Nomenclature of Organic Compounds

DISCLAIMER

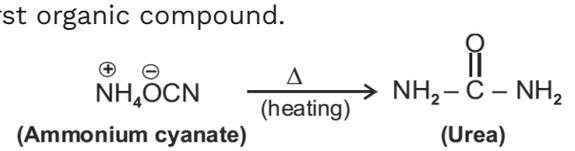
Introduction of Organic Compounds

Why is an entire branch of chemistry devoted to the study of carbon containing compounds?

- We study organic chemistry because just about all of the molecules that make life possible—proteins, enzymes, vitamins, lipids, carbohydrates, and nucleic acids—contain carbon, so the chemical reactions that take place in living systems, including our own bodies, are organic reactions.
- Most of the compounds found in nature—those we rely on for food, medicine, clothing (cotton, wool, silk), and energy (natural gas, petroleum).

Berzelius Vital Force Theory

- According to vitalism, organic compounds were only those that came from living organisms, and only living things could synthesize organic compounds through intervention of a vital force.
- Inorganic compounds were considered those compounds that came from nonliving sources.
- Because chemists could not create life in the laboratory, they assumed they could not create compounds with a vital force. With this mind-set, you can imagine how surprised chemists were in 1828 when Friedrich Wohler produced urea—a compound known to be excreted by mammals—by heating ammonium cyanate, an inorganic mineral.
- Failure of Berzelius vital theory and synthesis of first organic compound.



Introduction

Organic chemistry and you

- You are already a highly skilled organic chemist. As you read these words, your eyes are using an organic compound (retinal) to convert visible light into nerve impulses.
- When you picked up book, your muscles were doing chemical reactions on sugars to give you the energy you needed.

Definition

Old definitions of Organic Compounds

- Compounds which we can derive from living organisms (Plants & Animals) are called organic compounds

	Compounds	Source
1.	Formic acid	Ant
2.	Sugar	Sugarcane

- Specialized field of chemistry called organic chemistry, which derives its name from the fact that in the 19th century most of the them are known carbon compounds were considered to have originated in living organisms

Derivatives of Hydrocarbon

- If we replace one or more than Hydrogen from Hydrocarbon by an atom or group of atoms then compound formed is called derivative of Hydrocarbon.

$$\underset{\text{Hydrocarbon}}{C_2H_6} \xrightarrow[+OH]{-H} \underset{\text{ethanol}}{C_2H_5OH}$$

Hydrocarbon Hydrocarbon derivative

* Some Properties of Carbon

Catenation :

- Due to catenation properties of carbon, it can form long bonded covalent structures. (Chain form)
- Carbon can form single, double or triple bond (covalent).

  Eg.: Alkanes → C_nH_{2n+2}
  Alkenes → C_nH_{2n}
  Alkynes → C_nH_{2n-2}

- Carbon in general shows valency 4.
  (ability to form bond with carbon or other atoms.)
- It is not necessary to show valency 4. It may be variable sometime.

Acetone is used in some nail polish removers

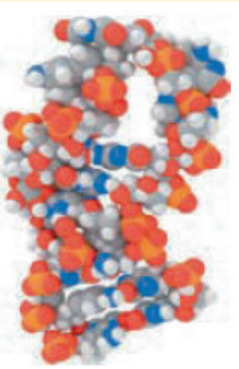
Definition

Modern Definition of Organic Compounds

- Hydrocarbon and their derivatives are called organic compounds.
- Compounds containing carbon and Hydrogen only are called Hydrocarbons.

Point to remember

- Some Compounds may appear as organic compounds but they are actually inorganic e.g., CO_2, $NaHCO_3$, H_2CO_3.



An RNA molecule

Types of Formula

1. Molecular formula :

Example :

(i) Water → H_2O

(ii) Sulphuric Acid → H_2SO_4

Definition

Formula which represent actual number of atoms in a molecule.

2. Empirical formula :

Example :

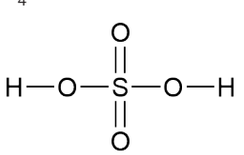
	Molecular formula	Empirical formula
(i) Glucose	$C_6H_{12}O_6$	$C_1H_2O_1$
(ii) Propene	C_3H_6	C_1H_2

Definition

Formula which represents the simplest ratio of atoms present in it.

3. Structural formula :

Example : H_2SO_4



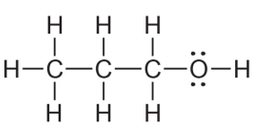
(Structural Formula)

Definition

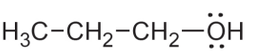
Formula which shows connectivity between atoms and groups.

* Representation of Organic Compounds

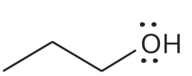
Organic chemists use a variety of formats to write structural formulas



Dash formula



Condensed formula



Bond-line formula

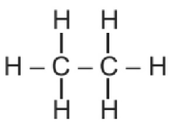
4. Dash-formula :

Definition

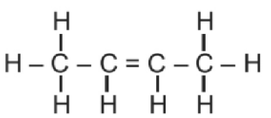
Dash structural formulas have lines that show bonding electron pairs, and include elemental symbols for all of the atoms in a molecule.

Q **(i) C_2H_6** **(ii) C_4H_8** **(iii) C_3H_4**

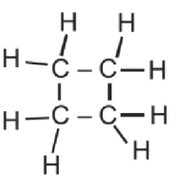
Sol (i) C_2H_6 →



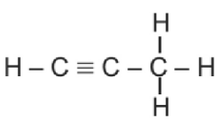
(ii) C_4H_8 →



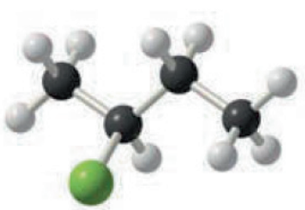
or

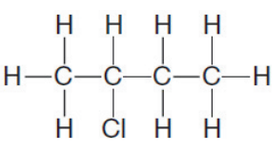


(iii) C_3H_4 →



5. Condensed Structural Formulas :





Dash formula

$CH_3CHCH_2CH_3$ or $CH_3CHClCH_2CH_3$

Cl

Condensed formulas

Definition

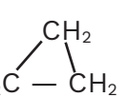
In fully condensed formulas, all of the atoms that are attached to the carbon are usually written immediately after that carbon, listing hydrogens first.

Q **Examples (Unsolved)**

(a) C_2H_6 → **(b) C_3H_6** →

(c) C_5H_{10} → **(d) C_4H_{10}** →

Sol **(a)** $H_3C - CH_3$

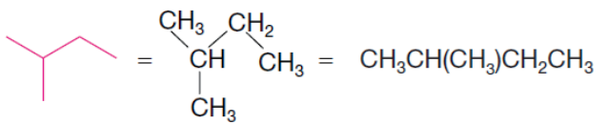
(b) $H_3C - CH = CH_2$ or 

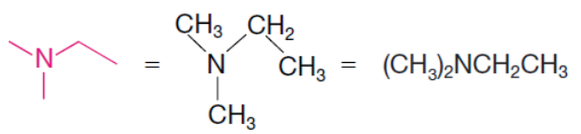
(c) $H_2C = CH - CH_2 - CH_3$

(d) $H_3C - CH_2 - CH_2 - CH_3$

6. Bond-Line Formulas :

Examples :





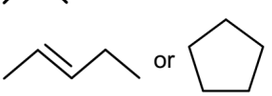
Bond line notation :

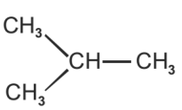
Terminal points and bends represent C, all other valencies are filled by H. Hydrogen atom attach to carbon is not shown.

Examples :

(a) C_3H_8 →

(b) C_5H_{10} →



(c) 

→

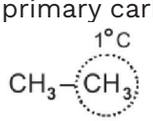
(d) CH_3CHO →

(e) C_4H_9OH →

Degree of Carbon :

Degree of a given carbon means number of carbon atoms directly attached to particular carbon atom has to be considered.

1° carbon → Attached to 1C – also known as primary carbon



Definition

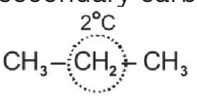
The most common type of structural formula used by organic chemists, and the fastest to draw, is the bond-line formula.

(Some chemists call these skeleton formulas.)

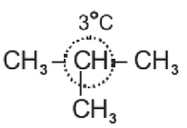
Note :

- If the compound has any hetroatom it will be shown any hydrogen atom attached with it will also be shown.

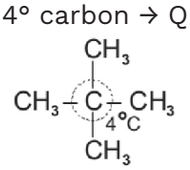
2° carbon → Attached to 2C – also known as secondary carbon



3° carbon → Tertiary carbon



4° carbon → Quaternary carbon

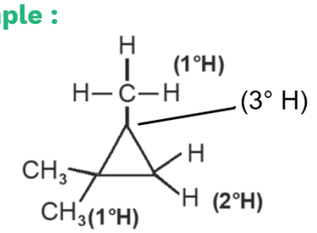


Degree of Hydrogen :

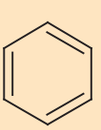
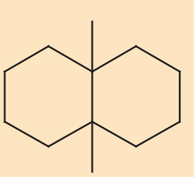
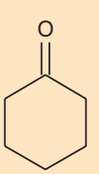
Similarly we define degree of H atom as the degree of carbon atom to which it is attached.

1° H → Attached to 1° C
2° H → Attached to 2° C
3° H → Attached to 3° C
4° H → Not possible

Example :

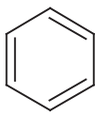
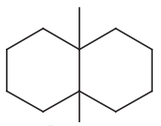
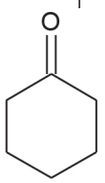


Q

Compound	1°C	2°C	3°C	4°C	1°H	2°H	3°H
(i) 		(ii) 			(iii) 		(iv) 

Sol

Compound	1°C	2°C	3°C	4°C	1°H	2°H	3°H
(i) 	4	0	0	1	12	0	0

(ii)		0	6	0	0	0	6	0
(iii)		2	8	0	2	6	16	0
(iv)		0	6	0	0	0	10	0

Degree of Alcohols :

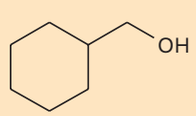
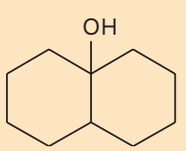
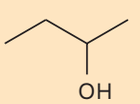
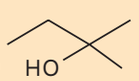
Example :

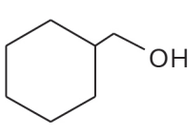
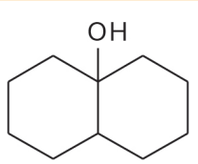
S.No.	Compound	Degree of Alcohol
(i)	$CH_3 - CH_2 - OH$	**1° alcohol**
(ii)	$CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - OH$	**2° alcohol**
(iii)	$CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}} - OH$	**3° alcohol**

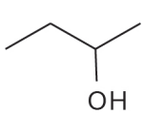
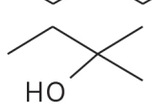
Note :

- Alcohols are hydrocarbon that contains –OH (hydroxy) group.
- Degree of alcohol is degree of carbon atom to which –OH group is attached.

Q **Identify the degree of given alcohols**

(i)  **(ii)**  **(iii)**  **(iv)** 

Sol **(i)**  1° **(ii)**  3°

(iii)  2° **(iv)**  3°

Degree of Alkyl halide (R–X) :

(i) $H_3C - CH_2 - Cl$ 1° halide

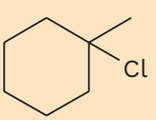
(ii) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - Cl$ 2° halide

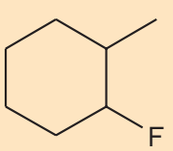
(iii) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}} - Cl$ 3° halide

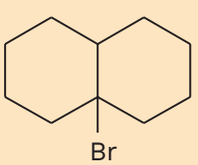
Definition

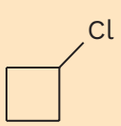
Degree of alkyl halide is the degree of carbon atom directly attached to halogen.

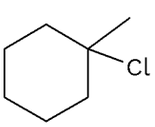
Q **Identify the degree of given halides :**

(i) 

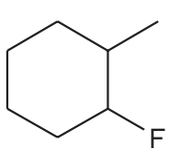
(ii) 

(iii) 

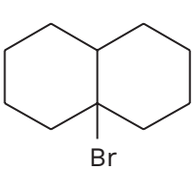
(iv) 

Sol **(i)** 

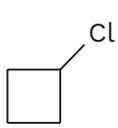
3°

(ii) 

2°

(iii) 

3°

(iv) 

2°

Degree of Amines ($R–NH_2$) :

Degree of amines is numbers of carbon atoms directly attached with nitrogen.

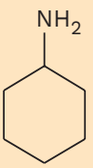
Examples :

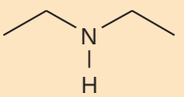
$CH_3–NH_2$ (1° amine)

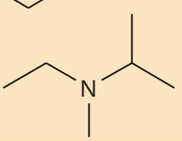
$CH_3 –NH–CH_3$ (2° amine)

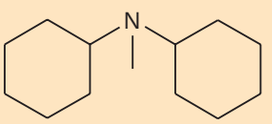
$H_3C—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{N}}—CH_3$ (3° amine)

Q **Identify the degree of given amines (1°, 2°, 3° amine) :**

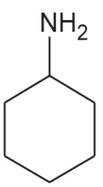
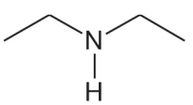
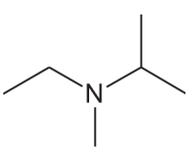
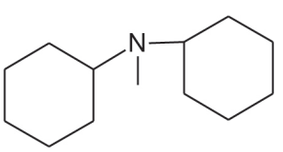
(i) 

(ii) 

(iii) 

(iv) 

Sol

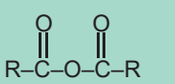
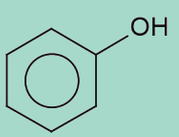
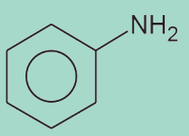
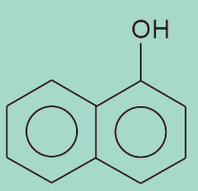
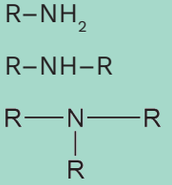
S.No.	Compound	1°	2°	3° amine
(i)		✓	×	×
(ii)		×	✓	×
(iii)		×	×	✓
(iv)		×	×	✓

Functional Groups and Classification

Functional groups

Definition

Part of the molecules which are responsible for the characteristics chemical reactions of those molecules.

