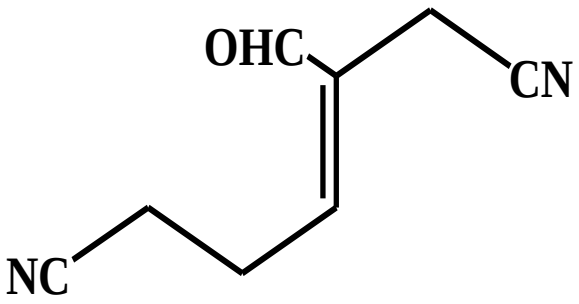
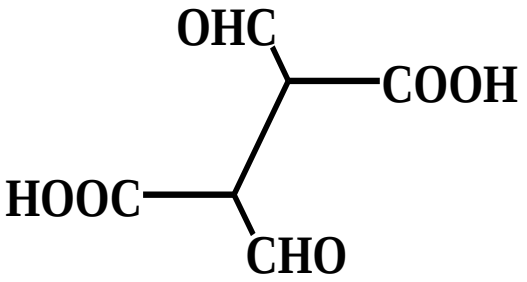
## 2- Formyl (CHO)

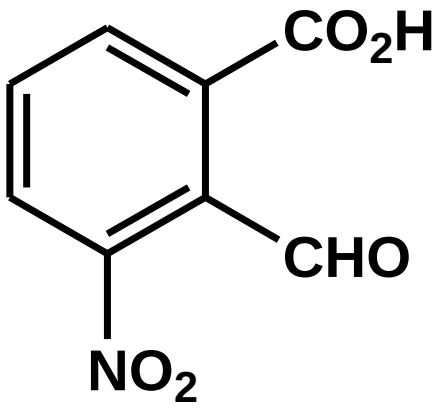
**taking into your account that the carbon of carbaldehyde is not counted and being exclusive in numbering of the longest chain.**




(3Z)3-Formyl-3-heptenedinitrile



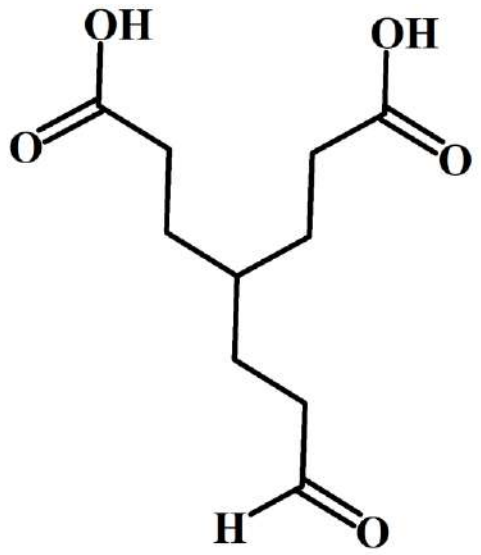

**2,3-Diformylbutandioic acid**



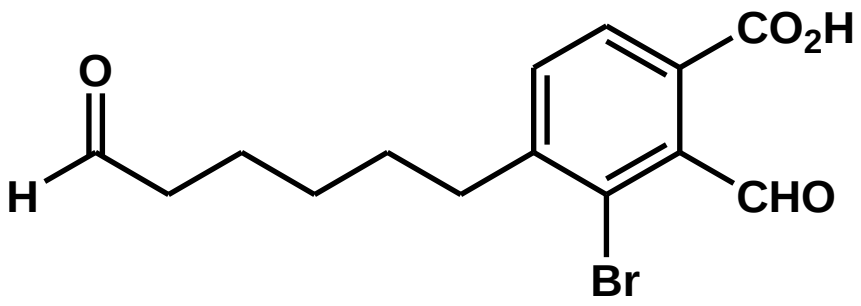

**2-Formyl-3-nitro-benzoic acid**

# 3- Oxoalkyl

**taking into your account that the carbon of carbaldehyde is not counted and being exclusive in numbering of the side chain. Examples;**




**4-(3-Oxo-propyl)-heptanedioic acid**




**3-Bromo-2-formyl-4-(6-oxo-hexyl)-benzoic acid**

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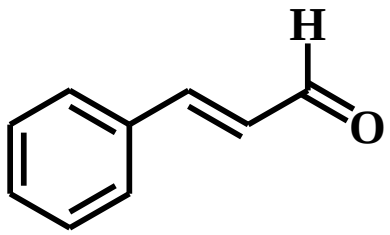
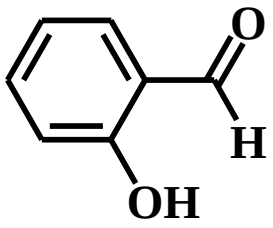
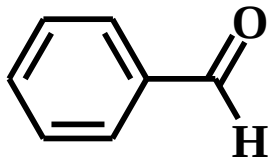
# Some well-known aldehydes



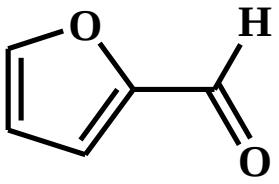

Cinnamaldehyde



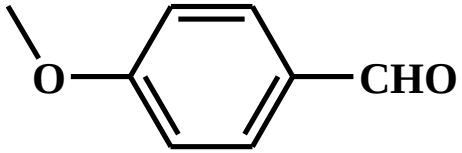

Salicylaldehyde



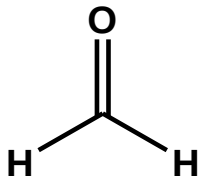

Benzaldehyde



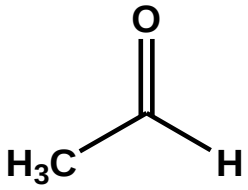

Furfural




Anisaldehyde




Formaldehyde

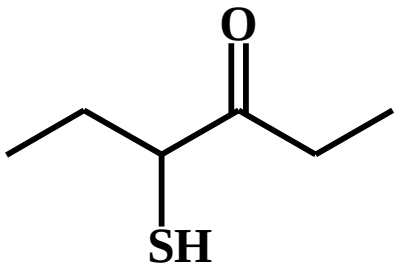



Acetaldehyde

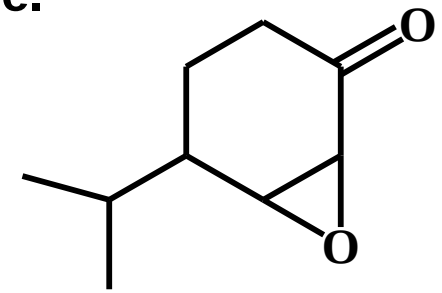
# 7] Ketone

## Case (I) Suffix "1"

**If the carbon of carbonyl group is being inclusive in the longest chain, then the letter "e" of alkane chain is replaced by one.**



