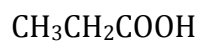
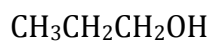


# General Organic Chemistry,

Q Y 2 W 2 I I 8 V W L F K X Y H C P C F  
X D Q G R I O D O M E T H A N E - B H Y  
G N V 1 B 1 R C I H C T C Z 8 H F D E W  
N V G P R M E T H A N E S N A Q C 0 P 5  
3 7 O B K 4 2 N D I C A C I O N A H T E  
H E X A N E G G A J G L N - 3 N S F A N  
C H L O R O M E T H A N E H 4 Y C I N X  
T B G S 7 4 Y O N 2 T 2 A R F T D 3 E Z  
P R O P A N - 1 - O L E R Z R 8 N F 1 D  
P R O P A N O I C A C I D W P E J X N 4  
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H O K 1 B - - H A T 0 2 2 0 Y 0 A H S R

## Word Search:



# Section 1

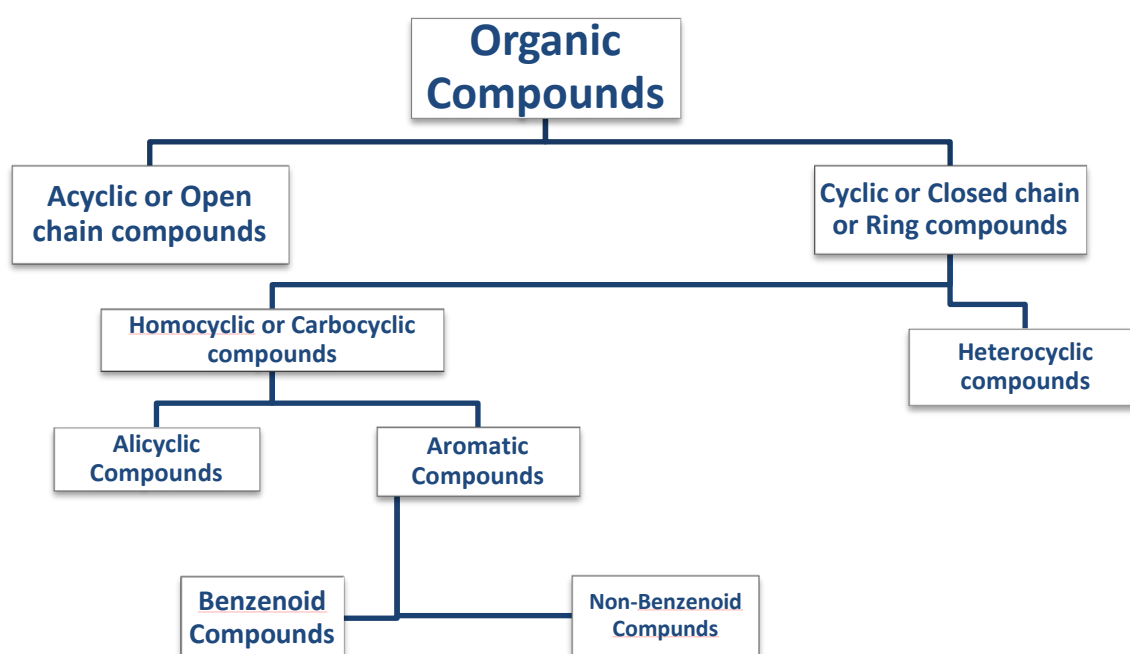
## Nomenclature of Alkanes

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	Functional Group.....	4
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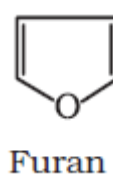
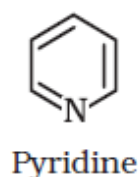
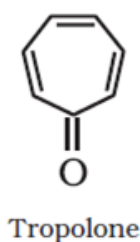
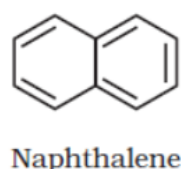
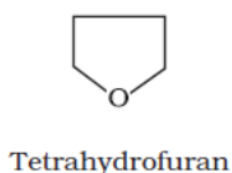
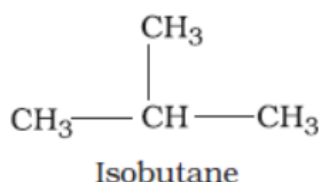
## 1 Nomenclature of Alkanes

The IUPAC nomenclature of organic chemistry is a systematic method of naming organic chemical compounds as recommended by the International Union of Pure and Applied Chemistry (IUPAC). Ideally, every organic compound should have a name from which an unambiguous structural formula can be drawn. The main idea of IUPAC nomenclature is that every compound has one and only one name, and every name corresponds to only one structure of molecules (i.e. a one-one relationship), thereby reducing ambiguity.

### 1.1 Organic Compounds



Examples:



## 1.2 Homologous Series

### Homologous series

A series of organic compounds where preceding or succeeding members differ by one  $\text{-CH}_2\text{-}$  group is called homologous series and the members are called homologues.

Characteristics of homologous series:

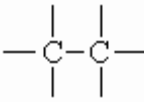
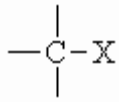
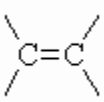
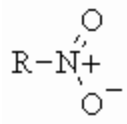
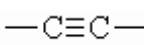
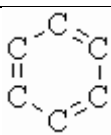
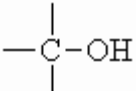
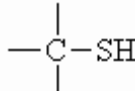
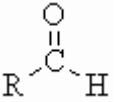
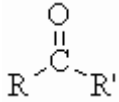
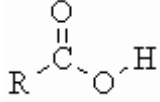
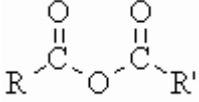
1. they're represented by a general molecular formula
2. difference in the molecular mass of two successive homologues is 14 ( $\text{-CH}_2\text{-}$ )
3. members of a homologous series can be prepared by a general methods
4. they show regular gradation in physical properties
5. they have almost similar chemical properties

## 1.3 Functional Groups

### Functional Groups

The functional group may be defined as an atom or group of atoms joined in a specific manner which is responsible for the characteristic chemical properties of the organic compounds.