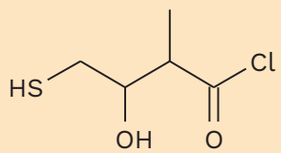
TYPE OF FUNCTIONAL GROUPS			
$H_2C = CH_2$	(Alkene)	R–CH=N–R	(Imine)
CH ≡ CH	(Alkyne)		(Anhydride)
R–OH	(Alcohol)		
R–SH	(Thio alcohol)		(Phenol)
R–O–R	(Ether)		
R–S–R	(Thio ether)		(Aniline)
R–CH=O	(Aldehyde)		
	(Ketone)		(Naphthol)
R–COOH	(Carboxylic acid)		
$R–SO_3H$	(Sulphonic acid)	$R–NH_2$	(1° amine)
R–C≡N	(Cyanide)	R–NH–R	(2° amine)
	(Isocyanide)		(3° amine)
	(Ester)		
	(Amide)		
	(Acid halide)		
R–N=O	(Nitroso)		
–N=N–	(Azo)		

Type of functional groups :

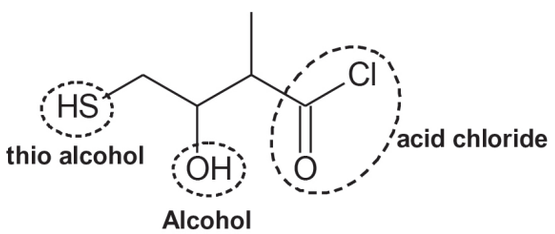
Point to remember

Due to difference in their properties 1°, 2°, 3° amine are treated as different functional groups but primary, secondary and tertiary alcohols are considered as same functional groups.

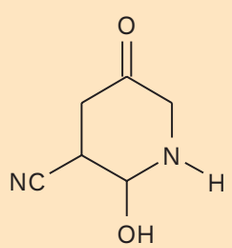
Q Identify the function group present in given molecule and encircle them:



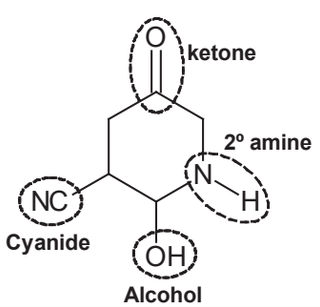
Sol



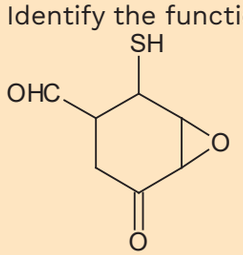
Q Identify the function group present in given molecule and encircle them:



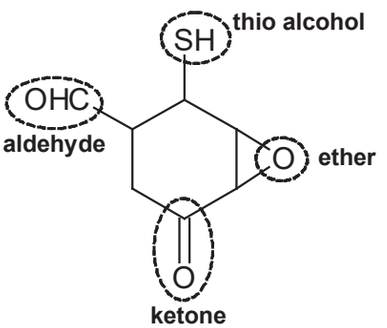
Sol



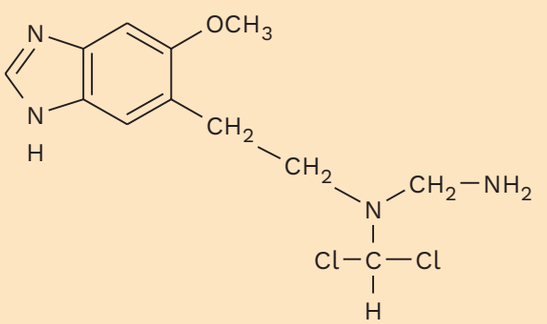
Q Identify the function group present in given molecule and encircle them:



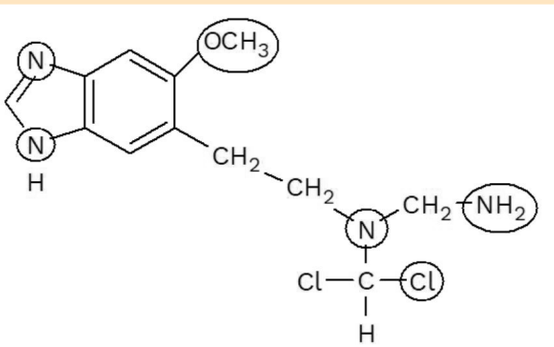
Sol



Q Number of different functional group present in given compound

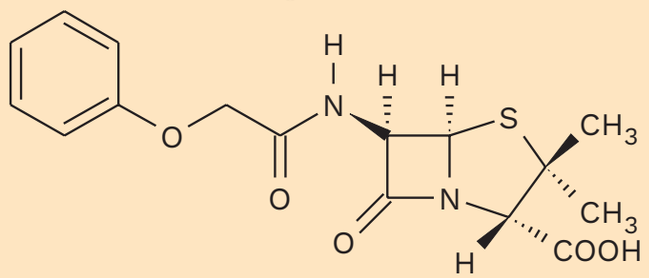


Sol



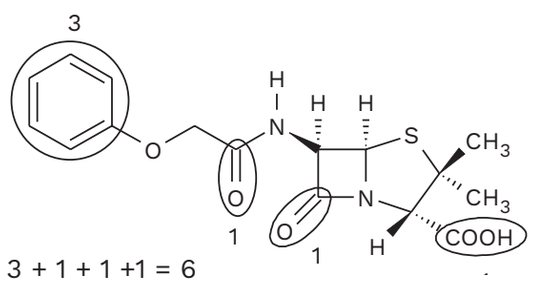
Total 5

Q Penicillin has following structure



Number of π-bonds possible in given structure

Sol



3 + 1 + 1 +1 = 6

Homologous Series

Let's understand

A homologous series is a series of compounds having same functional group (thus having same chemical properties) and consecutive members have a difference of molecular mass '14' or differ in molecular formula by $-(CH_2)-$ unit.

Example-1

• CH_4	Methane	Homologous series of alkanes (also known as paraffins). Each consecutive member differ by $-CH_2-$
• CH_3-CH_3	Ethane	
• $CH_3-CH_2-CH_3$	Propane	
• $CH_3-(CH_2)_2-CH_3$	Butane	
• $CH_3-(CH_2)_3-CH_3$	Pentane	

Example-2

• CH_3-OH	Methanol	Homologous series of alcohol.
• CH_3-CH_2-OH	Ethanol	
• $CH_3-CH_2-CH_2-OH$	Propanol	
• $CH_3-(CH_2)_2-CH_2-OH$	Butanol	
• $CH_3-(CH_2)_3-CH_2-OH$	Pentanol	

Example-3

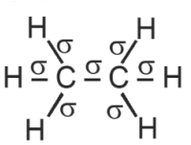
- $H-\overset{\overset{O}{\|}}{C}-OH$ Methanoic acid
- $CH_3-\overset{\overset{O}{\|}}{C}-OH$ Ethanoic acid
- $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-OH$ Propanoic acid
- $CH_3-(CH_2)_2-\overset{\overset{O}{\|}}{C}-OH$ Butanoic acid
- $H_3C-CH_2-CH_2-CH_2-\overset{\overset{O}{\|}}{C}-OH$ Pentanoic acid

Homologous series of carboxylic acid.

Calculation of number of σ bond and π bonds in the compound

σ bond :

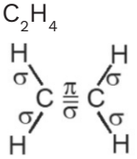
Ex. C_2H_6



⇒ 7 σ bonds

π bond :

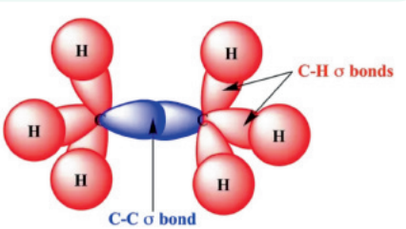
Ex. C_2H_4



⇒ 5 σ bond

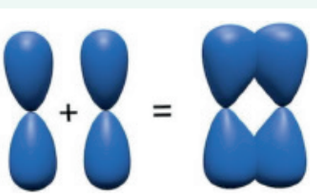
Introduction

- The first bond formed by atom is always σ bond. It is formed by axial overlapping. Single bonds are always σ bonds.



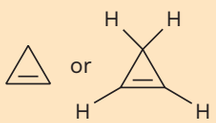
Introduction

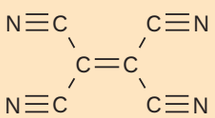
- If two atoms forms more than one bond between them except the first bond, rest all are π bonds. They are formed by sideways overlapping

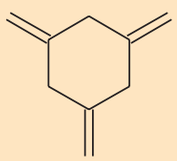


Q Find the number of bonds (σ bond and π bond) in following compounds :

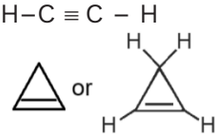
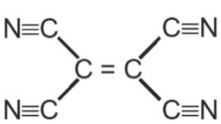
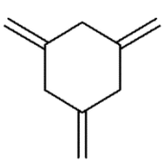
(i) H–C ≡ C – H

(ii) 

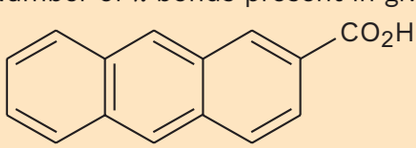
(iii) 

(iv) 

Sol

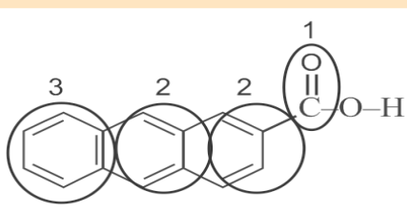
	Compound	σ bond	π bond
(i)	H–C ≡ C – H	3	2
(ii)		7	1
(iii)		9	9
(iv)		21	3

Q Number of π bonds present in given compound is

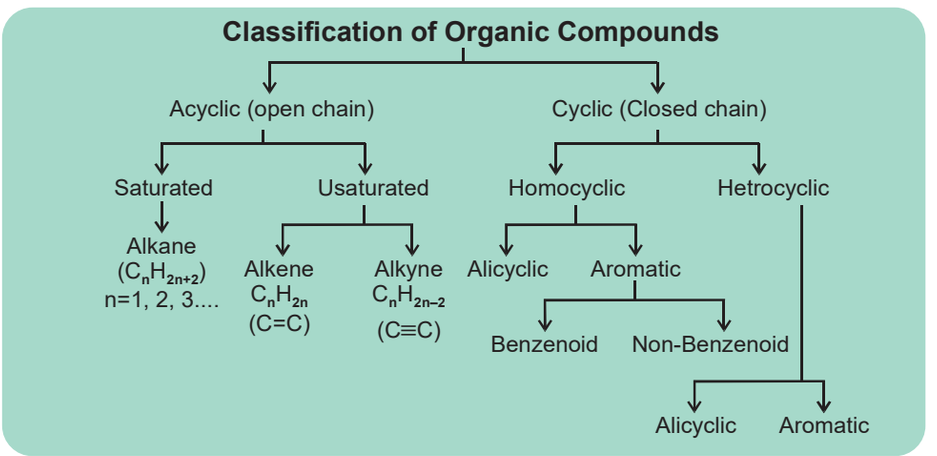


Number of π bonds present in given compound is :

Sol



3 + 2 + 2 + 1 = 8


Classification of Organic Compounds
Acyclic (open chain)
Cyclic (Closed chain)
Saturated
Usaturated
Homocyclic
Hetrocyclic
Alkane
(C_nH_{2n+2})
n=1, 2, 3....
Alkene
C_nH_{2n}
(C=C)
Alkyne
C_nH_{2n-2}
(C≡C)
Alicyclic
Aromatic
Benzenoid
Non-Benzenoid
Alicyclic
Aromatic

Nomenclature

Mainly three systems are adopted for naming an organic compound

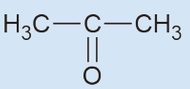
(i) Common names or Trivial system
(ii) Derived system
(ii) IUPAC system or Jeneva system

Trivial System :

Introduction

Initially organic compounds are named on the basis of source from which they were obtained for Some typical compounds in which common and trivial names are also differ.

S. NO.	ORGANIC COMPOUND	TRIVIAL NAME	SOURCE
1	CH_3OH	Wood spirit or Methyl spirit	Obtained by destructive distillation of wood
2	NH_2CONH_2	Urea	Obtained from urine
3	CH_4	Marsh gas (fire damp)	It was produced in marshy places
4	CH_3COOH	Vinegar	Obtained from Acetum –i.e. Vinegar
5	$\begin{matrix}COOH\\\vert\\COOH\end{matrix}$	Oxalic acid	Obtained from oxalis plant
6	HCOOH	Formic acid	Obtained from formicus [Red ant]
7	$H_3C-\underset{\underset{OH}{\vert}}{CH}-COOH$	Lactic acid	Obtained from sour mild
8	$\begin{matrix}H_2C-COOH\\\vert\\CH(OH)COOH\end{matrix}$	Malic acid	Obtained from apples
9	$CH_3CH_2CH_2COOH$	Butyric acid	Obtained from butter
10	$CH_3(CH_2)_4COOH$	Caproic acid	Obtained from goats

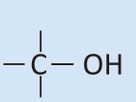
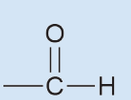
S.NO.	ORGANIC COMPOUND	TRIVIAL NAME	SOURCE (COMMON NAME)
1	CH_4	Marsh gas	Methane
2	CH_3OH	Wood spirit	Methyl alcohol
3	CH_3COOH	Vinegar	Acetic acid
4		Acetone	Dimethyl ketone

Derived System

- This system is reserved for the following nine homologous series.

Definition

- According to this system any compound is given name according to the parent name of the homologous series.

S. NO.	NAME OF HOMOLOGOUS SERIES	DERIVED NAME	STRUCTURE OF GROUP
1	Alkane	Methane	
2	Alkene	Ethylene	> C = C <
3	Alkyne	Acetylene	– C ≡ C –
4	Alkanol	Carbinol	
5	Alkanal	Acetaldehyde	

IUPAC system of Nomenclature

- International union of pure and applied chemistry.
- IUPAC system for naming is something that is very similar to addressing a person with his complete designation.

Definition

- According to IUPAC naming of organic compounds have some standard process may be called naming method in which anything about naming of molecule in a systematic way.