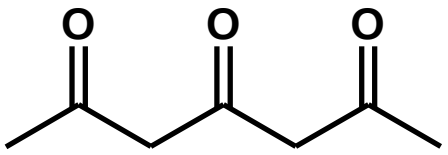

**4-Mercapto-3- hexanone**



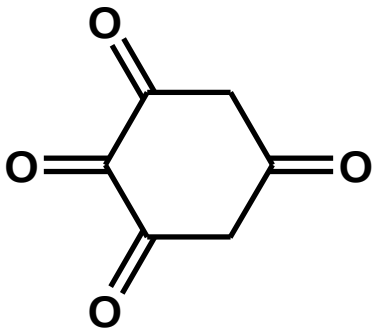

**2.3-Epoxy-4-isopropylcyclohexanone**

**Note:-If are two ketone groups in the compound; then it is Known as dione, then use the prefix; trione, tetraone, pentaone…..etc.**

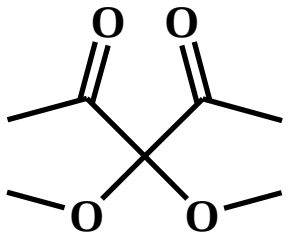
**Examples :-**




**2,4,6-Heptantrione**




**1,2,3,5-Cyclohexantetraone**

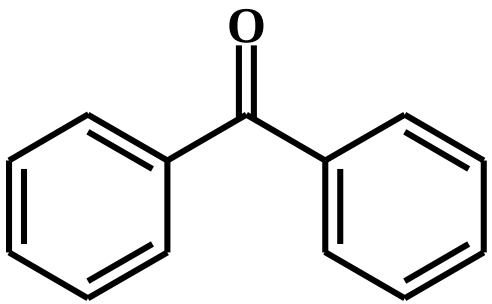



**3,3-Dimethoxy-2,4-pentandione**

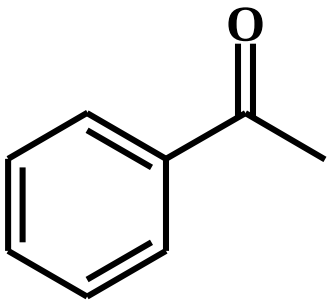
## Case (II) Suffix "2"

**If the ketone has the priority and not counted as a chain; it is named as the case of ether (alkylalkyl ketone or aryl aryl ketone or alkyl aryl ketone) looks like ether naming.**

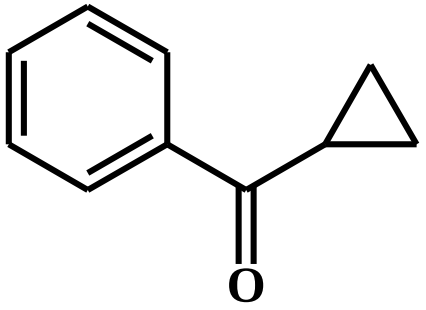
**Examples:-**



**Diphenyl ketone "Benzophenone"**



**Methylphenyl ketone "Acetophenone"**



**Cyclopropylphenyl ketone**

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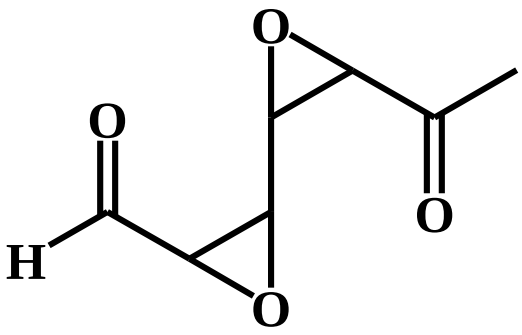
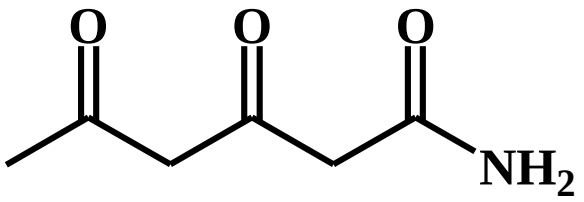
# Case III "Prefix“

**If there is a functional group which has more priority than the ketone; that means the ketone is a substituent. In this case the ketone is named as :-**

**1] Oxo taking into your account that the carbon of carbonyl is counted and being inclusive in numbering of the longest chain.**




**2,3,4,5-Diepoxy-6-oxoheptanal**




**3,5-Dioxo hexanamide**

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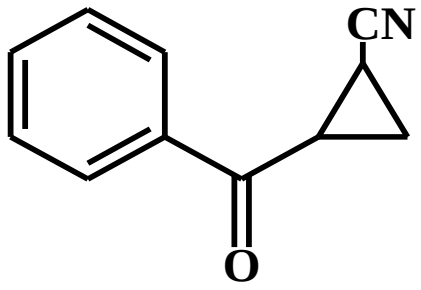
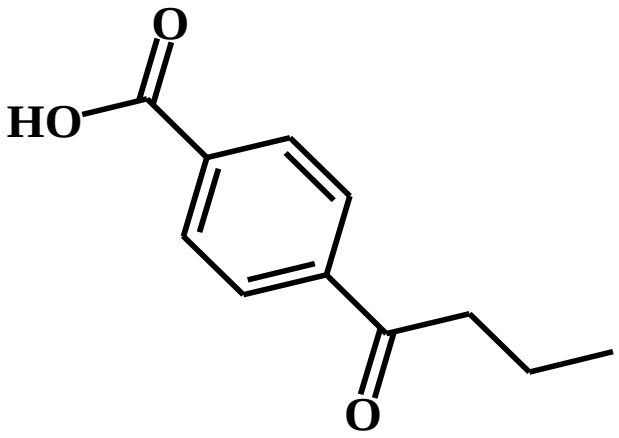
# 2] Alkanoyl or aroyl

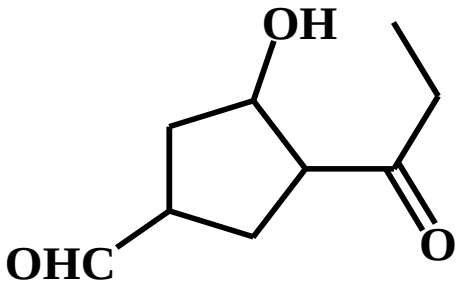
**taking into your account that the carbon of ketone is not counted and being exclusive in numbering of the longest chain.**