### List of Functional Groups

Alkane		Alkyl halide	
Alkene		Nitroalkane	
Alkyne		Arene	
Alcohol		Thiol	
Aldehyde		Ketone	
Carboxylic Acid		Acid anhydride	

Acyl halide		Nitrile	$R-C\equiv N$
Epoxide		Ester	
Amine		Ether	
Amide			

## 1.4 Rules of Nomenclature

**Nomenclature** has five parts:


Word root	denotes the number of carbon atoms present in the principal chain of the compound. C1-meth C2-eth C3-prop C4-but These are the special names for first four carbons.
1 <sup>o</sup> prefix	is used to differentiate between cyclic and acyclic compounds
2 <sup>o</sup> prefix	In IUPAC some functional groups are not considered as functional groups but are treated as substituents. To denote these we use secondary prefixes. Example: Flouro: -F, Chloro: -Cl, -NO <sub>2</sub> : nitro
1 <sup>o</sup> suffix	always added to the word root to indicate whether carbon chain is saturated or unsaturated.
2 <sup>o</sup> suffix	added to indicate a particular functional group present in the principal chain. Ex: alcohols, acids acid derivatives etc

**NAME = 2<sup>o</sup> prefix + 1<sup>o</sup> prefix + word root + 1<sup>o</sup> suffix + 2<sup>o</sup> suffix**

Some points to be noted:

- an extra 'a' is added to word root if primary suffix begins with a consonant.
- while adding the secondary suffix to primary the terminal 'e' of the primary suffix is dropped if secondary begins with a vowel else it's retained.

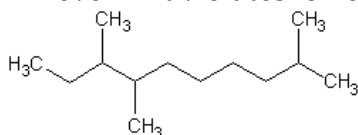
**Examples**

	Word root	Primary suffix	Secondary suffix	IUPAC name
CH <sub>3</sub> -CH <sub>2</sub> -OH	Eth	Ane	Ol	Ethanol
CH <sub>2</sub> =CH-CO- CH <sub>3</sub>	But	Ene	One	Butanone
	Primary prefix	Word root	Primary suffix	IUPAC name
	Cyclo	But	Ane	Cyclobutane

## 1.5 Nomenclature of hydrocarbons

### Nomenclature of hydrocarbons

- Parent chain rule:** From structure, the longest possible chain of C atoms is to be chosen this is called as parent chain. Accordingly the appropriate root word is fixed
- Lowest sum rule:** Once the parent chain is selected, the carbon atoms are numbered starting from the end that gives the lowest possible number to the carbon bearing substituent or sum of locants is least.
- Lowest locant rule:** when more than one substituent is present, carbon bearing substituent should be numbered such that there is least difference between them, even if it violates lowest sum rule. This is a bit tricky so have a look at this now only.



how would you name this ???

3,4,9-trimethyldecane or 2,7,8-trimethyldecane

the first one is right only if lowest sum rule is considered, but according to lowest locant rule the right name is the second name. This generally is accepted one, so lowest locant is given more preference than lowest sum rule.

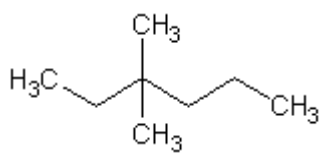
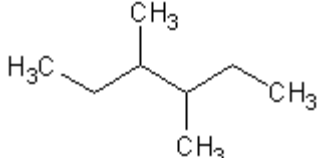
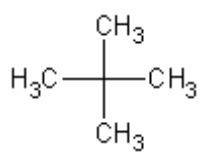
Here locant number is 2 in second and 3 in first  $2 < 3$ . Thus second one is correct. Confused you a bit??? Or having a bit of trouble with naming??? Then first read these points and go back to the problem.

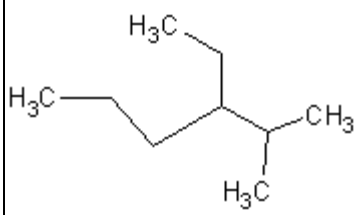
### The following points are to be noted carefully

- If there be more than one chain of same lengths, chain with maximum branches or substituents is to be chosen.
- Substituents are arranged in alphabetical order.
- when two or more identical substituents repeat, then numerical prefixes like di tri tetra are used.

- two numbers are separated by comma and number and alphabet are separated by a hyphen.
- When substituent is branched numbering of side chain begins at the point where it's attached to parent chain.

EXAMPLES:

		
3,3-dimethylhexane	3,4-dimethylhexane	2,2-dimethylpropane common name: neo-pentane

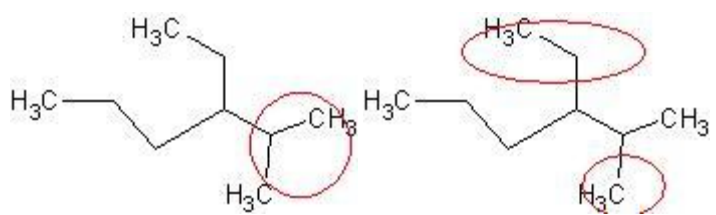


select the proper parent chain and name it.  
the chain containing more number of substituents should be chosen. there are two possibilities.

Naming is left as exercise.

the groups encircled are to be treated as substituents. which is right ? think for yourself


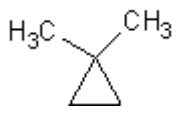

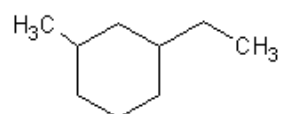
!



Ans: 3-ethyl-2-methylhexane

### Nomenclature of cycloalkanes

Each vertex represents carbon. Named based on no of carbons present with prefix cyclo

			
cyclopropane	1,1-dimethylcyclopropane	cyclopropylhexane	Try yourself

Just remember

When the number of carbon in side chain is more than in the ring then ring is substituent all other rules apply. i.e. lowest sum and lowest locant and alphabetical preference.

Fourth one. Think a bit here, alphabetical order takes preference. so go on name it!

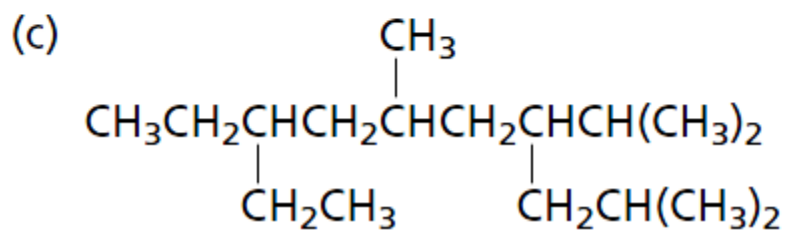
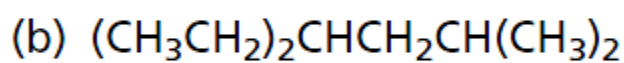
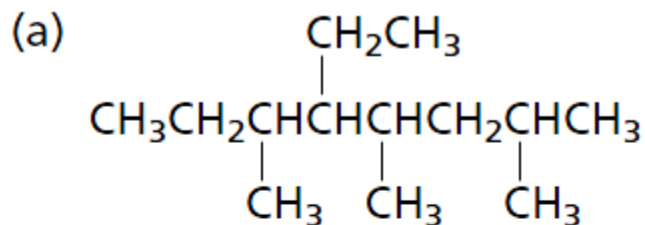
Ans: 1-ethyl-3-methylhexane

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**Section Test**

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Give the IUPAC Names of the following:



## Section 2

### Nomenclature functional groups-I

2.1	Nomenclature of Alkenes.....	11
2.2	Nomenclature of Alkynes .....	11

## 2 Nomenclature with functional groups - I

### 2.1 Nomenclature of Alkenes

#### Alkenes

- Name ends with -ene.
- Longest chain containing the double bond is chosen even if it violates longest chain rule.
- Double bond gets lowest number position of double bond and is indicated by a number between word root and suffix.