⇓	⇓	⇓
Dr.	**Abdul**	**Kalam**
(Prefix)	Main name	Surname

Systematic IUPAC name follow **SPWPS** rule

S	P	W	P	S
⇓	⇓	⇓	⇓	⇓
Secondary prefix	Primary prefix	Word root	Primary suffix	Secondary suffix

Secondary prefix

- It defines substituent & position of substituent.
- IUPAC considers following given groups as substituents :

1. –R ⇒ alkyl

Examples :

$-CH_3$	⇒	methyl
$-CH_2CH_3$	⇒	ethyl
$-CH_2CH_2CH_3$	⇒	propyl
$-CH_2CH_2CH_2CH_3$	⇒	butyl
–Ph	⇒	phenyl

2. –OR ⇒ alkoxy

Examples :

$-OCH_3$	⇒	methoxy
$-OC_2H_5$	⇒	ethoxy
$-OCH_2CH_2CH_3$	⇒	propoxy
–OPh	⇒	phenoxy

3. –X ⇒ Halo

Examples :

–F	⇒	Fluoro
–Cl	⇒	Chloro
–Br	⇒	Bromo
–I	⇒	Iodo

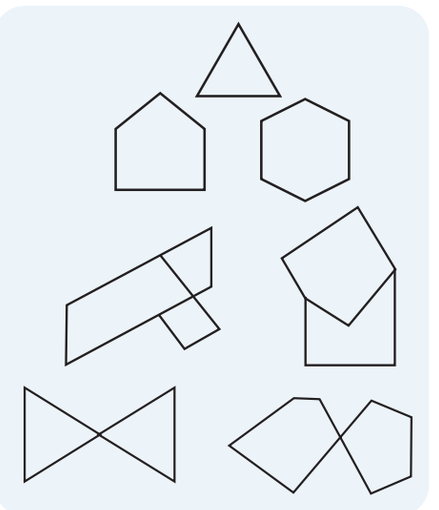
4. $-NO_2$ ⇒ Nitro

5. –NO ⇒ Nitroso

6. $-N_3$ ⇒ Azido

Primary prefix

- A primary prefix is used simply to distinguish cyclic from acyclic compounds.
- A primary prefix, cyclo is used immediately before the word root.
- It defines nature of parent carbon chain.
- Open chain (alicyclic) ⇒
- Closed chain (cyclic) ⇒ Cyclo
- Bicyclic ⇒ Bicyclo
- Spirane ⇒ Spiro



Word Root

- It is the basic unit of the name. It denotes the number of carbon atoms present in the principal chain (the longest possible continuous chain of carbon atoms including the functional group and based upon the common names of alkanes) of the organic molecules.

According to number of carbon's in parent C–chain.

$C_1 \rightarrow$ meth	$C_{11} \rightarrow$ undec
$C_2 \rightarrow$ eth	C12 $\rightarrow$ dodec
$C_3 \rightarrow$ prop	$C_{13} \rightarrow$ tridec
$C_4 \rightarrow$ but	:
$C_5 \rightarrow$ pent	:
$C_6 \rightarrow$ hex	$C_{20} \rightarrow$ eicos
$C_7 \rightarrow$ hept	:
$C_8 \rightarrow$ oct	:
$C_9 \rightarrow$ non	:
$C_{10} \rightarrow$ dec	$C_{100} \rightarrow$ hect

Primary Suffix

- A primary suffix is always added to the word root to indicate whether the carbon chain is saturated or unsaturated.
- The three basic primary suffixes are given below :

S.NO.	TYPE OF CARBON CHAIN	PRIMARY SUFFIX	GENERAL NAME
1	(a) Saturated	-ane	Alkane
2	(b) Unsaturated with one double bond	-ene	Alkene
3	(c) Unsaturated with one triple bond	-yne	Alkyne

Compound	2° prefix	1° prefix	Word root	1° suffix	2° suffix	IUPAC name
$CH_3CH_2CH_3$	–	–	prop	ane	–	Propane
$CH_3–CH = CH_2$	–	–	prop	ene	–	Propene
$CH_3–C \equiv CH$	–	–	prop	yne	–	Propyne
$HC \equiv CH$	–	–	eth	yne	–	Ethyne
	–	cyclo	but	ane	–	Cyclobutane
	–	cyclo	but	ene	–	Cyclobutene
	–	cyclo	oct	yne	–	Cyclooctyne

- If the parent carbon chain contain two, three or more double or triple bond, numerical prefix such as di (for two), tri (for three), tetra (for four) etc. are added to the primary suffix.
For example.

S.NO.	TYPE OF CARBON CHAIN	PRIMARY SUFFIX	GENERAL NAME
1	(a) Unsaturated with one double bond	-diene	Alkadiene
2	(b) Unsaturated with one triple bond	-diyne	Alkadiyne

Secondary Suffix

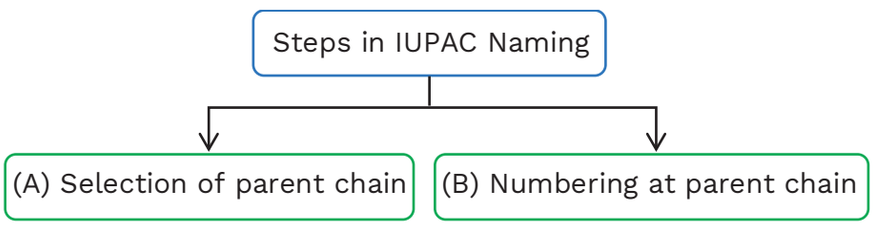
- A secondary suffix is always added to the primary suffix to indicate the nature of the functional group present in the organic compounds. Secondary suffix of some important functional groups are given below :

S.NO.	CLASS OF ORGANIC COMPOUNDS	FUNCTIONAL GROUP
1	Alcohols	–OH
2	Aldehydes	–CHO
3	Ketones	>C=O
4	Carboxylic acids	–COOH
5	Acid amides	$-CONH_2$
6	Acid chlorides	–COX
7	Esters	–COOR
8	Nitriles	–CN
9	Thioalcohols	–SH
10	Amines	$-NH_2$

Note :

- We will discuss secondary suffix in `detail after mono functional group naming.

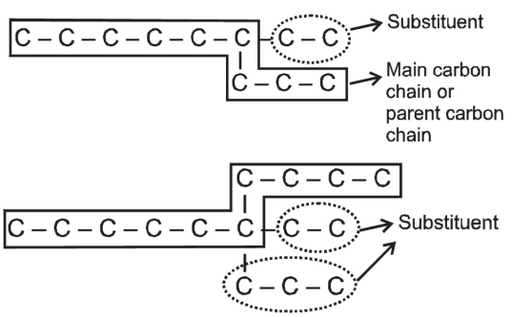
Nomenclature of Alkane



Rule-1 :

- Select the longest carbon chain containing maximum number of carbon and this longest carbon chain is also called parent carbon chain (PCC).
- Longest carbon chain not always straight.

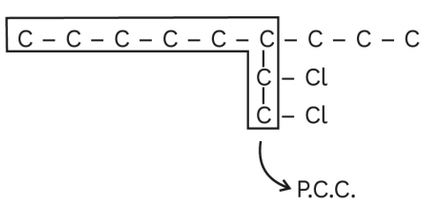
Eg. :

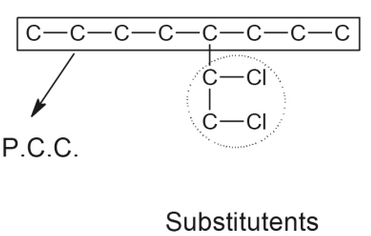


Rule-2 :

- If two or more carbon chain contains same number of carbon then PCC is considered which has more number of substituents.

Eg. :





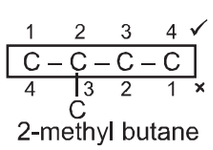
Rule-3 :

- Numbering of parent carbon chain is done by lowest locant rule.

Lowest Locant Rule :

- According to this rule numbering is done in such a way so that substituent will get lowest number.

Eg. :



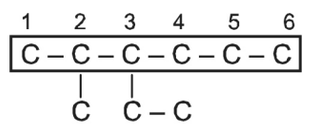
Note :

- In IUPAC naming numbers of substituent will be separated by (,) comma and number & alphabet is separated by ('–') hyphen.
-

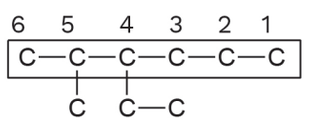
Rule-4 :

- If two or more different substituents are present at parent carbon chain then numbering is done according to lowest locant rule while writing IUPAC name follow alphabetical order.

Eg. :



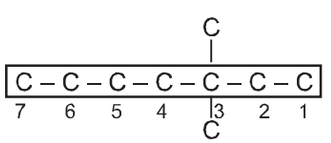
* 3-ethyl-2-methyl hexane



Rule-5 :

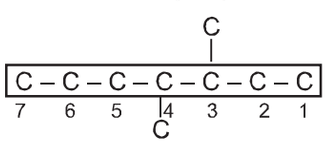
If two or more similar substituents are present on parent carbon chain then use di, tri, tetra etc. before 2° prefix while writing IUPAC name but di, tri, tetra, etc. are not considered alphabetically.

Eg. : (1)



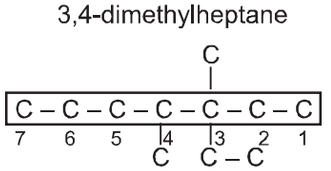
3,3-dimethylheptane

(2)



3,4-dimethylheptane

(3)

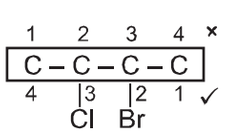


3-ethyl-3,4-dimethylheptane

Rule-6 :

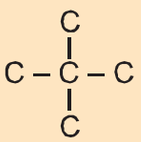
- If two or more substituents are present on parent carbon chain and they get same number from either side during numbering then numbering is done by alphabetical order.

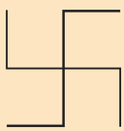
Eg. :

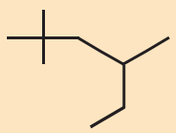


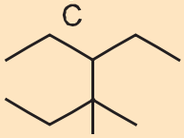
2-bromo-3-chlorobutane

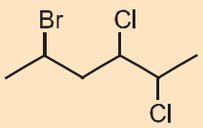
Q

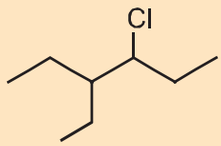
1. 

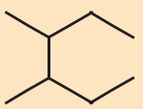
2. 

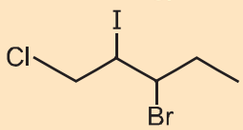
3. 

4. 

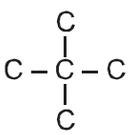
5. 

6. 

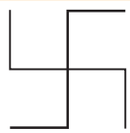
7. 

8. 

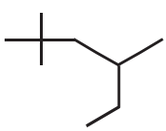
Sol

1. 

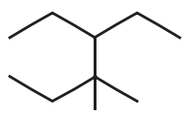
2,2-dimethylpropane

2. 

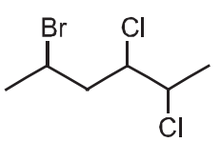
3,3-diethylpentane

3. 

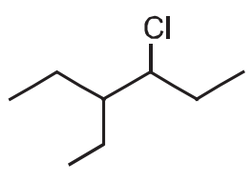
2,2,4-trimethylhexane

4. 

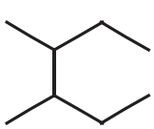
4-ethyl-3,3-dimethylhexane

5. 

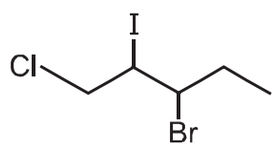
5-bromo-2,3-dichlorohexane

6. 

3-chloro-4-ethylhexane

7. 

3,4-dimethylhexane

8. 

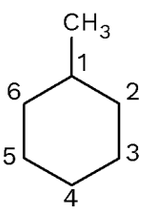
3-bromo-1-chloro-2-iodopentane

Nomenclature of cyclic alkane

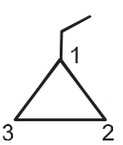
Rule :

- The cyclic structure or ring is considered as P.C.C. till the number of carbon in the ring is same or greater than number of carbon in chain.
- Rest all rules are similar as nomenclature of alkane.

Examples :

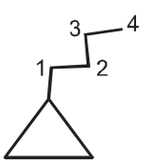
1. 

→ 1-methylcyclohexane

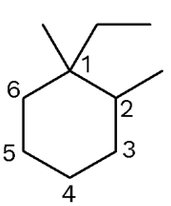
2. 

→ 1-ethylcyclopropane ‘or’ ethylcyclopropane

3. 
→ Propylcyclopropane

4. 

→ 1-cyclopropylbutane

5. 

→ 1-ethyl-1,2-dimethylhexane

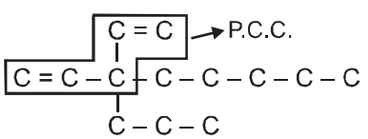
Nomenclature of Alkene & Alkyne

Rule-1 :

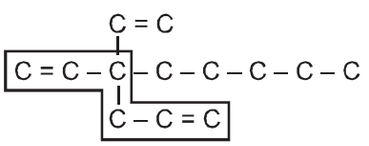
Parent carbon chain selection :

- Select the longest carbon chain containing maximum number of multiple bonds.
- If two chains having same number of multiple bonds then check maximum number of carbons to select parent carbon chain.
- If multiple bonds & carbon both are same then see maximum number of substituent to select parent carbon chain.
- Number of multiple bond > Number of carbon > Number of substituent (priority order)

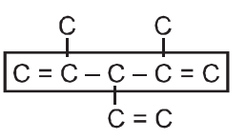
EXAMPLE-1 :



EXAMPLE-2 :



EXAMPLE-3 :

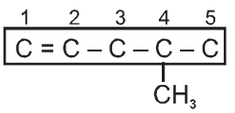


Rule-2 :

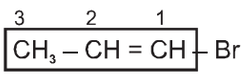
Numbering of parent carbon chain :

- While doing numbering in alkene and alkyne minimum number should be given to multiple bond.
- If multiple bond getting same number from either side then give minimum number to substituent.
- For numbering multiple bond priority is high compare to substituent

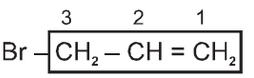
Examples :

1. 

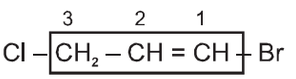
4-methylpent-1-ene
2° prefix | Word root | 1° suffix

2. 

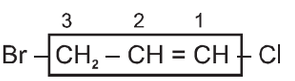
1-bromoprop-1-ene

3. 

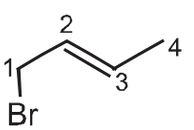
3-bromoprop-1-ene

4. 

1-bromo-3-chloroprop-1-ene

5. 

3-bromo-1-chloroprop-1-ene

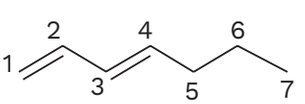
6. 

1-bromobut-2-ene

Rule–3 :

If two or more similar multiple bonds are present on PCC then use di, tri, tetra etc. before 1° suffix and before this di, tri, tetra etc. 'a' should be written.

Examples :

1. 

Hepta-1,3-diene

2. 