**2-Benzoylcyclopropanecarbonitrile**




**4-Butanoylbenzoic acid**




**3-Hydroxy-4-propanoyl cyclopentanecarbaldehyde**

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# Common Names of Carboxylic Acids

**formic acid**
*'ant'* in Latin
methanoic acid


**acetic acid**
*'vinegar'* in Latin
ethanoic acid


**propionic acid**
*'first fat'* in Greek
propanoic acid

**butyric acid**
*'butter'* in Greek
butanoic acid

**valeric acid**
*'valerian'* in English
pentanoic acid

**caproic acid**
*'goat'* in Latin
hexanoic acid

**enanthic acid**
*'blossom'* in Greek
heptanoic acid

**caprylic acid**
*'goat'* in Latin
octanoic acid

**pelargonic acid**
*'geranium'* in Greek
nonanoic acid

**capric acid**
*'goat'* in Latin
decanoic acid

**11**

**undecylic acid**
*'11'* from Greek
undecanoic acid

**lauric acid**
*'laurel'* in Latin
dodecanoic acid

**13**

**tridecylic acid**
*'13'* from Greek
tridecanoic acid

**myristic acid**
*'nutmeg'* in Latin
tetradecanonic acid

**15**

**pentadecylic acid**
*'15'* from Greek
pentadecanoic acid

**palmitic acid**
*'palm trees'* in English
hexadecanoic acid

**margaric acid**
*'pearl oyster'* in Greek
heptadecanoic acid


**stearic acid**
*'tallow'* in Greek
octadecanoic acid

**19**

**nonadecylic acid**
*'19'* from Greek
nonadecanoic acid

**arachidic acid**
*'peanuts'* in Latin
eicosanoic acid

**21**

**heneicosanoic acid**
*'21'* from Greek
heneicosanoic acid


**behenic acid**
*'11th month'* in Persian
docosanoic acid

**23**

**tricosylic acid**
*'23'* from Greek
tricosanoic acid


**lignoceric acid**
*'wood wax'* in Latin
tetracosanoic acid

**25**

**pentacosylic acid**
*'25'* from Greek
pentacosanoic acid

**cerotic acid**
*'wax'* in Greek & Latin
hexacosanoic acid

**27**

**heptacosylic acid**
*'27'* from Greek
heptacosanoic acid

**montanic acid**
*'mountain'* in Latin
octacosanoic acid

**29**

**nonacosylic acid**
*'29'* from Greek
nonacosanoic acid

**melissic acid**
*'bee'* in Greek
triacontanoic acid

**31**

**henatriacontylic acid**
*'31'* from Greek
henatriacontanoic acid

**?**

**lacceroic acid**
*(origin unknown)*
dotriacontanoic acid

**psyllic acid**
*'fleawort'* in Greek
tritriacontanoic acid

**?**

**gheddic acid**
*(origin unknown)*
tetratriacontanoic acid

**ceroplastic acid**
*'modelling wax' in Greek*
pentatriacontanoic acid

**36**

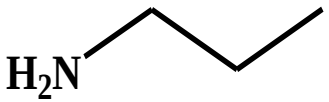
**hexatriacontylic acid**
*'36'* from Greek
hexatriacontanoic acid

# 8] Amine

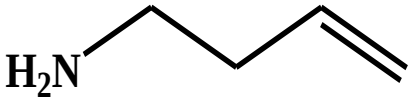
## Case (I) Suffix "1“

**Amines are named as alkanamines or alkylamine. The –e in the alkane name of the longest chain is changed to –amine or it can be named as alkyl or arylamine.**

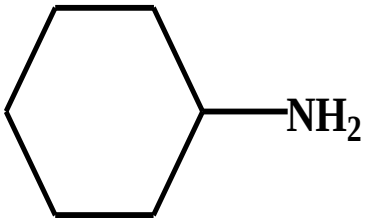
## Primary Amines




1-Propanamine
or
1-Propylamine




3-Butenamine
or
3-Butenylamine




Cyclohexanamine
or
Cyclohexylamine

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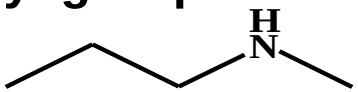
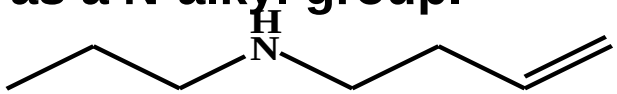
# Secondary and Tertiary Amines

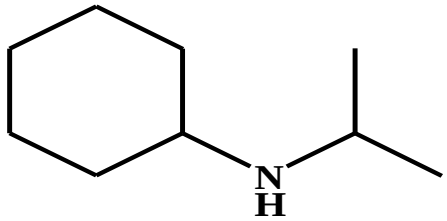
**In a secondary or tertiary amine. The longest alkane chain is numbered. Each alkyl group bonded to the N atom is named as a N-alkyl group.**



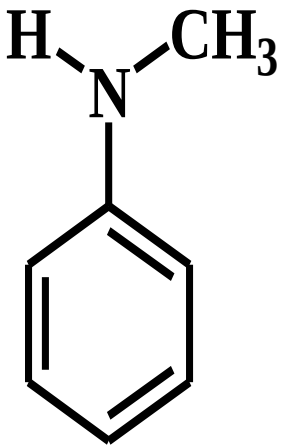
***N*-methylpropan-1-amine**
**or**
***N*-methyl-1-propylamine**



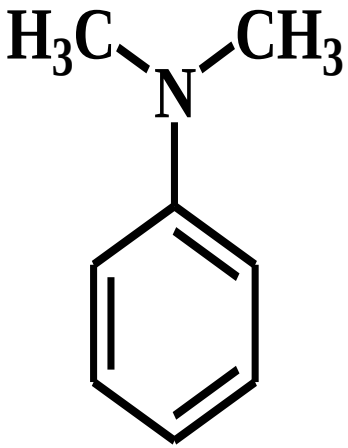
***N*-propyl-3-butenamine**
**or**
***N*-propyl-3-butenamine**