In cycloalkenes, number is not needed to denote position of double bond since ring is numbered such that double bond is between C1 and C2.

### 2.2 Nomenclature of Alkynes

#### Alkynes

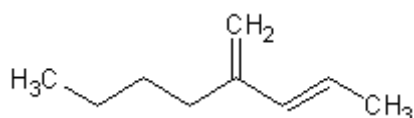
Name ends with -yne. All other rules are same as that of alkenes.

Imp.

- When both double and triple bonds are present. then its named as alkenyne
- Double bond is given more preference.

In case of poly-enes and poly-yne, chain with maximum number of multiple bonds is to be selected.

Examples

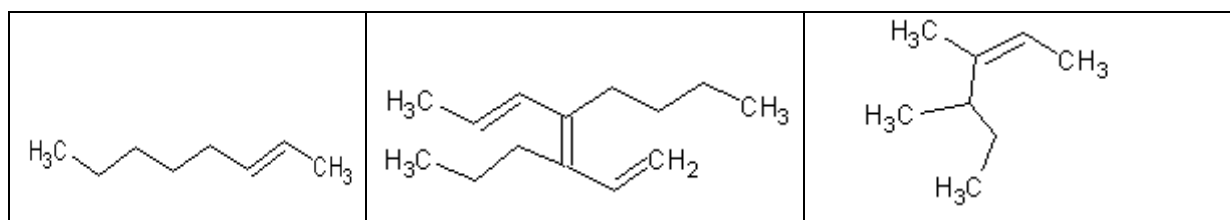


now how do you name this ???

There are two double bonds. So the principal chain must contain both.

Thus the name is 2-butylpent-1,3-diene.

Started with a tough one. Let's take on some easy ones. Try these

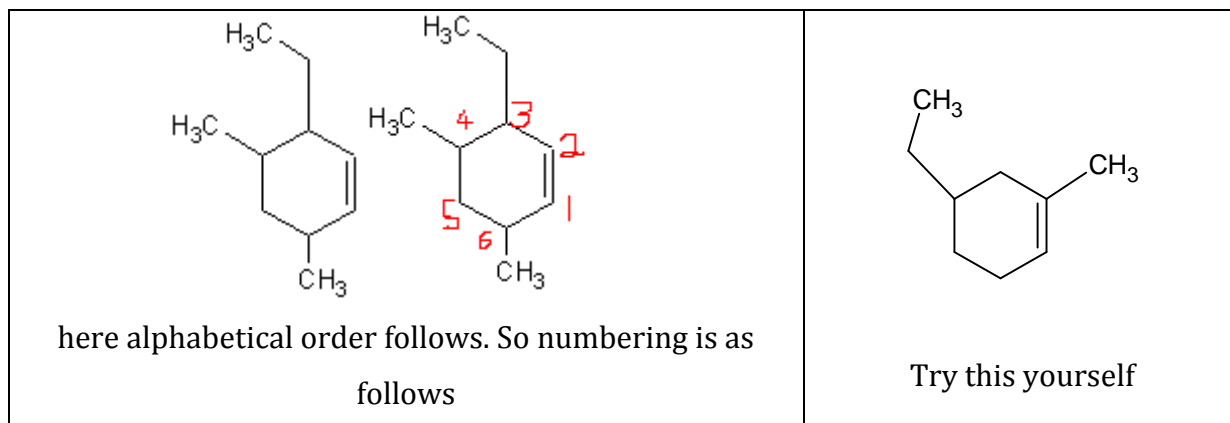


Ans: Oct-2-ene

4-butyl-3-propylhepta-1,3,5-triene

3,4-dimethylhex-2-ene

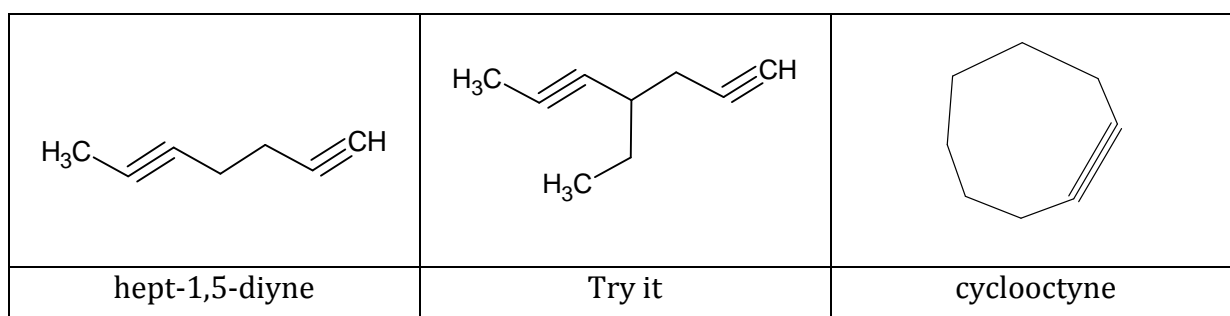
cyclic ones



3-ethyl-4,6-dimethylhex-1-ene

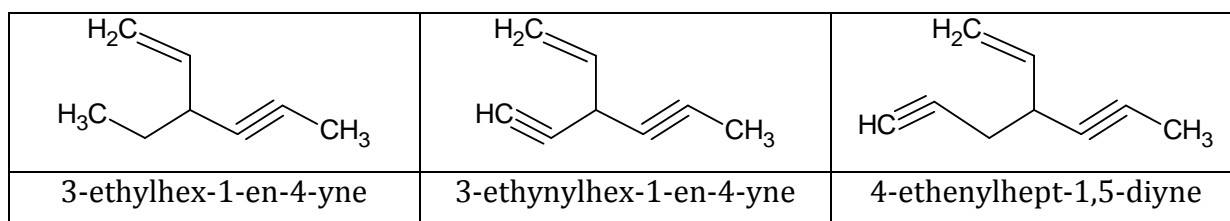
5-ethyl-1-methylcyclohex-1-ene

let's move to alkynes.



Ans: 4-ethyl-hepta-1,5-diyne

Moving onto alkenynes.