Penta-1,4-diene

Rule–4 :

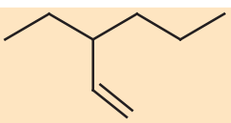
If in parent carbon chain alkene and alkyne both are present and they are getting same number from either side i.e. in between alkene and alkyne) then numbering is done from alkene side because alphabetically ene > yne.

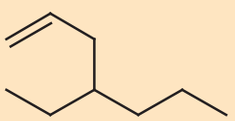
Examples :

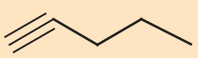
1. $\overset{1}{CH_2} = \overset{2}{CH} - \overset{3}{CH_2} - \overset{4}{C} \equiv \overset{5}{CH}$ Pent-1-en-4-yne

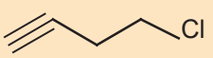
2. $\overset{1}{CH_3} - \overset{2}{CH} = \overset{3}{CH} - \overset{4}{CH_2} - \overset{5}{C} \equiv \overset{6}{C} - \overset{7}{CH_3}$ Hept-2-en-5-yne

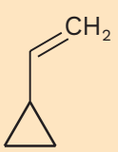
Q

1. 

2. 

3. 

4. 

5. 

6. **Br – C ≡ C – CH_2 – CH_3**

7. **CH_3 – C ≡ C – CH_2 – CH = CH_2**

Sol

1. 3-ethylhex-1-ene

2. 4-ethylhept-1-ene

3. 4-chlorobut-1-yne

4. Buta-1,3-diyne

5. 1-cyclopropyleth-1-ene

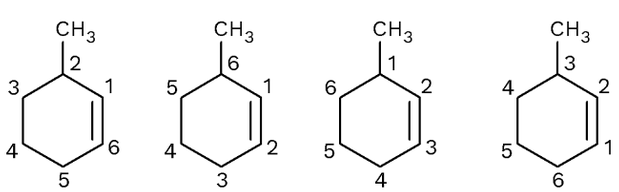
6. 1-bromobut-1-yne

7. Hex-1-en-4yne

Nomenclature of cyclic alkene

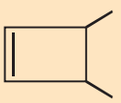
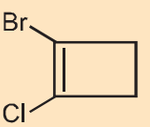
Rule :

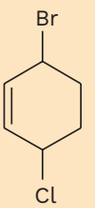
All rules are similar to alkene & alkyne but during numbering 1 number is always given to alkene.

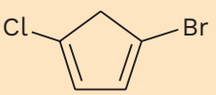


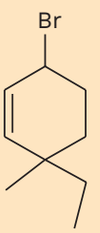
× × × ✓

3-methylcyclohex-1-ene

Q **1.**  **2**  **3.** 

4. 

5. 

6. 

Sol **1.** 3,4-dimethylcyclobut-1-ene

2. 1,4-dimethylcyclobut-1-ene

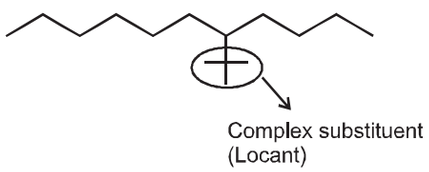
3. 1-bromo-2-chlorocyclobut-1-ene

4. 3-bromo-6-chlorocyclohex-1-ene

5. 1-bromo-4-chlorocyclopenta-1,3-diene

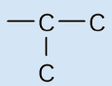
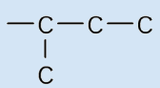
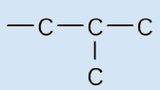
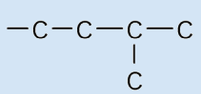
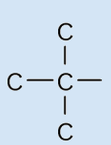
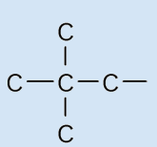
6. 6-bromo-3-ethyl-3-methylcyclohex-1-ene

Nomenclature of Complex Locant



Definition

Complex locant is defined as which consist of substituent in substituent.

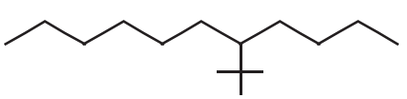
S.NO.	COMPLEX LOCANT	COMMON NAME	IUPAC NAME
1		Iso propyl	1-methyl ethyl
2		Sec-butyl	1-methyl propyl
3		Iso-butyl	2-methyl propyl
4		Iso-pentyl	3-methyl butyl
5		Tert-butyl	1,1-dimethyl ethyl
6		Neo pentyl	2,2-dimethyl propyl

NOTE :

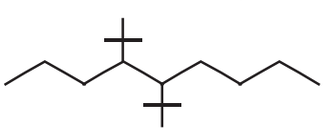
- Complex locant are written in square brackets [ ]
- In complex locant di, tri, tetra etc. should be considered in alphabetical order. iso, neo, sec. are also considered in alphabetic order.
- IUPAC name will be preferred over common name.
- If two similar complex locant are present then use bis, tris, tetrakis etc.

[di = bis, tri = tris, tetra = tetrakis]

Examples :

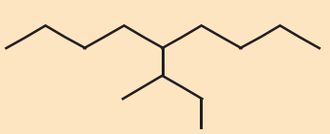


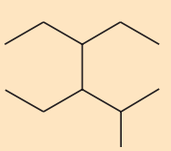
5-[1,1-dimethylethyl]undecane

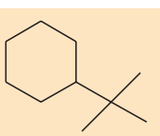


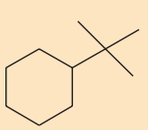
4,5-bis [1,1-dimethylethyl]nonane

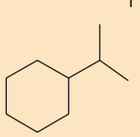
Q

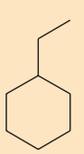
1. 

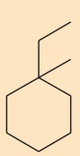
2. 

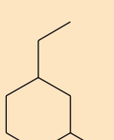
3. 

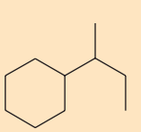
4. 

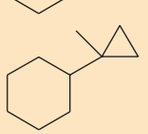
5. 

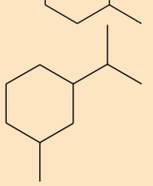
6. 

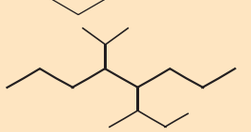
7. 

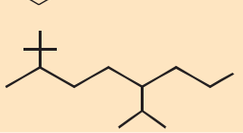
8. 

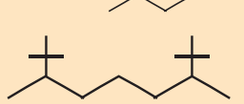
9. 

10. 

11. 

12. 

13. 

14. 

Sol

1. 5-[1-methylpropyl]nonane
2. 3,4-diethyl-2-methylhexane
3. 3-ethyl-2,2 dimethylhexane
4. 1-[1,1-dimethylethyl]cyclohexane
5. 1-[1-methylethyl]cyclohexane
6. 1-ethylcyclohexane
7. 1-ethyl-1-methylcyclohexane
8. 1-ethyl-3-methylcyclohexane
9. 1-[1-methylpropyl]cyclohexane
10. 1-[1-methylcyclopropyl]cyclohexane
11. 1-cyclopropyl-3[1-methylethyl]cyclohexane
12. 3-methyl-5-[1-methylethyl]-4-propyl-octane
13. 2,2,3-trimethyl-6[1-methylethyl]nonane
14. 2,2,3,7,8,8-hexamethylnonane

Substitutent Consist of Multiple Bond

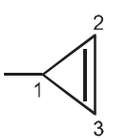
1. If substituent having double bond :
2° prefix / secondary prefix alkenyl

Examples :

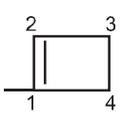
(i) $-\overset{1}{C}H=\overset{2}{C}H_2$ ethenyl

(ii) $-CH=CH-CH_3$ prop-1-enyl

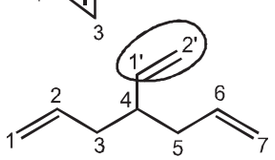
(iii) $-CH_2-CH=CH_2$ prop-2-enyl

(iv) 

cycloprop-2-enyl

(v) 

cyclobut-1-enyl

(vi) 

4-ethenylhepta-1,6-diene

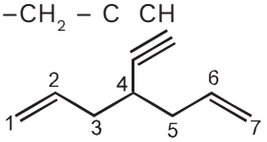
2. If substituent having triple bond :
2° prefix alkynyl

Examples :

(i) $-C\equiv CH$ ethynyl

(ii) $-C\equiv C-CH_3$ prop-1-ynyl

(iii) $-CH_2-C\equiv CH$ prop-2-ynyl

(iv) 

4-ethynylhepta-1,6-diene

3. If substituent attached to parent carbon chain by multiple bond :
2° prefix ⇒ alkylidene

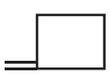
Examples :

(i) $= CH_2$ Methylene or methylidene only for this

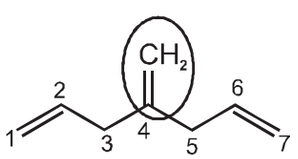
(ii) $= CH-CH_3$ Ethylidene

(iii) $= CH-CH_2-CH_3$ Propylidene

(iv)  Cyclopropylidene

(v)  Cyclobutylidene

Example :



4-methylenehepta-1,6-diene

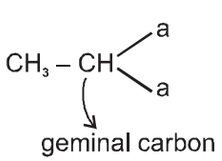
'or'

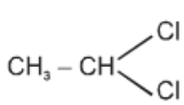
4-methylidenehepta-1,6-diene

Note :

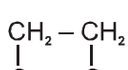
1. $CH_2=CH_2$ vinyl $CH_2 = CH -$ (vinylic carbon)

2. $CH_3-CH=CH_2$ allyl $CH_2=CH-CH_2-$ (allylic carbon)

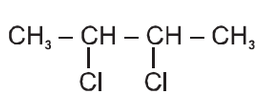
3. 

Example : 

gem-dichloride

4. 

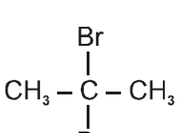
vicinal (vic)

Example : 

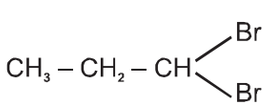
vicinaldichloride

Q $C_3H_6Br_2$, How many gem dibromide are possible and how many vicinal dibromide are possible ?

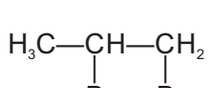
Sol



Geminal



Geminal

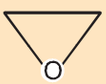


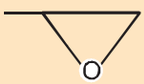
Vicinal

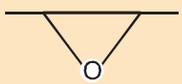
Nomenclature of Epoxy

2° prefix - epoxy

Q

1. 

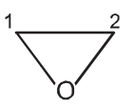
2. 

3. 

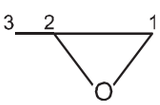
4. 

5. 

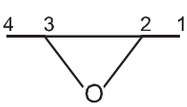
Sol

1. 

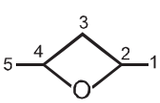
1, 2-epoxyethane

2. 

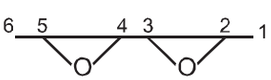
1, 2-epoxypropane

3. 

2,3-epoxybutane

4. 

2,4-epoxypentane

5. 

(2,3), (4,5)-diepoxyhexane

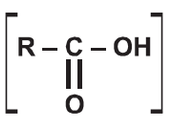
IUPAC Naming of Functional Groups

IUPAC Naming of Functional Groups

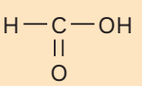
1. Carboxilic Acid
2. Sulphonic Acid
3. Acid Anhydride
4. Ester

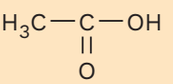
1. Nomenclature of Carboxylic Acid

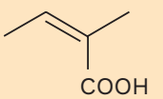
2° suffix oic acid

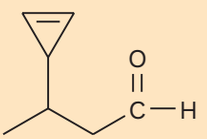


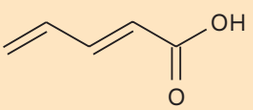
Q

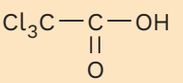
1. 

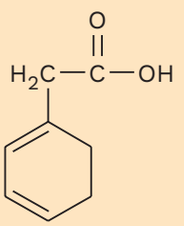
2. 

3. 

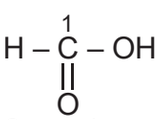
4. 

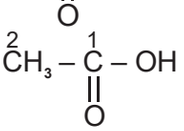
5. 

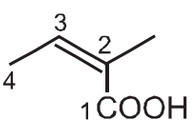
6. 

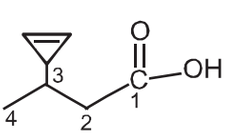
7. 

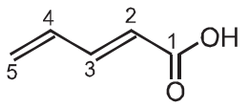
Sol

1.  Methanoic acid

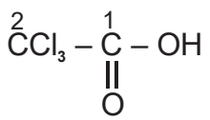
2.  Ethanoic acid

3.  2-methylbut-2-en-oic acid

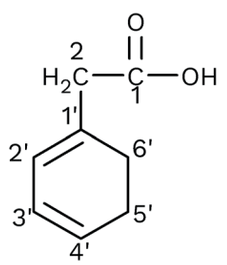
4.  3[cycloprop-2-enyl]butanoic acid

5. 

Penta-2,4-dienoic acid

6. 

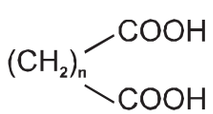
2,2,2-trichloroethanoic acid

7. 

2-[cyclohexa-1,3 dienyl]ethanoic acid

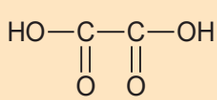
Nomenclature of Dicarboxylic Acid

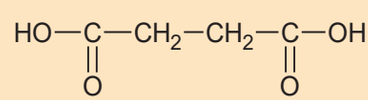
General molecular formula :

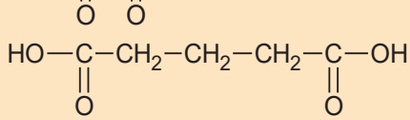


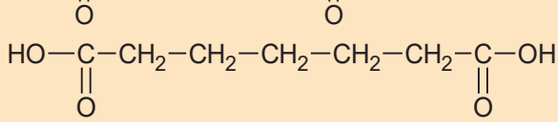
N ⇒ 0	1	2	3	4	5	6
O	M	S	G	A	P	S
Oxalic acid	Malonic acid	Succinic acid	Glutaric acid	Adipic acid	Pimelic acid	Suberic acid

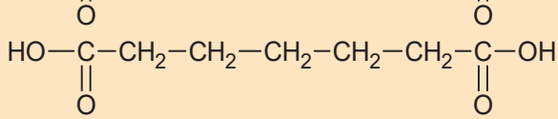
Q

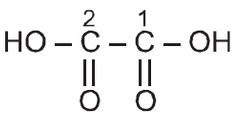
1. 