***N*-isopropylcyclohexanamine**
**or**
***N*-isopropylcyclohexylamine**



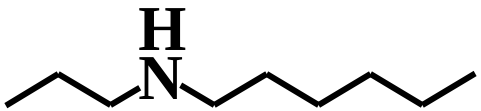
***N*-Methylaniline**



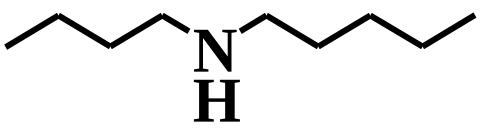
***N*,*N*-Dimethylaniline**

# Case (II) Suffix "2“

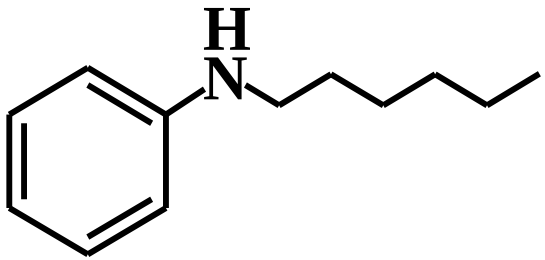
**Another sort of nomenclature; it looks like the ether one. Alky-alkylamine, arylalkylamine or arylarylamine**



**Hexylpropylamine**



**Butylpentylamine**



**Hexylphenylamine**

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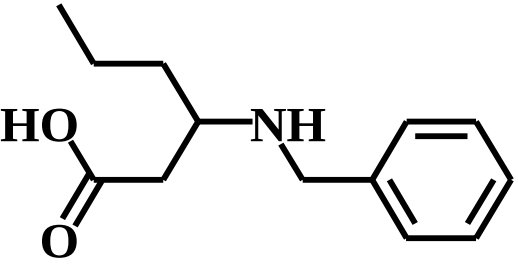
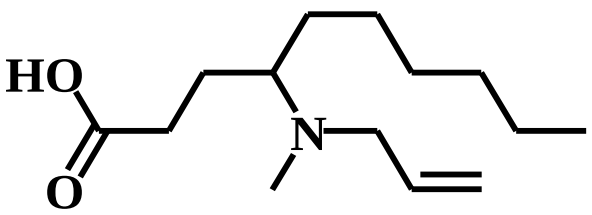
# Prefix:-

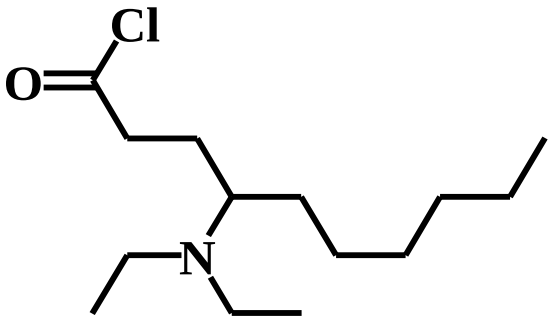
**If amine is un-substituted ($NH_2$) then it is named as amino; if it is primary; alkylamino or aryl amino is it is secondary and dialkyl or diarylamino…….as follow**




**3-Benzylaminohexanoic acid**




**4-Allylmethylaminodecanoicacid**




**4-Diethylamino-decanoyl chloride**

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# Applications

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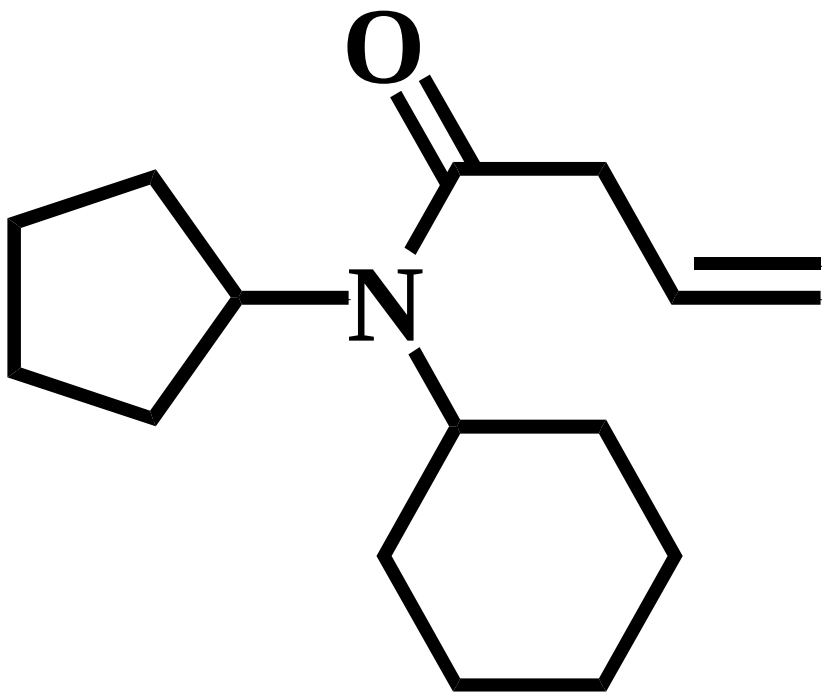
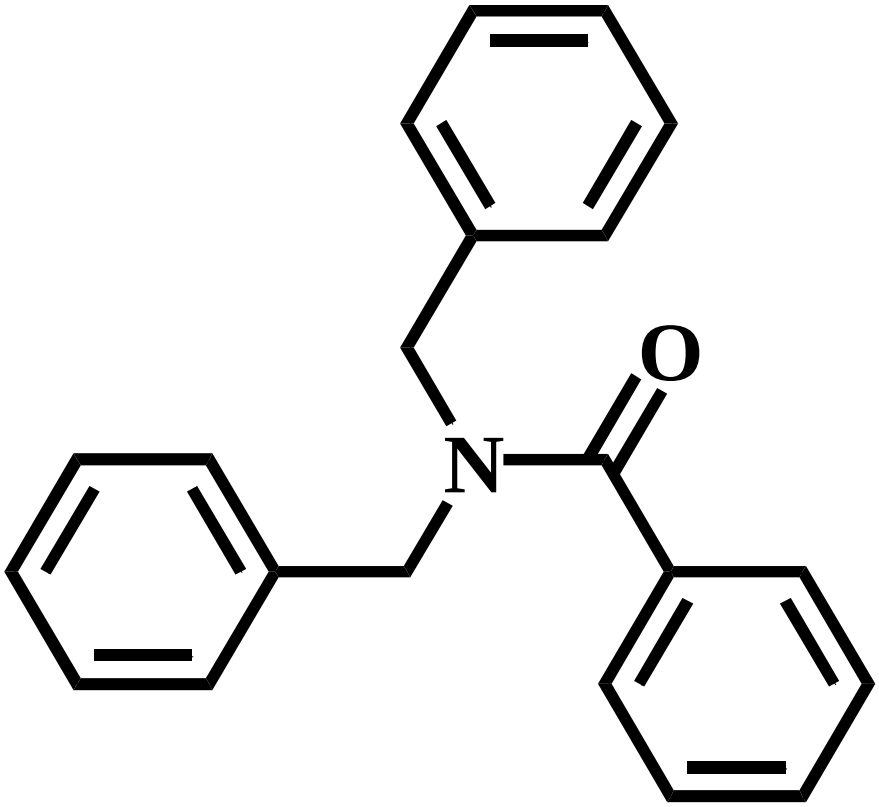
**1]**