Points to remember in each case

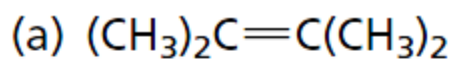
1. here double bond takes more importance
2. the longest chain with maximum number of double bonds is to be chosen (double bond to be given more preference)
3. here also longest chain with most multiple bonds is to be chosen

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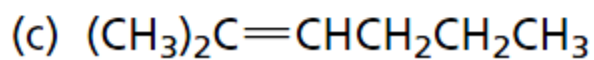
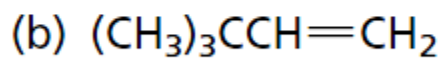
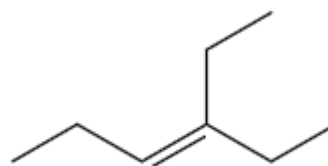
**Section Test**

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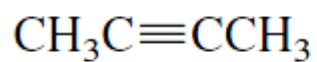
Give the IUPAC Names of the following:



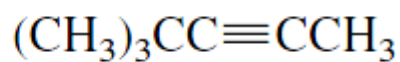
(d)



(e)



(f)



## Section 3

### Nomenclature functional groups-II

3.1	Nomenclature of compounds containing substituents .....	15
	Ether, Alkyl Halide .....	15
	Acids and Acid Derivatives.....	16
	Amides, Acid Halides and other Groups .....	17
	Priority order for more than one functional Groups.....	20

### 3.1 Nomenclature of compounds containing substituents

**Alkyl halides:** they're named as haloalkanes.

Where halo is any halogen atom.

Examples:

1,2-dichloro-3-ethyl-5-flouro-pentane	3-bromo-4-methylhexane	1-chloro-1-cyclopentylbutane

In (2) alphabetical order of preference is followed and in (3) cyclopentane becomes substituent

**Nomenclature of nitro compounds.** The same rules apply as above except that nitro is the substituent.

**Ethers:** alkoxyalkanes  $R-O-R_1$

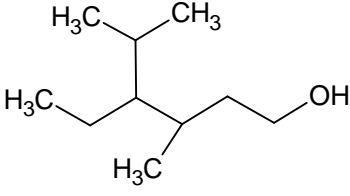
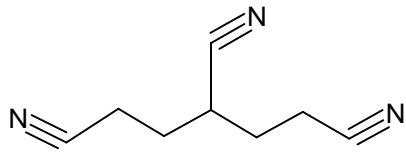
The group R or  $R_1$  is chosen as parent depending on no of carbon atoms.

Ethoxypropane	2-propoxypropane

#### Nomenclature of compounds with one functional group

longest possible chain of carbon atoms containing the functional group and also maximum number of multiple bonds(if present) is selected without much consideration for longest chain rule.

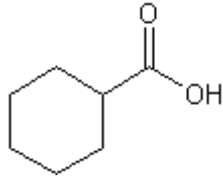
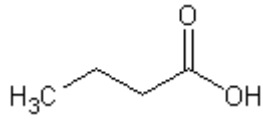
position of functional group must be given lowest possible number.

	
4-ethyl-3,5-dimethylhexan-1-ol	pentane-1,3,5-tricyanide

According to the new IUPAC rule, if an unbranched chain is directly linked to more than two like functional groups, the organic compound is named as a derivative of the parent alkane which doesn't include carbon of functional groups.

### Nomenclature of carboxylic acids and their derivatives

'e' of hydrocarbon is replaced by -oic acid. Carbon in functional group must be given lowest number and must be included in chain.

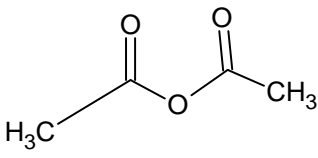
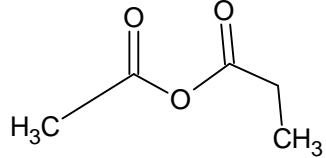
	
cyclohexanecarboxylic acid	butanoic acid

Note: here carbon of functional group is not included in ring.

### Acid Anhydrides.

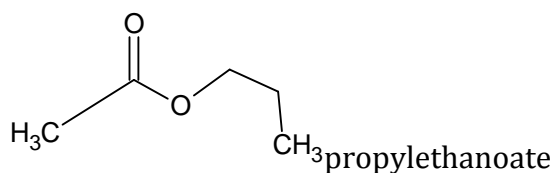
Symmetrical ones are named by writing acid name followed by anhydride

Unsymmetrical ones by writing names of acid in alphabetical order followed by anhydride.

	
acetic anhydride, IUPAC: ethanoic anhydride	ethanoicpropanoic anhydride

**Ester:** alkyl alkanoate

First word of name is alkyl group attached to oxygen, then comes name of parent acid with suffix acid replaced by -ate



## AMIDES

There are three types of amides

Primary	Secondary	Tertiary

Examples

N-methylethanamide	N,N-dimethylethanamide

Nomenclature of acid halides

Acid chloride is named using acid name and by replacing -oic acid by -oyl halide

Alkanoic acid → alkanoyl halide

Alkenoic acid → alkenoyl halide

Alkynoic acid → alkynoyl halide

ethanoyl chloride	cyclohexanecarbonyl chloride ( acid is cyclohexanecarboxylic acid )

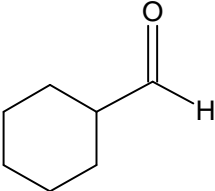
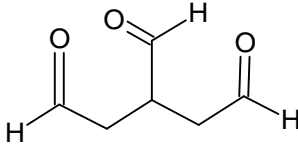
### Nomenclature of Nitriles

$R-C\equiv N$  is the general formula of nitriles considered as derivatives of acids because, they react with water to form carboxylic acids like acid chlorides, esters and amides. named as alkanenitrile, alkenenitrile, alkynenitrile.

$H_3C-C\equiv N$	
ethanenitrile	Try it

### Nomenclature of carbonyl compounds

**Aldehydes:** 'e' of hydrocarbon is replaced by -al

HCHO		
Methanol	cyclohexanecarbaldehyde	propane-1,2,3-tricarbaldehyde

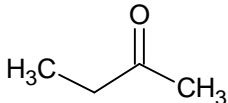
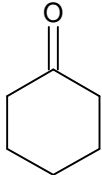
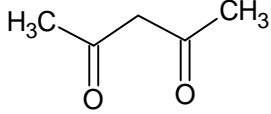
When the carbonyl group is attached to a ring, then aldehyde is named by adding carbaldehyde to name of cyclic compound.

### Ketones

alkanone is the general name of the ketone.

'e' of hydrocarbon is replaced by -one.

position of functional group is indicated if positional isomerism is possible (isomerism and its types are to be discussed in the coming chapters).

		
Butanone	Cyclohexanone	pentan-2,4-dione

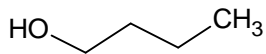
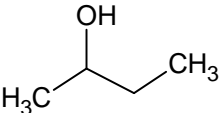
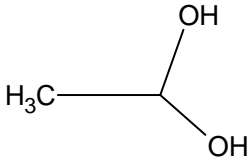
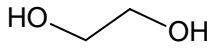
First is actually butan-2-one, But 2 can be left. Why? Try to find any other ketone with 4 carbons.