2. 

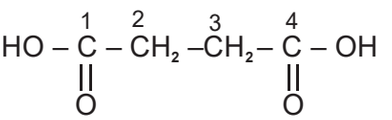
3. 

4. 

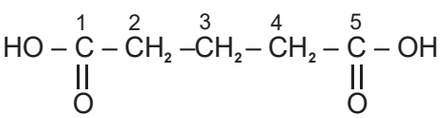
5. 

Sol **1.** 

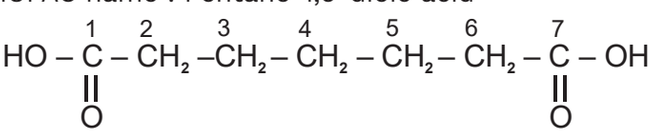
Common name : Oxalic acid
IUPAC name : Ethane-1,2-dioic acid

2. 

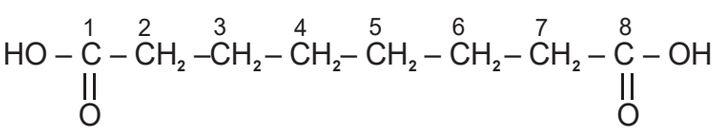
Common name : Succinic acid
IUPAC name : Butane-1,4-dioicacid

3. 

Common name : Glutaric acid
IUPAC name : Pentane-1,5-dioic acid

4. 

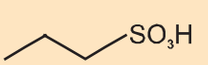
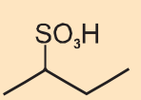
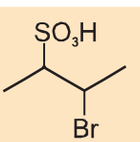
Common name : Pimelic acid
IUPAC name : Hetpane-1,7-dioic acid

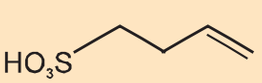
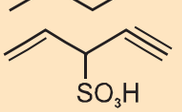
5. 

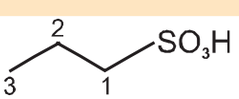
Common name : Suberic acid
IUPAC name : Octane-1,8-dioic acid

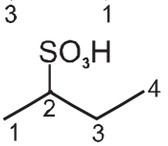
2. Nomenclature of Sulphonic Acid

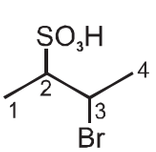
2° suffix Sulphonic acid

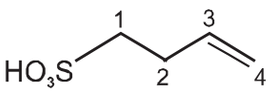
Q **1.**  **2.**  **3.** 

4.  **5.** 

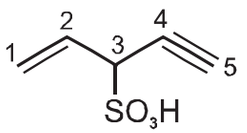
Sol **1.**  Propane-1-sulphonic acid

2.  Butane-2-sulphonic acid

3.  3-bromobutane-2-sulphonic acid

4. 

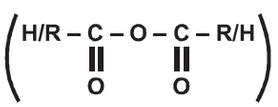
But-3-ene-1-sulphonic acid

5. 

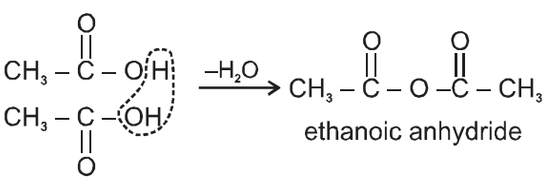
Pent-1-en-4-yne-3-sulphonic acid

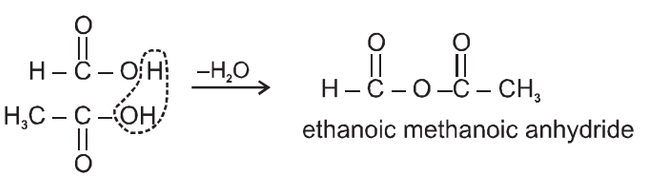
3. Nomenclature of Anhydride

2° suffix oic anhydride

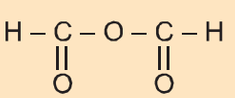


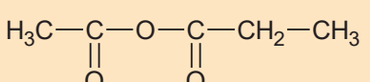
Examples :

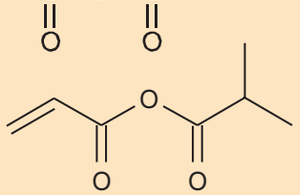
1. 

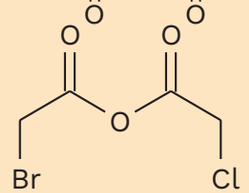
2. 

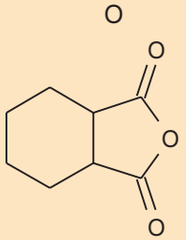
Q

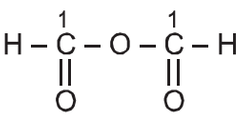
1. 

2. 

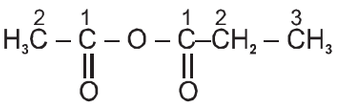
3. 

4. 

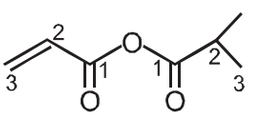
5. 

Sol **1.** 

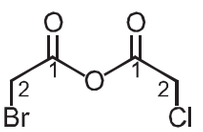
Methanoicanhydride

2. 

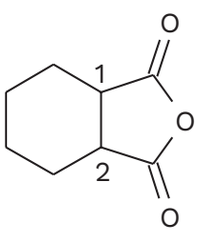
Ethanoicpropanoicanhydride

3. 

2-methylpropanoic-prop-2-enoic anhydride

4. 

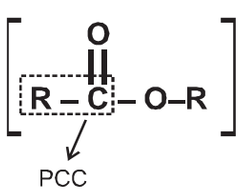
2-bromoethanoic-2-chloroethanoic anhydride

5. 

Cyclohexane-1,2-dicarboxylic anhydride

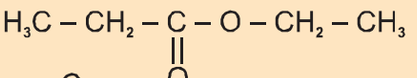
4. Nomenclature of Ester

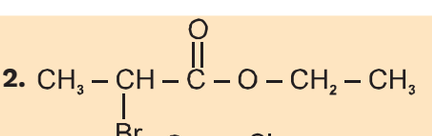
2° suffix oate

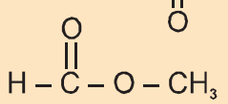


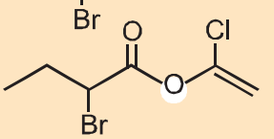
IUPAC name : alkylalkanoate

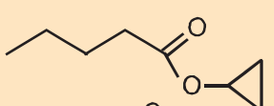
Q

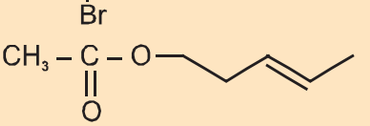
1. 

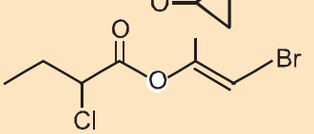
2. 

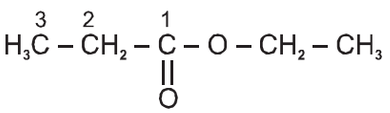
3. 

4. 

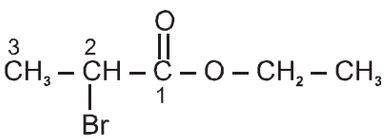
5. 

6. 

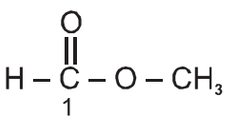
7. 

Sol **1.** 

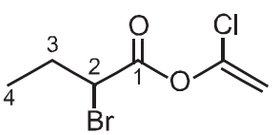
Ethylpropanoate

2. 

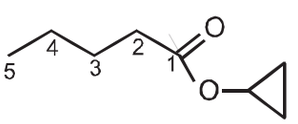
Ethyl-2-bromopropanoate

3. 

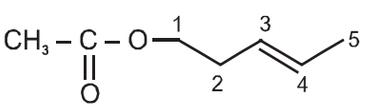
Methylmethanoate

4. 

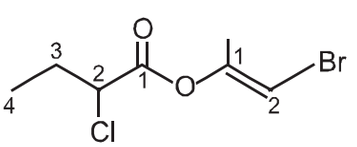
[1-chloroethenyl]-2-bromobutanoate

5. 

Cyclopropylpentanoate

6. 

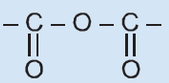
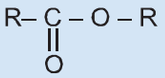
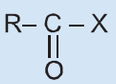
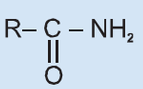
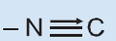
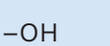
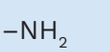
Pent-3-enylethanoate

7. 

2-bromo-1-methyleth-1-eyl-2-chlorobutanoate

Priority List of Functional Group

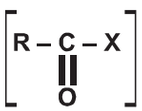
S.NO.	FUNCTIONAL GROUP	2° PREFIX	2° SUFFIX
1	– COOH	carboxylic acid	oic acid
2	– SO_3H	sulpho	sulphonic acid

3		–	oic anhydride
4		Alkanoyl oxy or alkoxy carbonyl	oate
5		halo formyl	oylhalide
6		carbamoyl	amide
7		cyano	nitrile
8		isocyano	isonitrile
9		3 or 4	al
10		keto/oxo	one
11		hydroxy	ol
12		sulphonyl/ mercapto	thiol
13		amino	amine
14		epoxy	–

IUPAC Naming of Functional Groups

Nomenclatue of Acid Halide

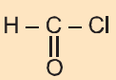
2° suffix : oyl halide

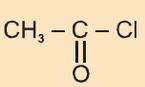


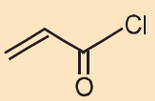
Let's understand

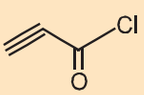
1. Acid Halide
2. Amide
3. Cyanide
4. Aldehyde
5. Ketone

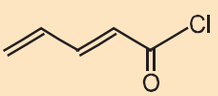
Q

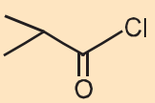
1. 

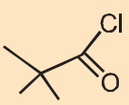
2. 

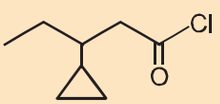
3. 

4. 

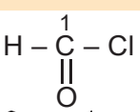
5. 

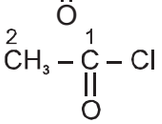
6. 

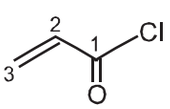
7. 

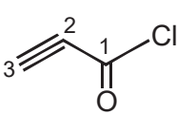
8. 

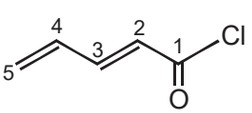
Sol

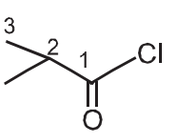
1.  Methanoylchloride

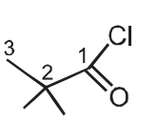
2.  Ethanoylchloride

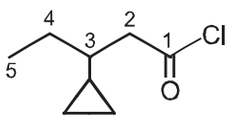
3.  Prop-2-en-1-oylchloride

4.  Prop-2-yn-1-oylchloride

5.  Penta-2,4-dien-1-oylchloride

6.  2-methylpropan-1-oylchloride

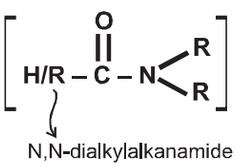
7.  2,2-dimethylpropan-1-oylchloride

8. 

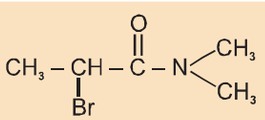
3-cyclopropylpentan-1-oylchloride

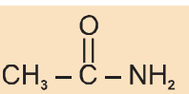
Nomenclatue of Amide

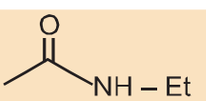
2° suffix : amide

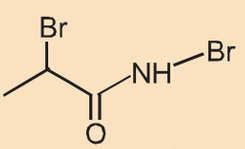


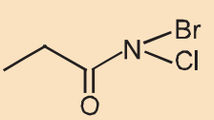
Q

1. 

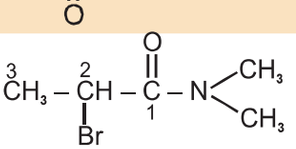
2. 

3. 

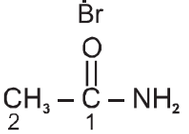
4. 

5. 

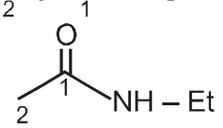
Sol

1. 

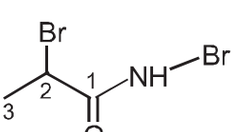
2-bromo-N,N-dimethylpropanamide

2. 

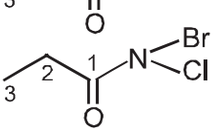
Ethanamide

3. 

N-ethylethanamide

4. 

N, 2-dibromopropanamide

5. 

N-bromo-N-chloropropanamide

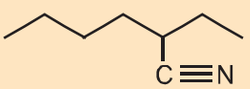
Nomenclature of Cyanide (R–CN)

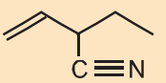
2° suffix nitrile

Q

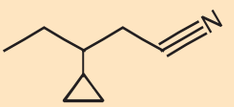
1. $CH_3 - C \equiv N$

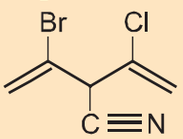
2. 

3. 

4. 

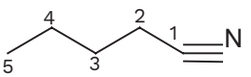
5. $CH_2=CH-CN$

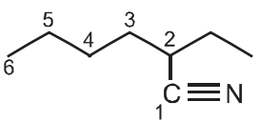
6. 

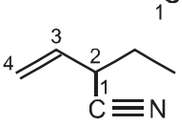
7. 

Sol

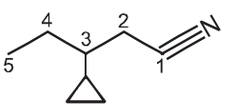
1. $CH_3 - C \equiv N$ — Ethanenitrile

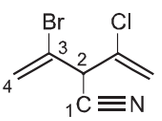
2. 
 — Pentanenitrile

3. 
 — 2-ethylhexanenitrile

4. 
 — 2-ethylbut-3-ene-1-nitrile

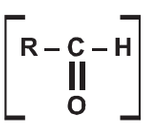
5. $\overset{5}{CH_2} = \overset{4}{CH} - \overset{3}{C} \equiv \overset{2}{C} - \overset{1}{C} \equiv N$ — Pent-4-en-2-yne-1-nitrile

6. 
 — 3-cyclopropylpentanenitrile

7. 
 — 3-bromo-2-[1-chloroethenyl]-but-3-enenitrile

Nomenclature of Aldehyde

2° suffix al



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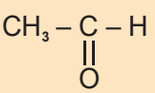
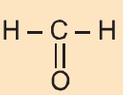
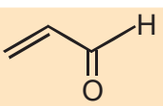
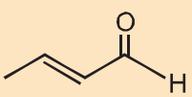
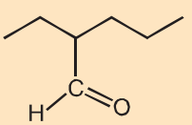
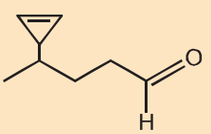
1. 