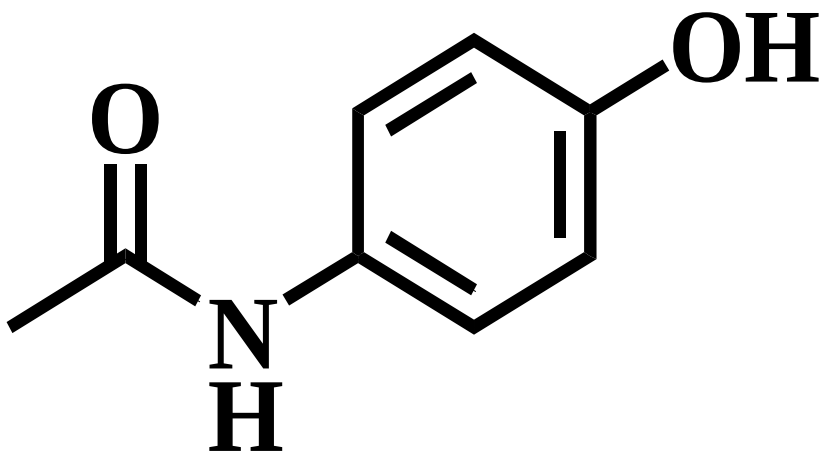

# *N*-Cyclohexyl-*N*-cyclopentyl -3-butenamide

2]




***N*,*N*-Dibenzylbenzamide**

3]

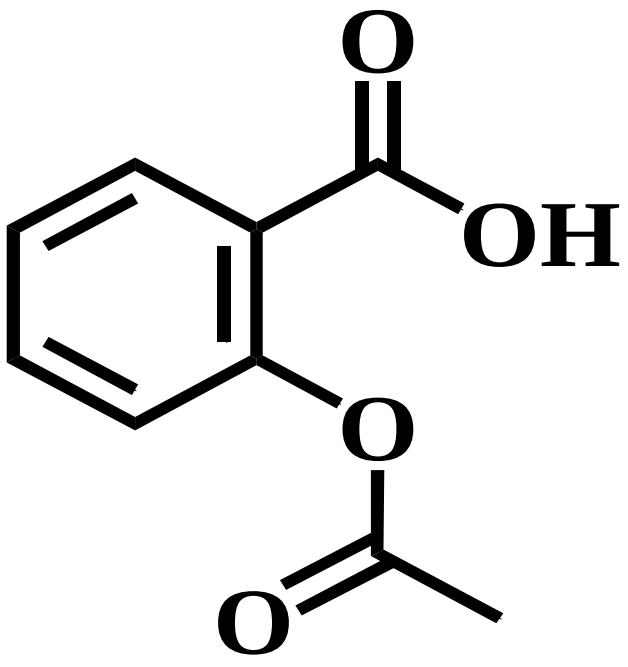



***N*-(4-Hydroxy-phenyl)-acetamide**

**or**

**Paracetamol**

4]