### Nomenclature of alcohols:

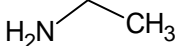
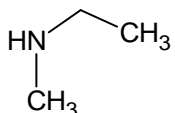
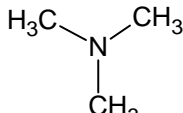
NOTE : if two hydroxy groups are present on the same carbon then it's called as a geminaldiol .

If the two hydroxy groups are present on adjacent carbons then it's called as a vicinal diol .

All rules apply here for nomenclature of compounds containing one functional group, 'e' of hydrocarbon is replaced by -ol

			
butan-1-ol	butan-2-ol	ethan-1,1-diol ( geminaldiol)	ethane-1,2-diol ( vicinal diol ) or ethylene glycol

### Nomenclature of amines:

		
Ethanamine (primary)	N-Methylethanamine (Secondary)	N,N-dimethylmethanamine (tertiary)

### Nomenclature of compounds containing more than one functional group

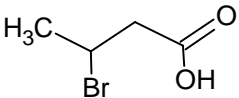
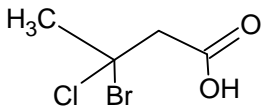
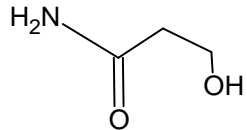
- 1) Principal functional group: Principal functional group is selected; other functional groups are treated as substituent.
- 2) Selection of principal chain: it's selected to include as many functional groups as possible.
- 3) Numbering is done such that principal functional group gets least number followed by multiple bonds and other functional groups

PRINCIPAL FUNCTIONAL GROUP > DOUBLE BOND > TRIPLE BOND > OTHER FUNCTIONAL GROUPS

Order of priority of functional groups.

Class	Formula	Suffix (if present as a functional group)	Prefix (if present as a substituent)
Carboxylic acid	-COOH	-oic acid	Carboxy
Sulfonic acid	-SO <sub>3</sub> H	Sulfonic acid	Sulfo
Esters	-COOR	Alkyl alkanoate	Alkoxy carbonyl
Acyl halides	-COX	-oyl halide	Halocarbonyl
Amides	-CONH <sub>2</sub>	-amide	Carbamoyl
Nitriles	-C≡N	Nitrile	Cyano
Isocyanides	-NC	Isocyanide	isocyano
Aldehydes	-CHO	-al	Formyl
Ketones	-CO-	-one	Oxo
Alcohols	-OH	-ol	Hydroxy
Thiols	-SH	-thiol	sulfanyl
Amines	-NH <sub>2</sub>	Amine	Amino
Imines	=NH	Imine	imino
Ethers	-O-	Alkoxy alkane	-oxy
Alkenes		-ene	Alkenyl
Alkynes	-C≡C-	-yne	Alkynyl
Halides	-X	-	Halo
Nitro	-NO <sub>2</sub>	-	Nitro
Alkanes		-ane	Alkyl

Now for some examples .

		
3-bromobutanoic acid	Try it	3-hydroxypropanamide

Types of carbon atoms in an organic compound - $\alpha$ , $\beta$ , $\gamma$  carbons.

Carbon attached to the functional group is called as  $\alpha$ -carbon, the hydrogen attached to it is called as  $\alpha$ -hydrogen.

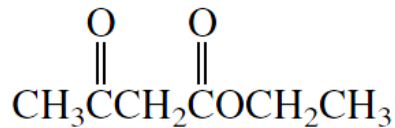
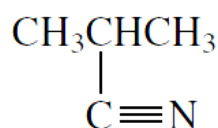
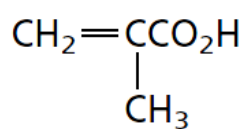
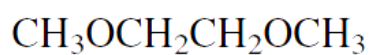
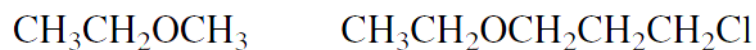
The Carbon attached to  $\alpha$ -C is called as  $\beta$ -carbon and similarly hydrogen attached to it is  $\beta$ -Hydrogen and so on so forth.

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**Section Test**

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Give the IUPAC Names of the following:



## Section 4

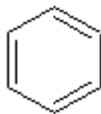
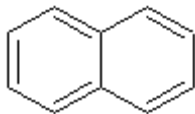
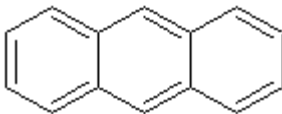
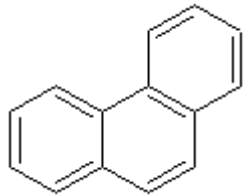
### Nomenclature of benzene derivatives

4.1	Nomenclature of benzene derivatives .....	23
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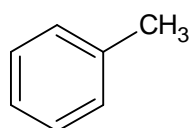
## 4 Nomenclature of Benzene Derivatives

### 4.1 Nomenclature of Benzene Derivatives

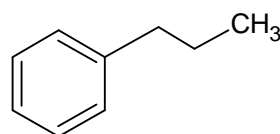
Benzene is actually cyclohexa-1,3,5-triene, but for convenience benzene is accepted as IUPAC name

			
benzene	naphthalene	Anthracene	Phenanthrene

alkyl derivatives are named with lowest number locants



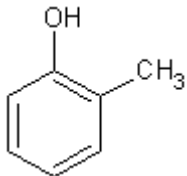
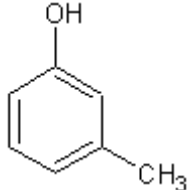
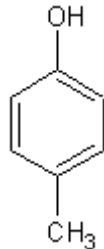
methylbenzene



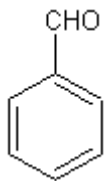
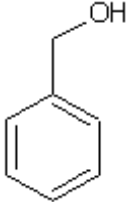
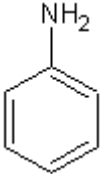
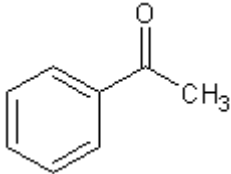
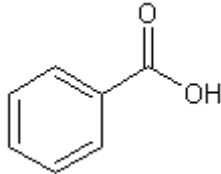
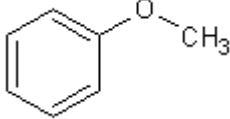
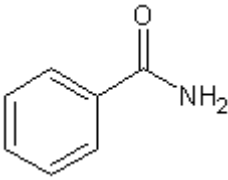
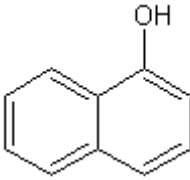
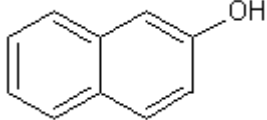
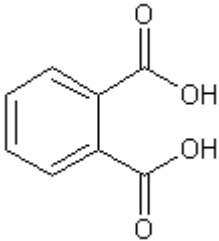
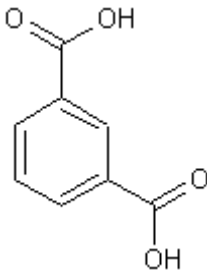
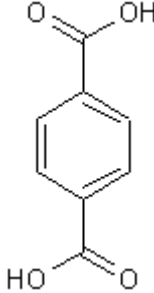
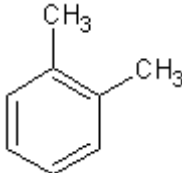
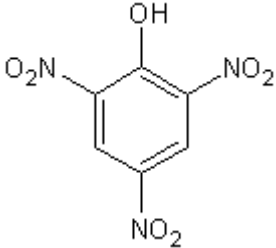
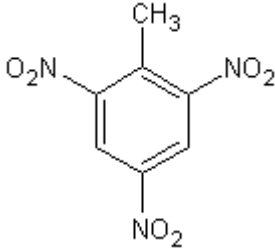
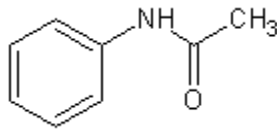
propylbenzene