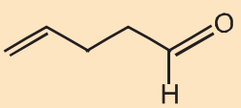
2. 

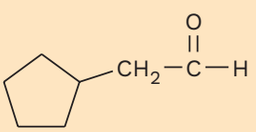
3. 

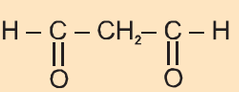
4. 

5. 

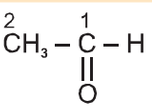
6. 

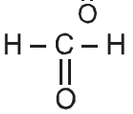
7. 

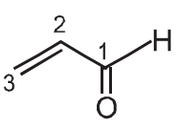
8. 

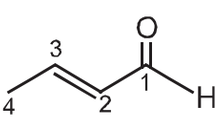
9. 

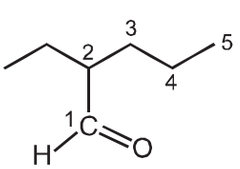
Sol

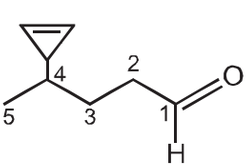
1.  Ethanal

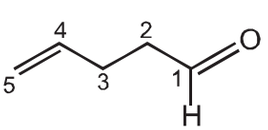
2.  Methanal

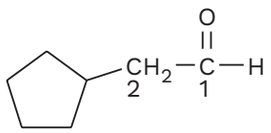
3.  Prop-2-en-1-al

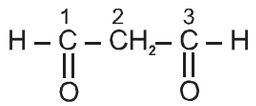
4.  But-2-en-1-al

5.  2-ethylpent-1-al

6.  4-[cyclolprop-2-enyl]pentan-1-al

7.  Pent-4-en-1-al

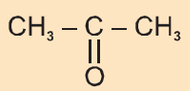
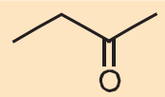
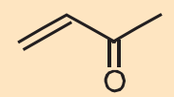
8.  2-cyclopentylethan-1-al

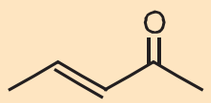
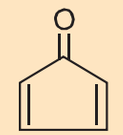
9.  Propan-1,3-dial

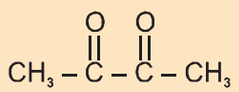
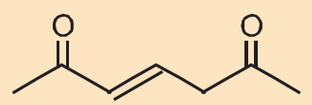
Nomenclature of Ketone

2° suffix one

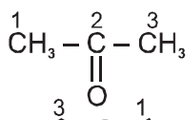
Q

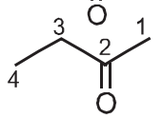
1.  **2.**  **3.** 

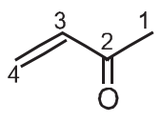
4.  **5.**  **6.** 

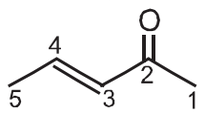
7.  **8.** 

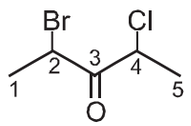
Sol

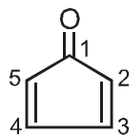
1.  Propan-2-one

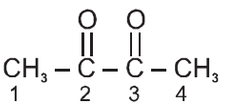
2.  Butan-2-one

3.  But-3-en-2-one

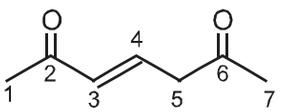
4.  Pent-3-en-2-one

5.  2-bromo-4-chloropentan-3-one

6.  Cyclopenta-2,4-dien-1-one

7. 

Butane-2,3-dione

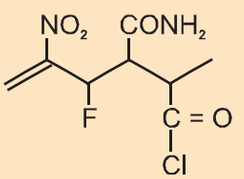
8. 

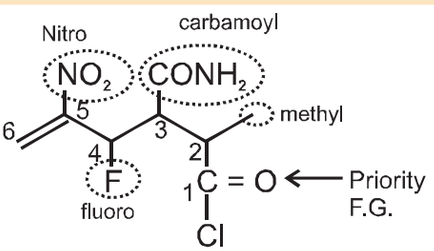
Hept-3-en-2,6-dione

IUPAC Naming of Polyfunctional Groups

Subjective Problems

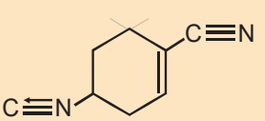
Q1 **Write down the correct IUPAC name of given compound :**

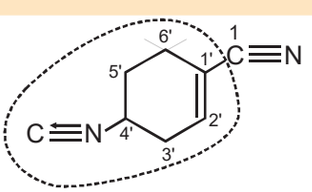


Sol 

3-carbamoyl-4-fluoro-2-methyl-5-nitrohex-5-enoylchloride

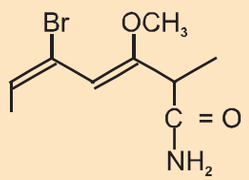
Q2 **Write down the correct IUPAC name of given compound :**



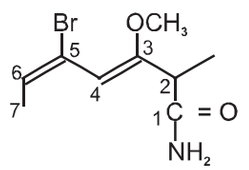
Sol 

1-[4'-isocyanocyclohexene]methanenitrile

Q3 Write down the correct IUPAC name of given compound :

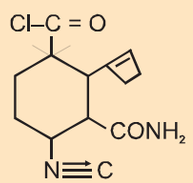


Sol

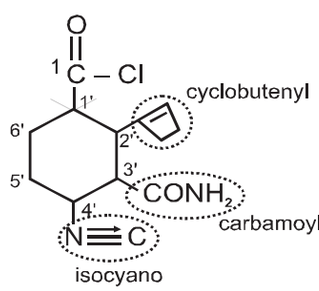


5-bromo-3-methoxy-2-methylhepta-3,5-dienamide

Q4 **Write down the correct IUPAC name of given compound :**

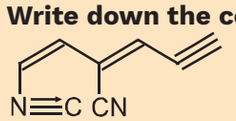


Sol

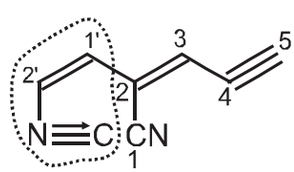


3'-carbamoyl-2-cyclobutenyl-4'-isocyanocyclohexanoylchloride

Q5 **Write down the correct IUPAC name of given compound :**

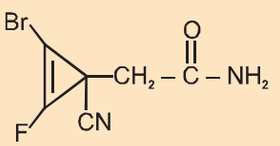


Sol

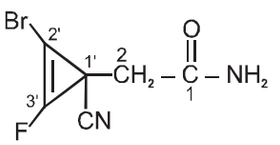


2-[2'-isocyanoethenyl]pent-2-en-4-ynenitrile

Q6 **Write down the correct IUPAC name of given compound :**



Sol



2-[2'-bromo-1'-cyano-3'-fluorocycloprop-2-enyl] ethanamide

IUPAC Naming of Alcohol and Amine

Nomenclatue of Alcohol (R–OH)

Secondary suffix – 'ol'

Rule-1 :

Select longest carbon chain containing

1. Functional group
2. Multiple bond
3. Locant / substituent

Priority : (i) > (ii) > (iii)

Rule-2 :

While numbering, functional group is given more preference over multiple bonds.

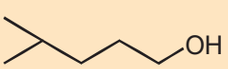
Priority :

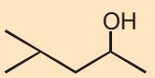
Functional group > Multiple bond > Substituents

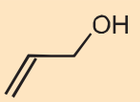
Let's understand

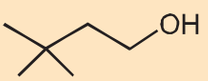
IUPAC Naming of
1. Alcohol
2. Amine

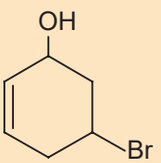
Q

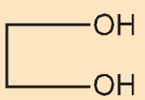
1. 

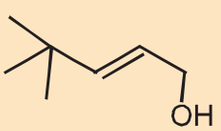
2. 

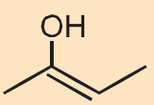
3. 

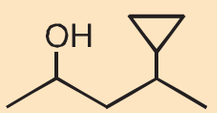
4. 

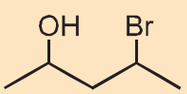
5. 

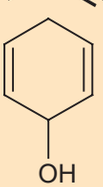
6. 

7. 

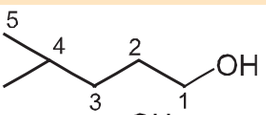
8. 

9. 

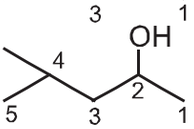
10. 

11. 

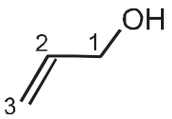
Sol

1. 

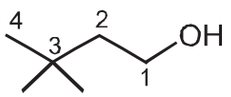
4-methylpentan-1-ol

2. 

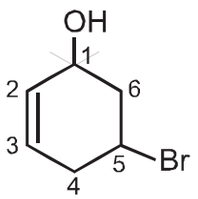
4-methylpentan-2-ol

3. 

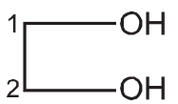
Prop-2-ene-1-ol

4. 

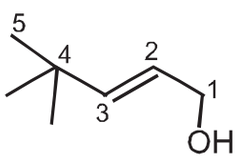
3,3-dimethylbutan-1-ol

5. 

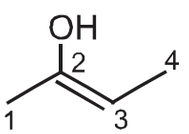
5-bromocyclohex-2-en-1-ol

6. 

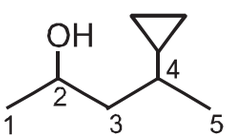
Ethan-1,2-diol

7. 

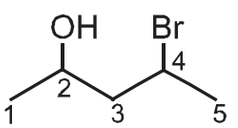
4,4-dimethylpent-2-en-1-ol

8. 

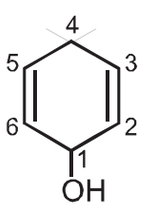
But-2-en-2-ol

9. 

4-cyclopropylpentan-2-ol

10. 

4-bromopentan-2-ol

11. 

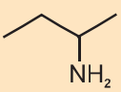
Cyclohexa-2,5-dien-1-ol

Nomenclature of Amine [R – NH_2]

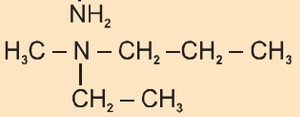
2° suffix amine

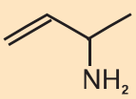
Q

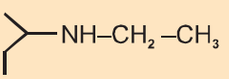
1. $CH_3 - NH_2$

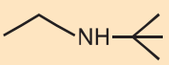
2. 

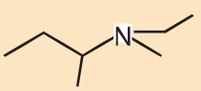
3. $CH_3 - NH - CH_2 - CH_3$

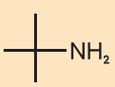
4. 

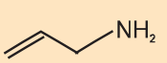
5. 

6. 

7. 

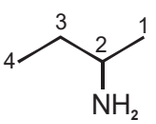
8. 

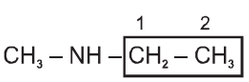
9. 

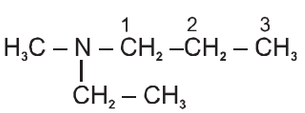
10. 

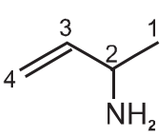
Sol

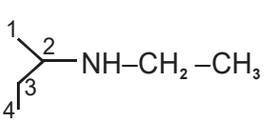
1. $CH_3 - NH_2$ — Methanamine

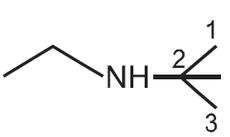
2.  — Butan-2-amine

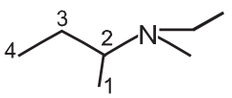
3.  — N-methylethanamine

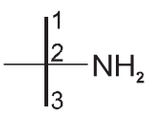
4.  — N-ethyl-N-methylpropan-1-amine

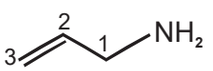
5.  — But-3-en-2-amine

6.  — N-ethylbutan-2-amine

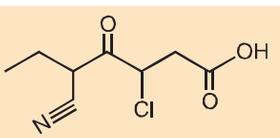
7.  — N-ethyl-2-methylpropan-2-amine

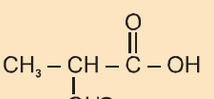
8.  N-ethyl-N-methylbutan-2-amine

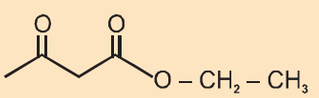
9.  2-methylpropan-2-amine

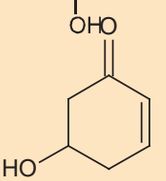
10.  Prop-2-en-1-amine

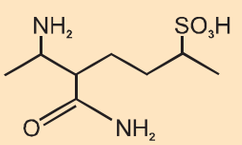
Q

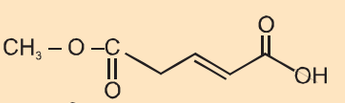
1. 

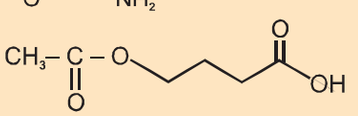
2. 

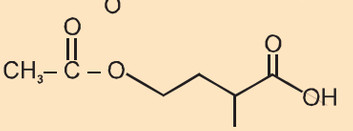
3. 

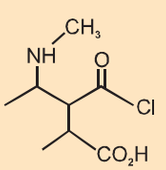
4. 

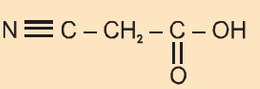
5. 

6. 

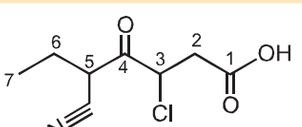
7. 

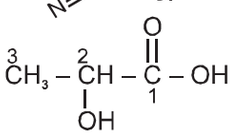
8. 

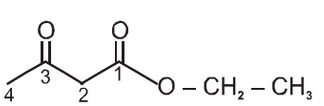
9. 

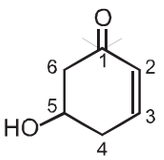
10. 

Sol

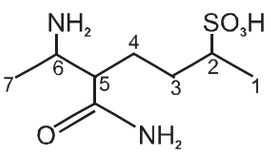
1.  3-chloro-5-cyano-4-oxoheptanoicacid

2.  2-hydroxypropanoicacid

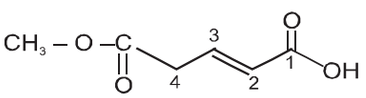
3.  Ethyl-3-oxobutanoate

4. 