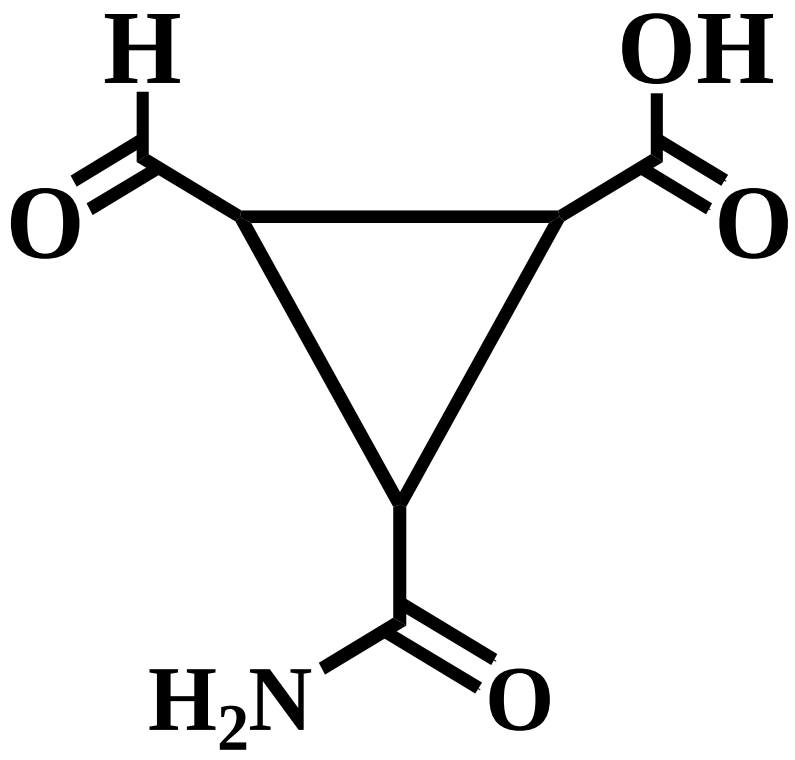

**2-Acetoxy-benzoic acid**

**or**

***O*-Acetyl salicylic acid**

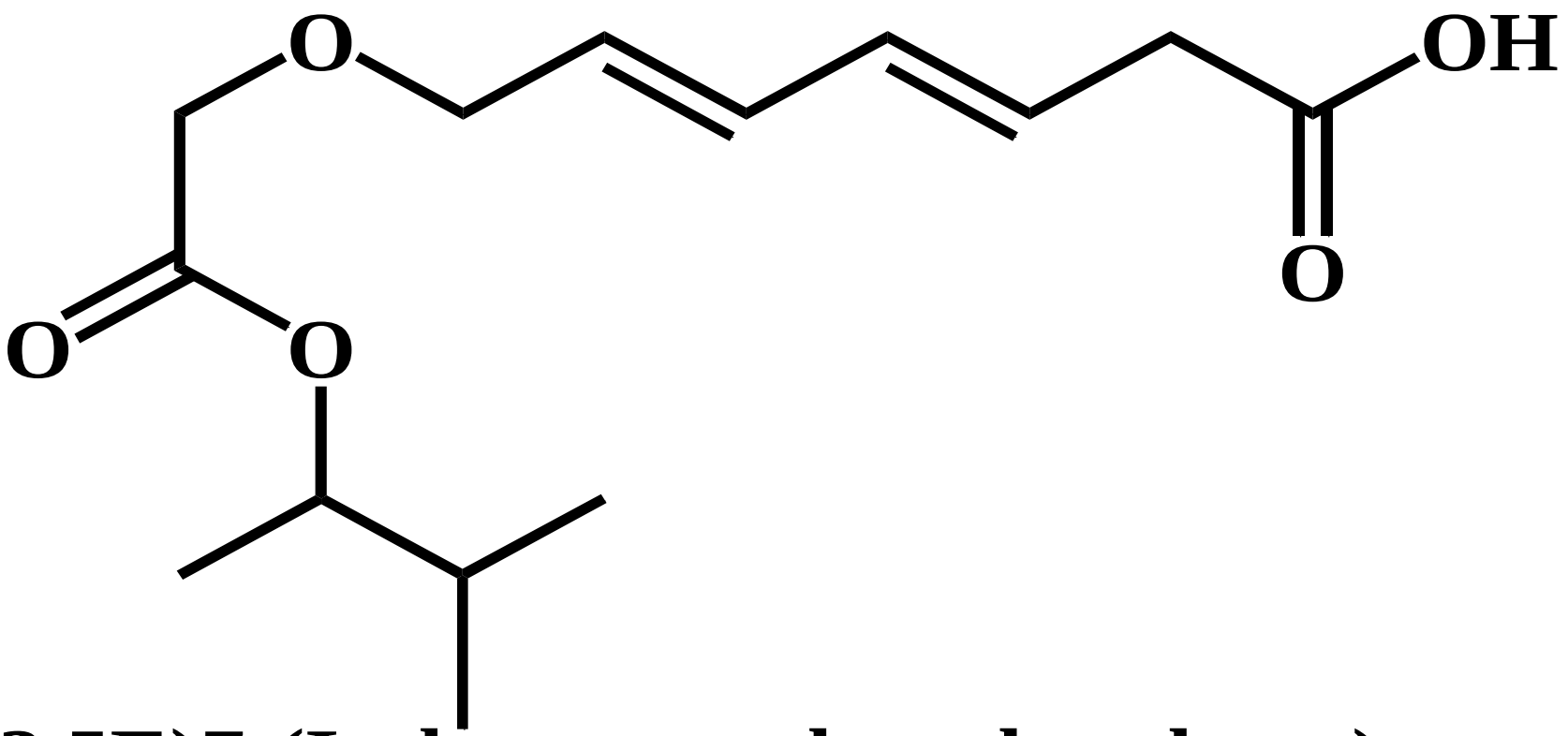
**“Aspirin”**

5]



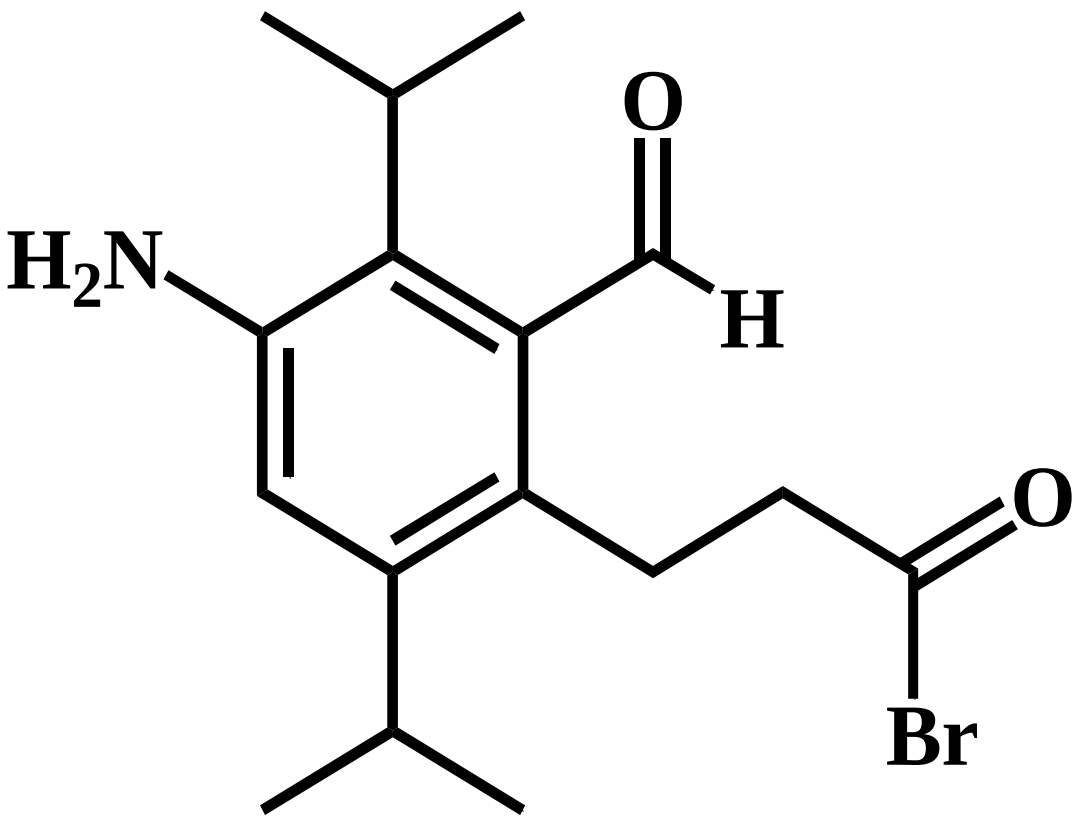

**2-Carbamoyl-3-formyl-cyclopropane carboxylic acid**

6]