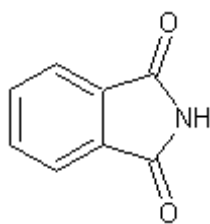
The position 1 is not indicated as all carbons are equivalent

when there are two substituents then ortho(1,2), meta(1,3), para (1,4) prefixes are used.

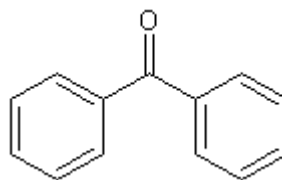
		
o-methylphenol (2-methylphenol)	m-methylphenol (3-methylphenol)	p-methylphenol (4-methylphenol)

some more compounds which are common

				
benzaldehyde	Benzyl alcohol	aniline	acetophenone	Benzoic acid
				
Anisole (methoxy benzene)	Benzamide (benzenecarboxamide)		$\alpha$ -naphthol	B-naphthol
				
Phthalic acid (1,2-benzenedicarboxylic acid)		Isophthalic acid (1,3-benzenedicarboxylic acid)	Terephthalic acid (1,4-benzenedicarboxylic acid)	
				
Xylene	Picric acid 2,4,6-trinitrophenol	Trinitrotoluene 2,4,6-trinitrotoluene	Acetanilide N-phenylethanamide	

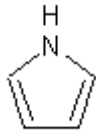


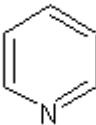
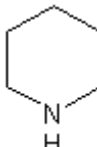


phthalimide



benzophenone

Some important heterocyclics

				
pyrrole	furan	Thiophene	pyridine	Piperidine

### Classification of organic compounds

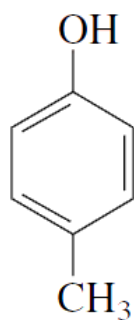
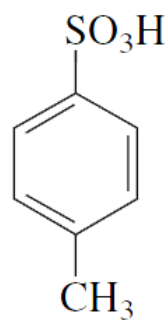
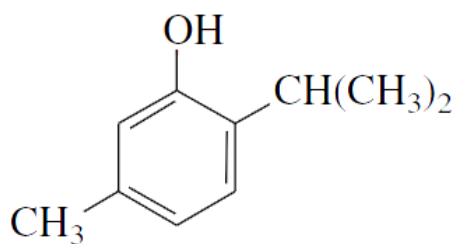
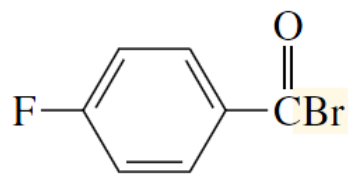
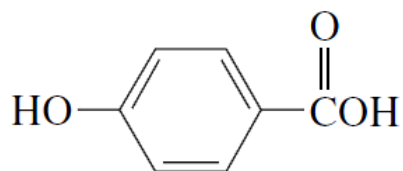
Like inorganic compounds, organic compounds cannot be studied by knowing only their molecular formula.  $\text{Na}_2\text{SO}_4$  has two atoms of Na and one  $\text{SO}_4^{2-}$  radical. The bond between them is ionic and hence is non-directional. Consider this molecular formula  $\text{C}_6\text{H}_{12}\text{O}_6$ . This can be the molecular formula for many compounds as here bonding is covalent and is directional and also depends on how two atoms are attached and what are the two atoms???

Thus, to determine what kind of organic compound a given compound is, we need to know the structure of it, sometimes both 2 Dimensional and 3 Dimensional. The classes of organic compounds are very large, and their classification depends on many factors. This classification is endless, so we'll stick to the syllabus.

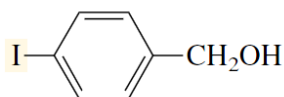
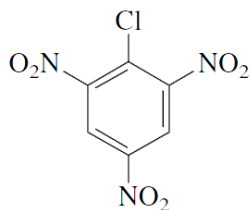
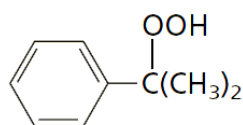
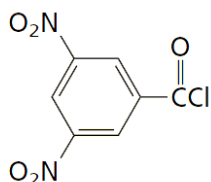
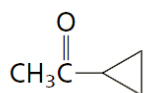
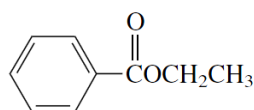
The general properties of the different types of compounds mentioned here will be discussed in the coming sets. Giving emphasis on the factors which determine their properties i.e chemical and physical properties.

## Section Test

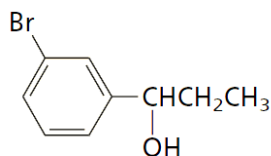
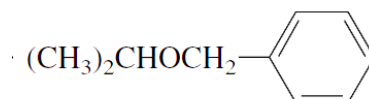
Give the IUPAC Names of the following:



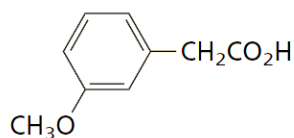
## Solved Examples

*p*-Iodobenzyl alcohol2-Chloro-  
1,3,5-trinitrobenzene1-Methyl-1-phenylethyl  
hydroperoxide3,5-Dinitrobenzoyl  
chlorideCyclopropyl  
methyl ketone

Ethyl benzoate

1-(*m*-Bromophenyl)-1-propanol

Benzyl isopropyl ether

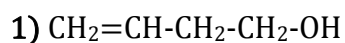
*m*-Methoxyphenylacetic acid

Cyclohexylamine

## Assignments

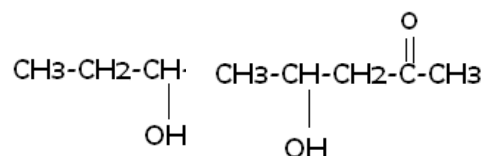
### Level-1

Give IUPAC names of the following:



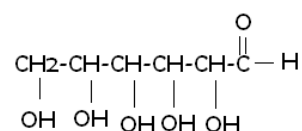
2)

3)

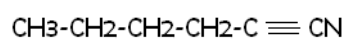
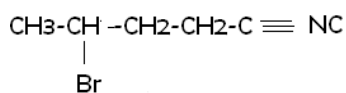


4)

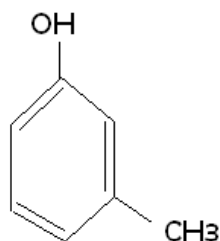
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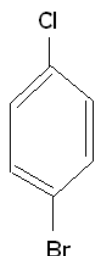
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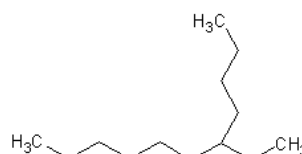
7)



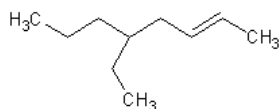
8)



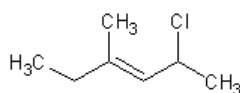
9)



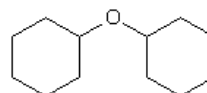
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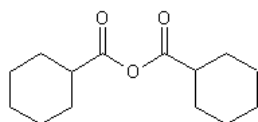
11)



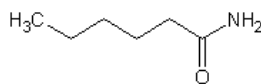
12)



13)



14)



15)



Draw structures of the following (and find if the name written is correct or not)

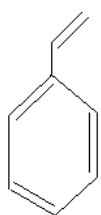
16) pentan-4-ol      17) 2-ethylpropane    18) 4-chloropentan-4-ol

19) Find the hybridization of carbon in methane, ethane, ethene

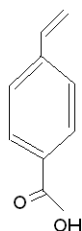
### Level-II

Give the IUPAC names of the following organic compounds

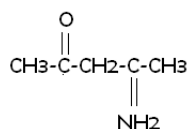
1)



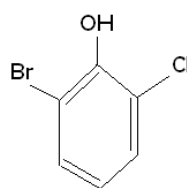
2)



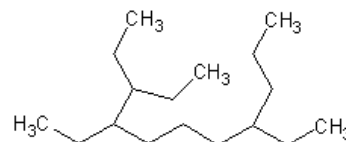
3)



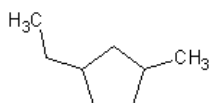
4)



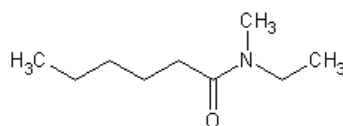
5)



6)



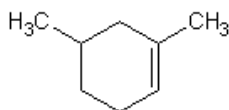
7)



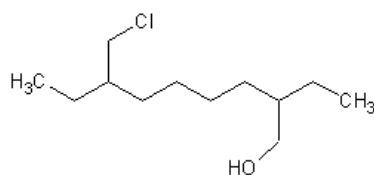
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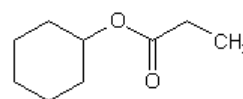
9)



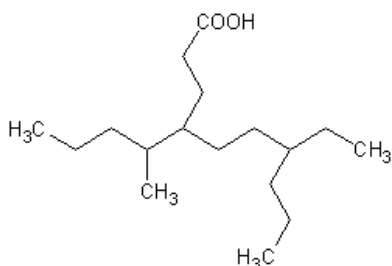
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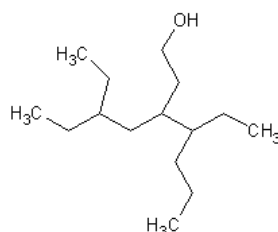
11)



12)



13)



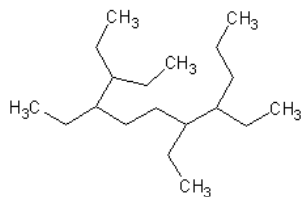
Draw the structures of the organic compounds whose IUPAC names are given below:

- 14) ethyl acetate                      15) 2-oxopropanal                      16) 3-ethyl heptanal                      17) 3-acetylhept-6-enal  
 18) 4-formyl-2-sulphobenzoic acid                      19) 1-ethyl-3-nitro benzene

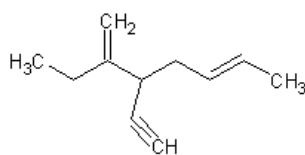
## Level-III

Give IUPAC names for the following

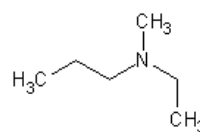
1)



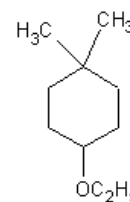
2)



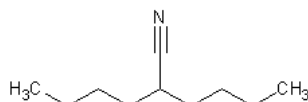
3)



4)



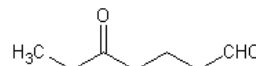
5)



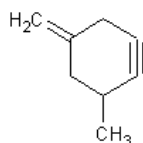
6)



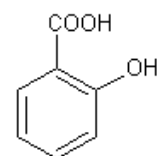
7)



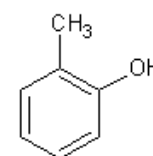
8)



9)



10)



Draw the structures of the organic compounds whose IUPAC names are given below:

- 11) 1-(3-bromophenyl)hexan-1-one                      12) 2-methylcyclopentanecarboxamide  
 13) 3,5,6-trimethylheptan-2-amine                      14) ethyl 3-chloro-4-sulphany benzoate  
 15) cyclohexanecarbonitrate

16) The ratio of sigma and pi bonds in benzene (C<sub>6</sub>H<sub>6</sub>) is

17) Find the hybridization of each carbon in CH<sub>3</sub>-CH=C=CH-CH<sub>3</sub>

Answers

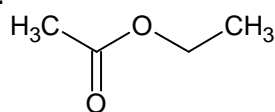
Level-I

1. But-3-en-1-ol
2. 4-hydroxypentane-2-one
3. 3-hydroxypentanal
4. Hexanenitrile

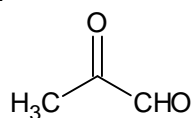
5. 4-bromopentanyl isocyanide
6. 2,3,4,5,6-pentahydroxyhexanal
7. 3-methylphenol
8. 1-bromo-4-chlorobenzene
9. 5-ethylundecane
10. 5-ethylocta-2-ene
11. 2-chloro-4-methylhex-3-ene
12. cyclohexyloxycyclohexane
13. cyclohexanoic anhydride
14. Hexanamide
15. Methylcyclopentane
16.  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$ , the name is wrong it should be pentan-2-ol
17.  $\text{CH}_3\text{CH}(\text{C}_2\text{H}_5)\text{CH}_3$ , name is wrong, it should be  $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3$  and name 2-methylbutane
18.  $\text{CH}_3\text{C}(\text{Cl})(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CH}_3$ , it should be named as 2-chloro-2-methylpentane
19. Methane:  $\text{sp}^3$ , ethane: both  $\text{sp}^3$ , ethene; both  $\text{sp}^2$