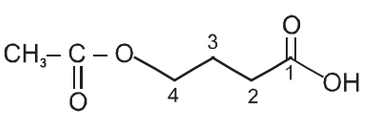
5-hydroxycyclohex-2-en-1-one

5. 

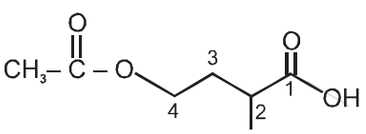
6-amino-5-carbamoylheptane-2-sulphonic acid

6. 

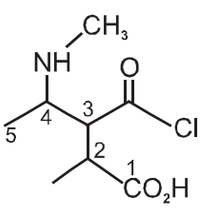
4-methoxycarbonylbut-2-en-1-oic acid

7. 

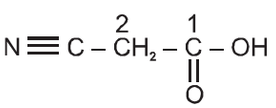
4-ethanoyloxybutanoic acid

8. 

4-ethanoyloxy-2-methylbutanoic acid

9. 

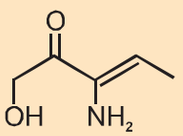
3-chloroformyl-2-methyl-4-[N-methylamino]pentanoic acid

10. 

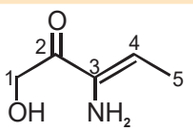
2-cyanoethanoic acid

Subjective Problems

Q1 **Write the IUPAC name of given compound :**

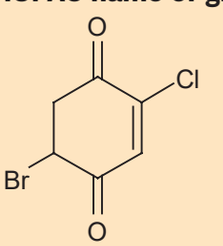


Sol



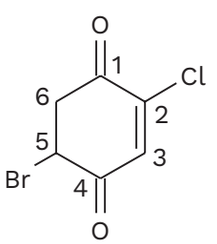
3-amino-1-hydroxypent-3-en-2-one

Q2 **IUPAC name of given compound is a-bromo-b-chlorocyclohex-p-en-1,4-dione**



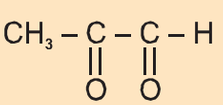
Find a + b + p =

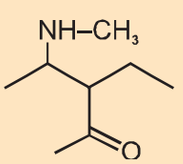
Sol

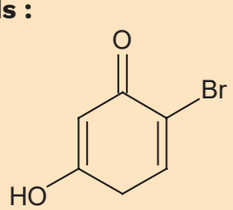


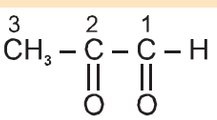
5-bromo-2-chlorocyclohex-2-en-1,4-dione
a = 5, b = 2, p = 2
$\therefore$ a + b + p = 5 + 2 + 2 = 9

Q **Write down the correct IUPAC name of following compounds :**

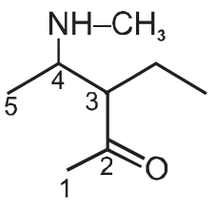
(I) 

(II) 

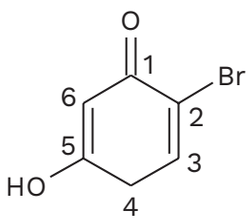
(III) 

Sol **(I)** 

2-oxopropanal

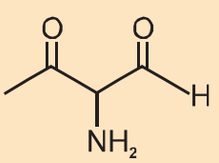
(II) 

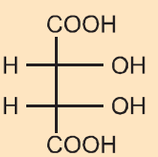
3-ethyl-4-[N-methylamino]pentane

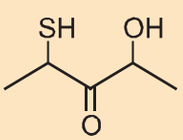
(III) 

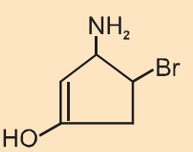
2-bromo-5-hydroxycyclohexa-2,5-dien-1-one

Q **Identify the principle functional group according to IUPAC priority table for following given compound.**

(I) 

(II) 

(III) 

(IV) 

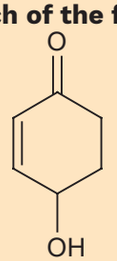
Sol **(I)** Aldehyde

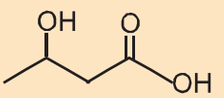
(II) Carboxylic acid

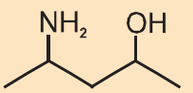
(III) Ketone

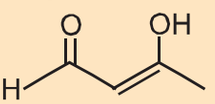
(IV) Alcohol

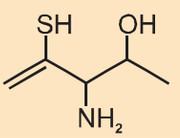
Q **Which of the following compounds have main functional group alcohol ?**

(I) 

(II) 

(III) 

(IV) 

(V) 

Sol **Priority:** $-COOH > -\overset{\overset{O}{\|}}{C}-H > -\overset{\overset{O}{\|}}{C}- > -OH > -SH > NH_2$

$\therefore$ III, V have main functional group alcohol.

Specific Rule and Aromatic Compound Naming

Introduction

Specific Rule of 1993

In an unbranched alkane 3 or more than 3 carbon containing functional group are attached then alkane is considered as parent carbon chain.

Q

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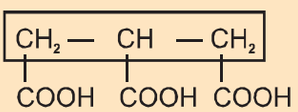

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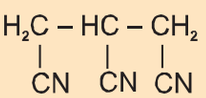

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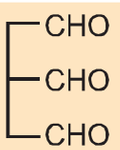

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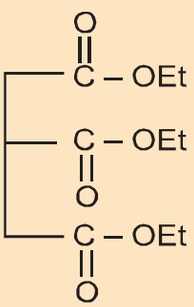

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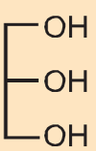
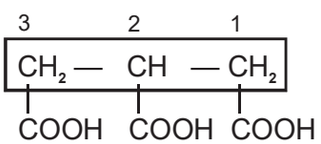


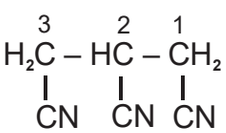
Sol

1.



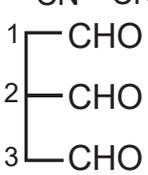
propane-1,2,3-tricarboxylic acid

2.



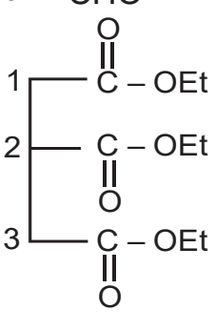
propane-1,2,3-tricarbonitrile

3.

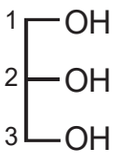


propane-1,2,3-tricarbaldehyde

4.



triethylpropane-1,2,3-tricarboxylate

5. 

propane-1,2,3-triol

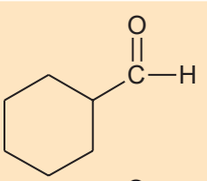
Special Note

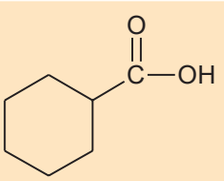
1.	Aldehyde	1.	Carbaldehyde
2.	Carboxylic acid	2.	Carboxylic acid
3.	Acid Chloride	3.	Carbonylchloride
4.	Amide	4.	Carboxamide
5.	Cyanide	5.	Carbonitrile
6.	Ester	6.	Carboxylate

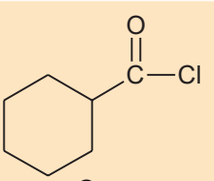
Point to remember

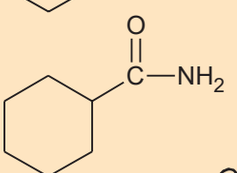
If carbon containing terminal functional group is present on cyclic ring then ring is considered as parent carbon chain and carbo word is introduced for that functional group.

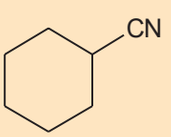
Q

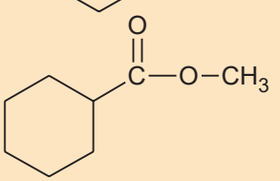
1. 

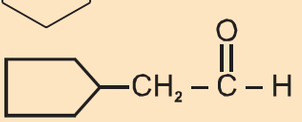
2. 

3. 

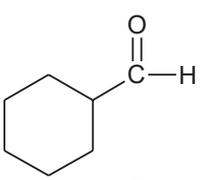
4. 

5. 

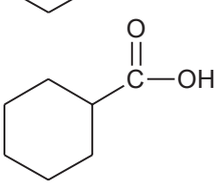
6. 

7. 

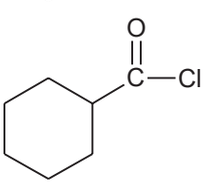
Sol

1. 

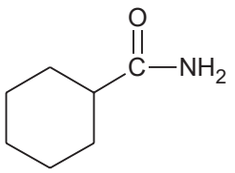
cyclohexanecarbaldehyde

2. 

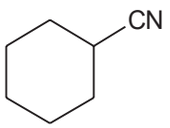
cyclohexanecarboxylic acid

3. 

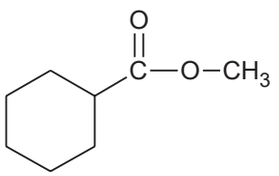
cyclohexanecarbonylchloride

4. 

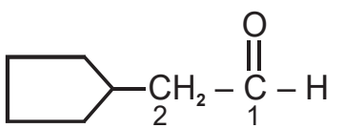
cyclohexanecarboxamide

5. 

cyclohexanecarbonitrile

6. 

methylcyclohexanecarboxylate

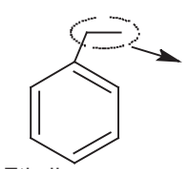
7. 

2-cyclopentylethanal

NOMENCLATURE OF AROMATIC COMPOUND

1. Simple Naming

Rule-1 :

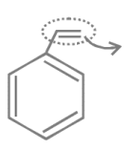


Ethylbenzene

Point to remember

If pure alkane directly attached with benzene then consider benzene as parent chain and write as benzene only.

Rule-2 :

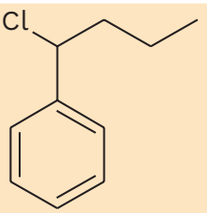


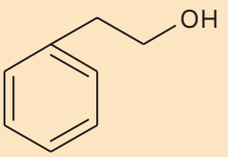
1-phenylethene

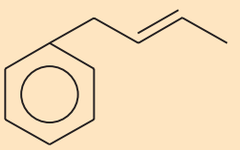
Point to remember

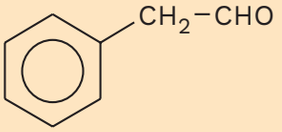
If attached group on benzene is not pure alkane then benzene will be considered as substituent and 2° prefix phenyl is used for it.

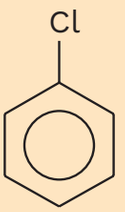
Q

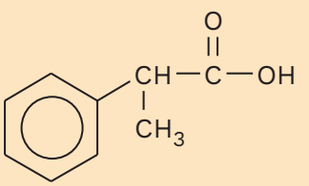
1. 

2. 

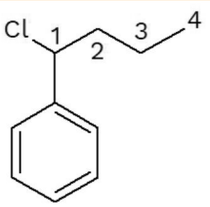
3. 

4. 

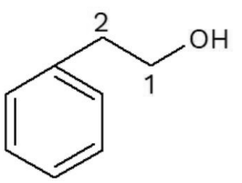
5. 

6. 

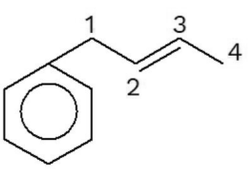
Sol

1. 

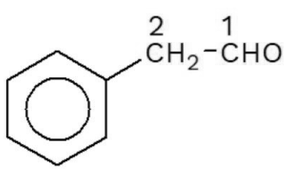
1-chloro-1-phenylbutane

2. 

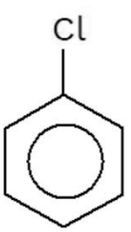
2-phenylethanol

3. 

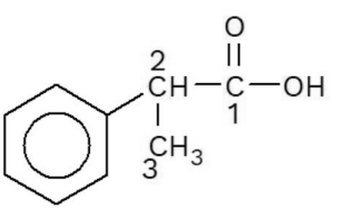
1-phenylbut-2-ene

4. 

2-phenylethanal

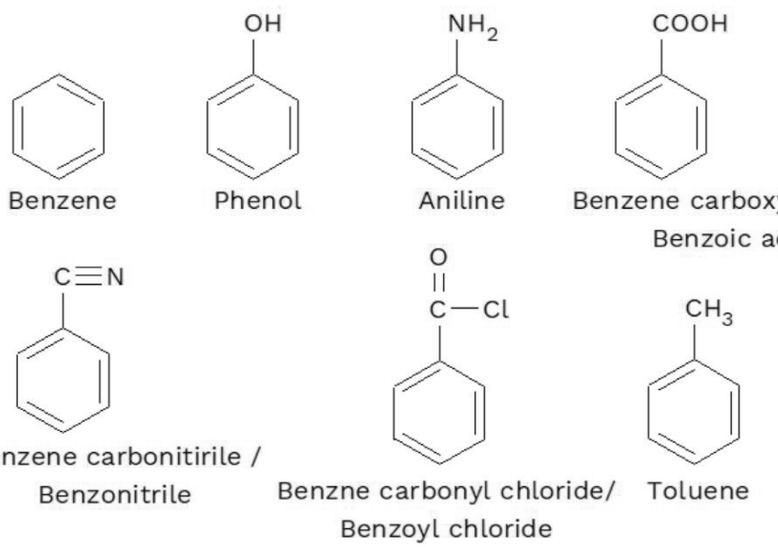
5. 

1-chlorobenzene

6. 