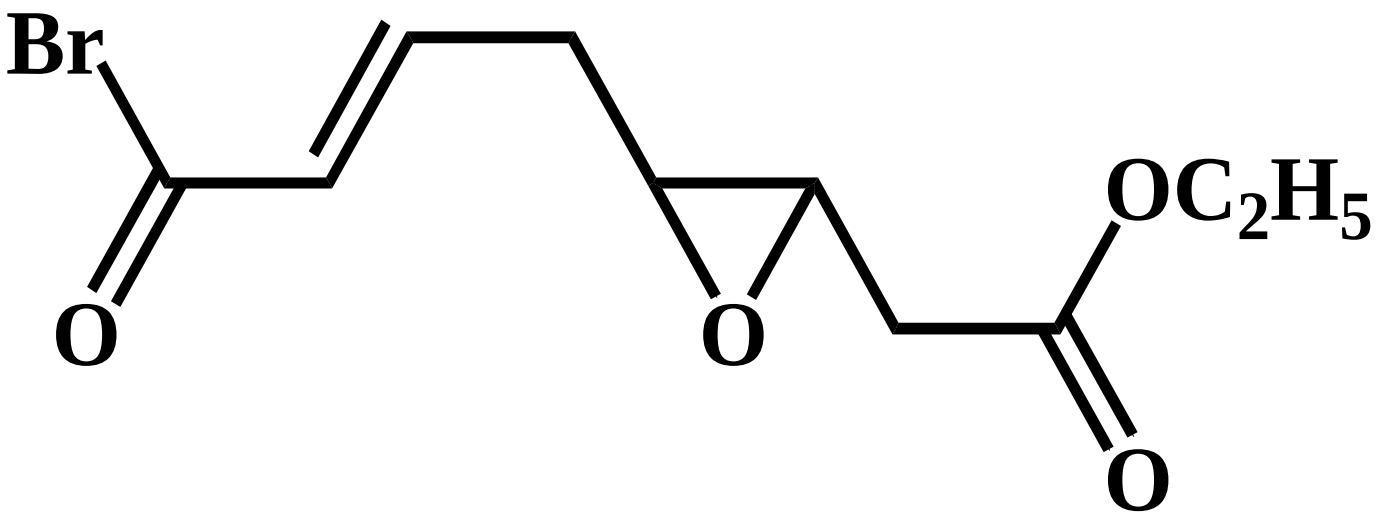

**(3,5E)7-(Isobutoxycarbonylmethoxy) -3,5-heptadienoic acid**

7]




**3-(4-Amino-2-formyl-3,6-diisopropyl-phenyl)-propanoyl bromide**

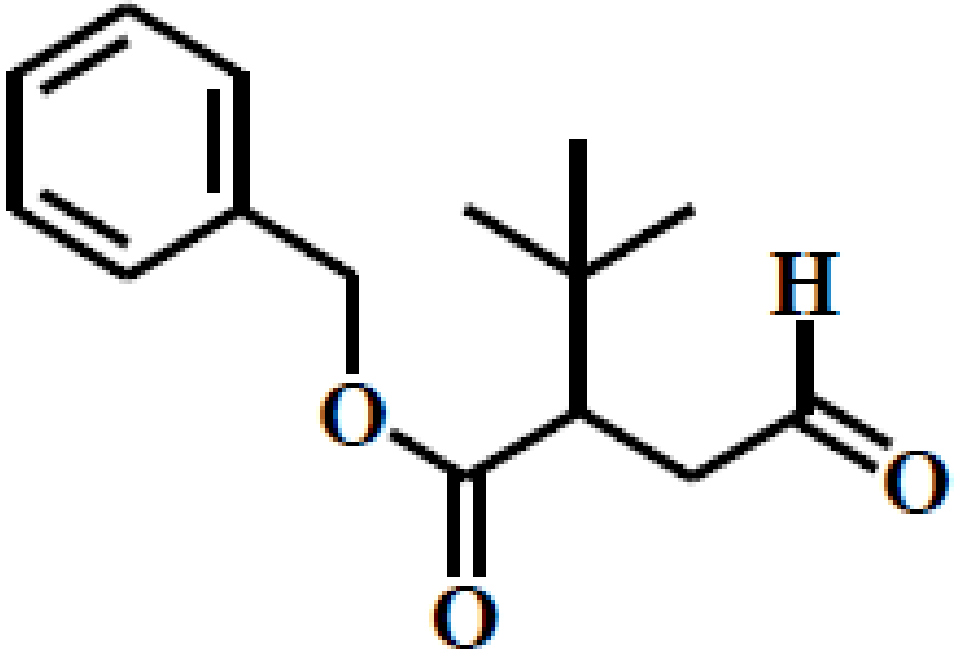
8]




**(E) Ethyl-7-Bromocarbonyl-3,4-epoxy -6-heptenoate**

.