## Level-II

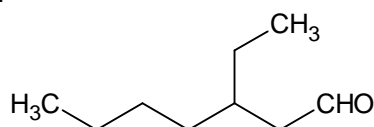
1. Ethenylbenzene
2. 4-ethenyl benzoic acid
3. Structure is incorrect
4. 2-bromo-6-chlorophenol
5. 3,4,8-triethylundecane
6. 1-ethyl-3-methylcyclopentane
7. N-ethyl-N-methylhexanamide
8. 10-oxodecanoic acid
9. 1,5-dimethylcyclohexene
10. 8-chloro-2,7-diethyloctan-1-ol
11. cyclohexyl ethanoate
12. 7-ethyl-4-(1-methyl)butyldecanoic acid
13. 4-ethyl-3-(2-ethyl)butylheptan-1-ol
- 14.



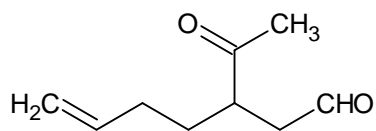
15.



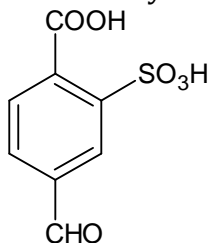
16.



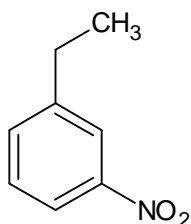
17.



18. It is 4-formyl-2-sulphobenzoic acid

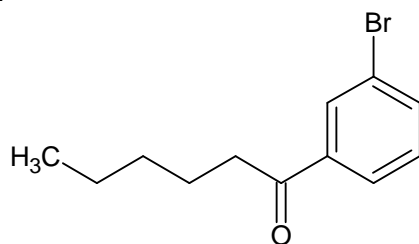


19.

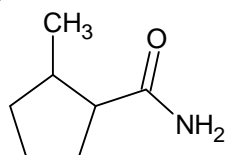


### Level-III

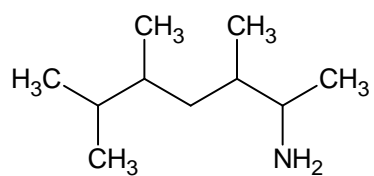
1. 3,4,7,8-tetraethylundecane
2. 2-ethyl-3-ethynylhept-1,5-diene
3. N-ethyl-N-methylpropanamine
4. 1-ethoxy-4,4-dimethylcyclohexane
5. 2-butylhexannitrile
6. 1,9-nonandial
7. 5-oxoheptanal
- 8.
9. 2-hydroxybenzoic acid
10. 2-methylphenol
- 11.



12.



13.



14.

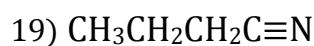
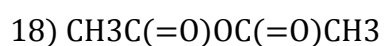
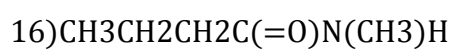
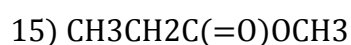
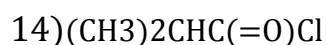
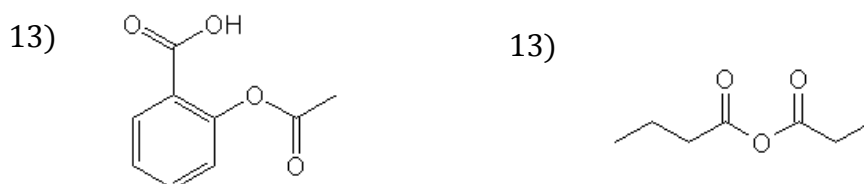
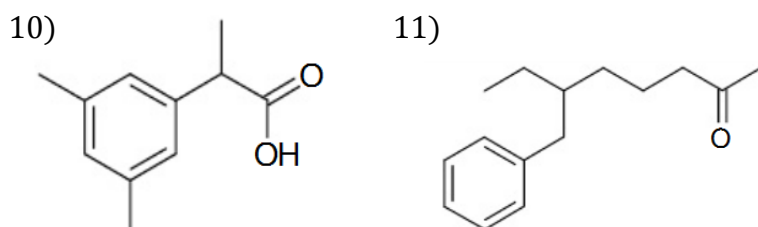
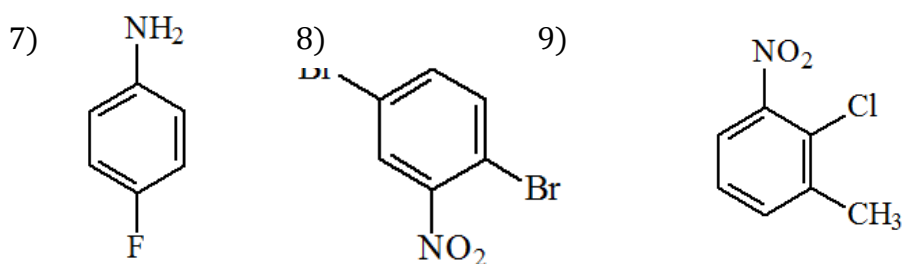
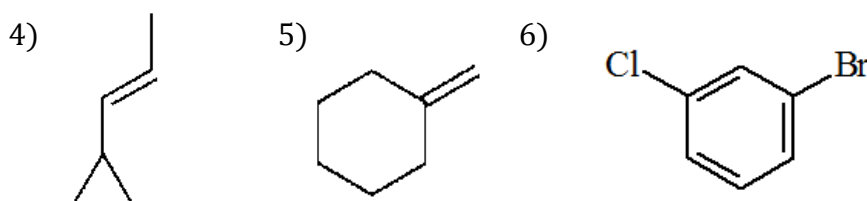
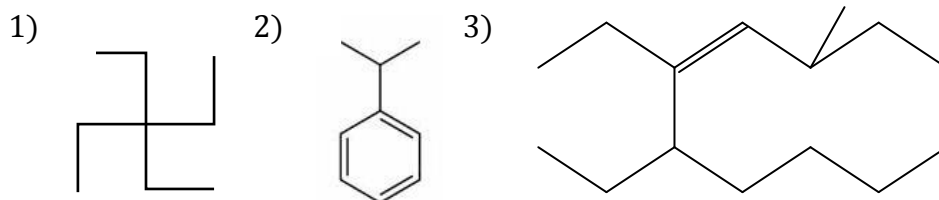
15.

16. The number of  $\sigma$ -bonds=12, number of  $\pi$  bonds=3; ratio is 12:3=4:1

17.  $sp^3$ ,  $sp^2$ ,  $sp$ ,  $sp^2$ ,  $sp^3$

## Chapter Test

Give the IUPAC names of the following



20)