**9]**




**Benzyl-2-tertbutyl-4-oxobutanoate**

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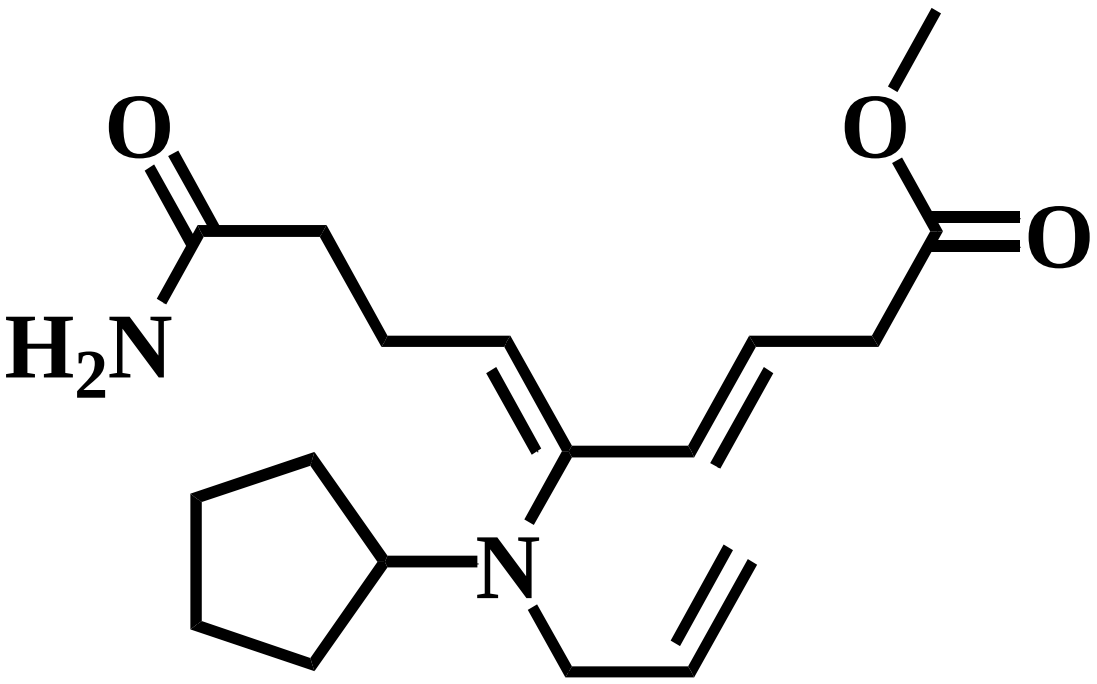
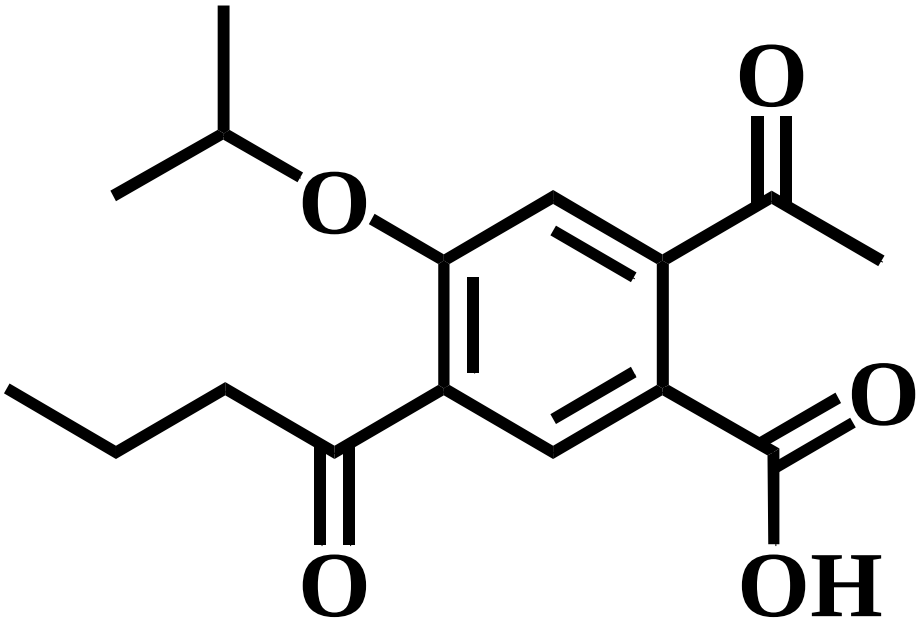
10]




**(3E,5Z) Methyl -5-(Allylcyclopentylamino) -8-carbamoyl--3,5-octadienoate**

.

**11]**




**2-Acetyl-5-butanoyl-4-isopropoxy benzoic acid**

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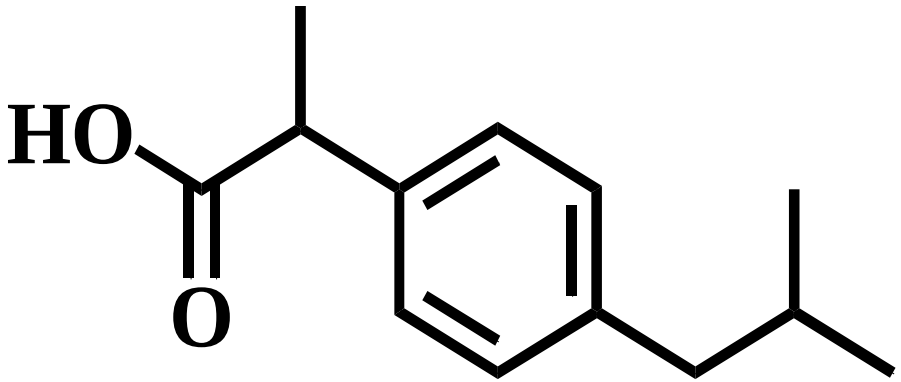
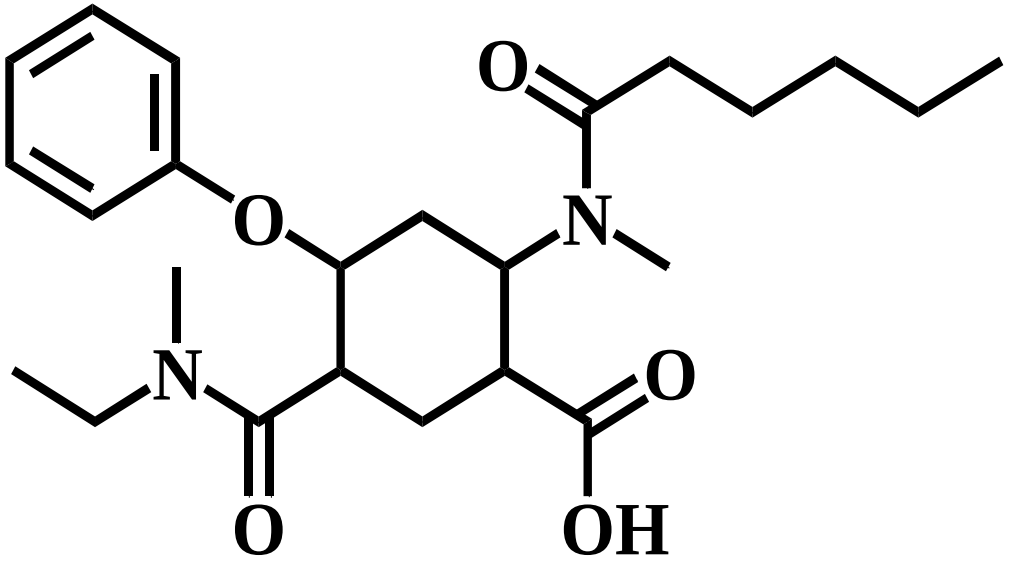
12]




**2-(4-Isobutyl-phenyl)propanoic acid**
**or**
**Ibuprofen**

.

**13]**




**5-(Ethylmethylcarbamoyl)-2-(hexanoylmethylamino)-4-phenoxy-cyclohexanecarboxylic acid**

.