2-phenylpropanoic acid

NOMENCLATURE OF AROMATIC COMPOUND
(Considered as parent carbon chain by IUPAC)



Q

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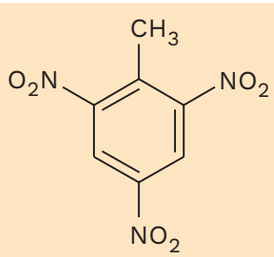

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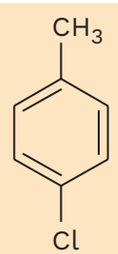

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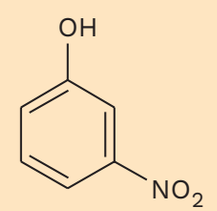

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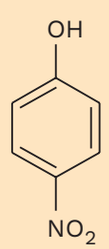

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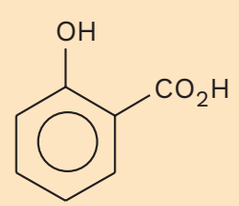

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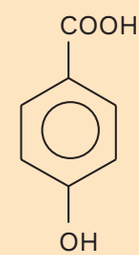
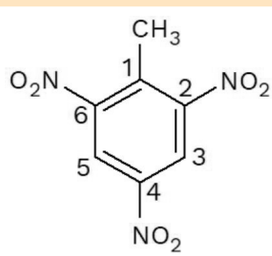
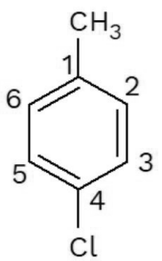


Sol **1.**

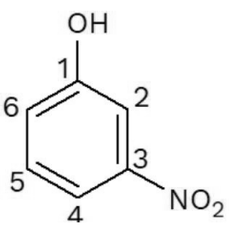


2, 4, 6-trinitrotoluene

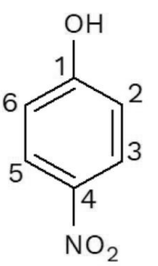
or 1-methyl-2,4,6-trinitro benzene

2. 

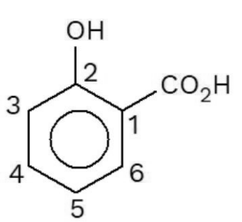
4-chlorotoluene or 1-chloro-4-methylbenzene

3. 

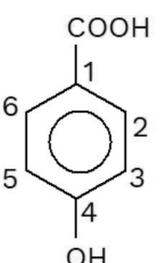
3-nitrophenol

4. 

4-nitrophenol

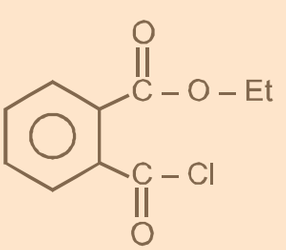
5. 

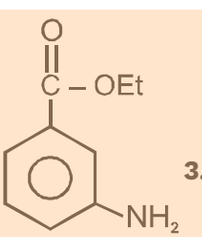
2-hydroxybenzoic acid

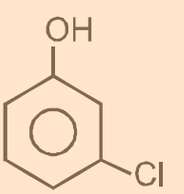
6. 

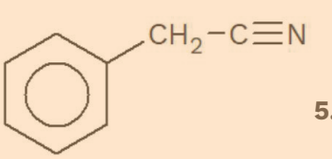
4-hydroxybenzoic acid

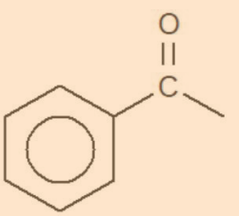
Subjective Questions :

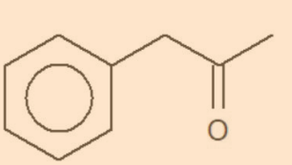
Q **1.** 

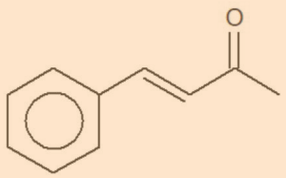
2. 

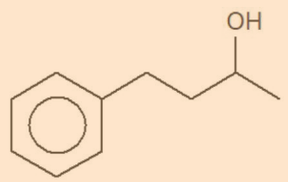
3. 

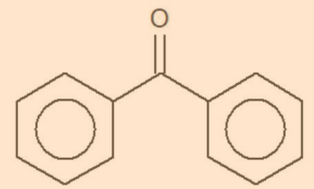
4. 

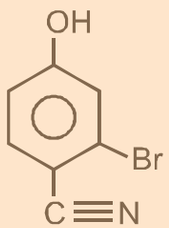
5. 

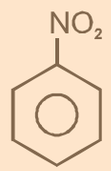
6. 

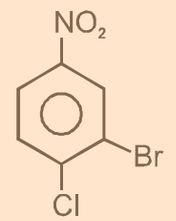
7. 

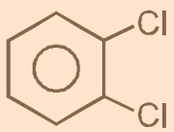
8. 

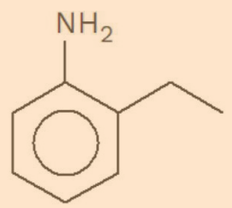
9. 

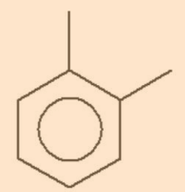
10. 

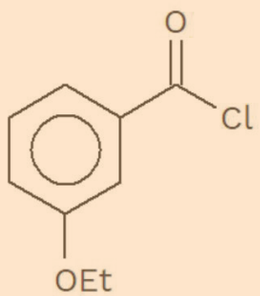
11. 

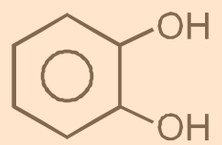
12. 

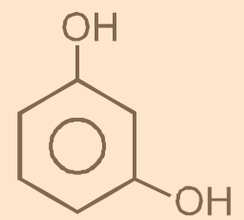
13. 

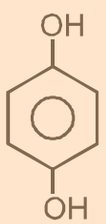
14. 

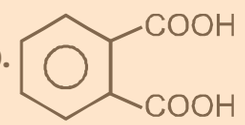
15. 

16. 

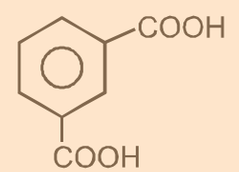
17. 

18. 

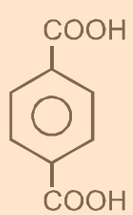
19. 

20. 

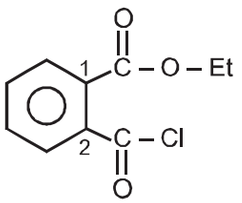
Phthalic acid

21. 

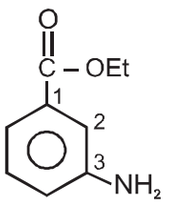
isophthalic acid

22. 

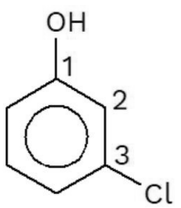
terephthalic acid

Sol **1.** 

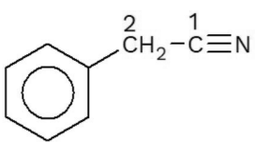
ethyl-2-chlorocarbonylbenzene carboxylate

2. 

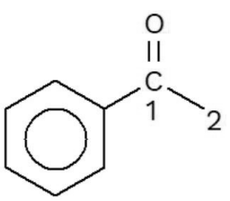
ethyl-3-aminobenzoate

3. 

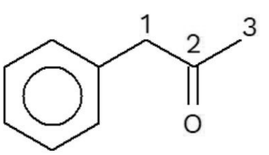
3-chlorophenol

4. 

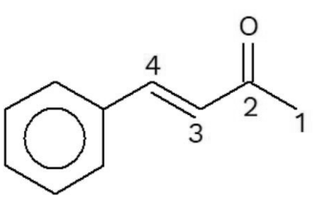
2-phenylethanenitrile

5. 

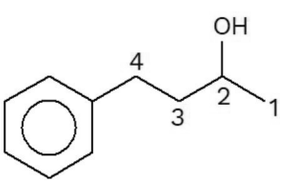
1-phenylethanone

6. 

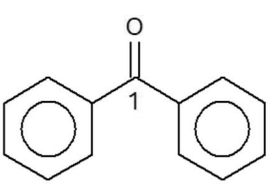
1-phenylpropan-2-one

7. 

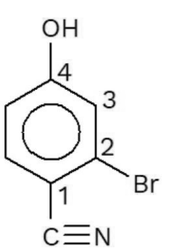
4-phenylbut-3-en-2-one

8. 

4-phenylbutan-2-ol

9. 

1,1-diphenylmethanone

10. 

2-bromo-4-hydroxybenzonitrile

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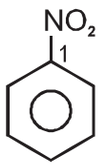

1-nitrobenzene

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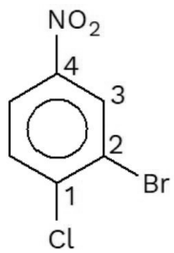

2-bromo-1-chloro-4-nitrobenzene

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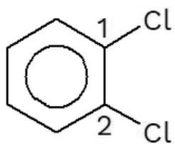

1,2-dichlorobenzene

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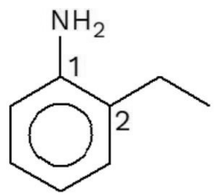

2-ethylaniline

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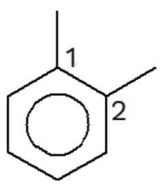

1,2-dimethylbenzene

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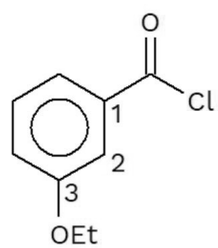

3-ethoxybenzoylchloride

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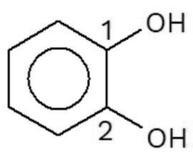

benzene-1,2-diol

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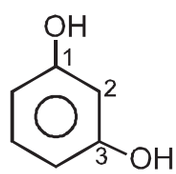

benzene-1,3-diol

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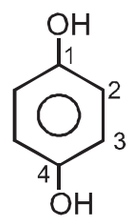
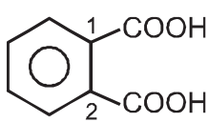


benzene-1,4-diol

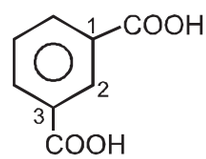
20.



Phthalic acid

benzene-1,2-dicarboxylic acid

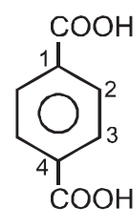
21.



isophthalic acid

benzene-1,3-dicarboxylic acid

22.



Benzene-1,4-dicarboxylic acid

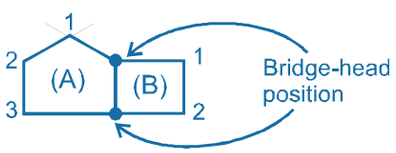
Naming of Bicyclo Compounds

Naming of Bicyclo Compounds

- The prefix bicyclo is followed by the name of the alkane whose number of C atoms is equal to the number of C atoms in the two rings.
- The bracketed numbers show the number of C atoms (except bridge-head position C atoms) in each bridge and they are written in decreasing order.

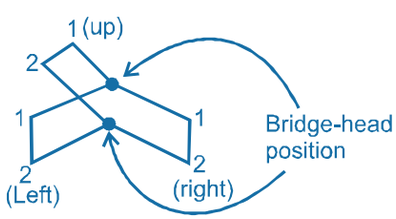
Examples :

1.



Bicyclo[3.2.0]heptane
(i) Number of C atoms in ring A = 3
(ii) Number of C atoms in ring B = 2
(iii) Number of C atoms between bridge-head position = 0

2.



Bicyclo[2.2.2]octane
If substituents are present, number of the bridge-head proceeding first along the longest bridge-head (i.e., the larger right), then along the next longest bridge-head, and back to the first bridge-head. The shortest bridge is numbered last.

Example :

IUPAC name : 7-methylbicyclo[4.3.0]nonane

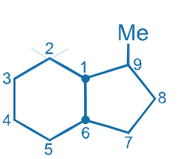
Numbering from the longest bridge-head (i.e., from the larger ring) to the next longest bridge-head (i.e., to the smaller ring).

Definition

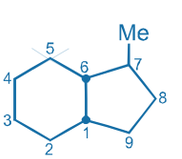
Compound with two fused cycloalkane rings are called bicyclo compounds. They are cyclo alkanes having two or more atoms in common.

Point to remember

Out of the two bridge-head C atoms, start numbering from that bridge-head C atom from where the position of the substituent is lowest.

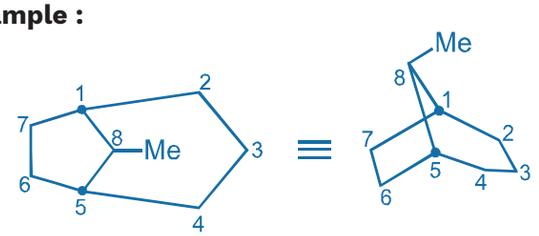


Wrong numbering since the position of the substituent is at C-9



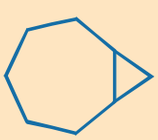
Correct numbering since the position of the substituent is at the lowest number, i.e. at C-7

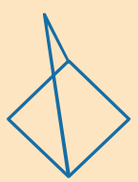
Example :

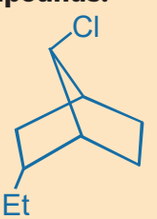


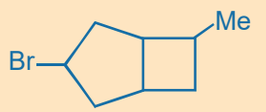
8-Methyl bicyclo [3.2.1] octane

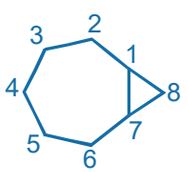
Q **Give the IUPAC names of the following compounds:**

1. 

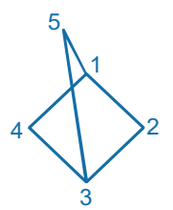
2. 

3. 

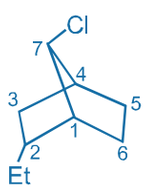
4. 

Sol **1.** 

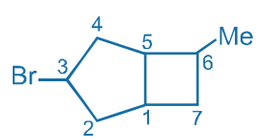
Bicylo [5.1.0] octane

2. 

Bicylo [1.1.1] pentane

3. 

7-chloro-2-ethyl bicyclo [2.2.1] heptane

4. 

3-bromo-6-methyl bicyclo [3.2.0] heptane

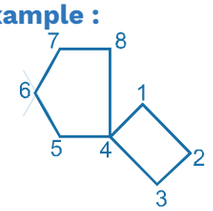
NAMING OF SPIRANES / SPIRO

- In substituted spiranes, the numbering is started next to the fused C atom in the lower-membered ring.

Definition

Spiranes are poly cyclics that share only one C atom.

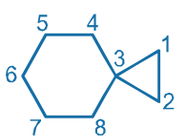
Example :



Spiro[3,4]octane

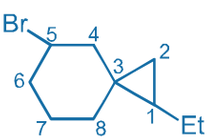
Example :

1.



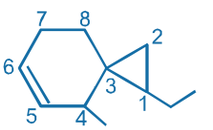
Spiro[2,5]octane

2.



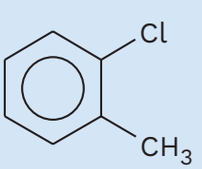
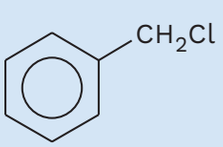
5-bromo-1-ethyl spiro[2,5]octane

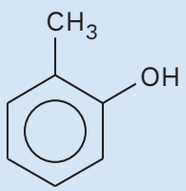
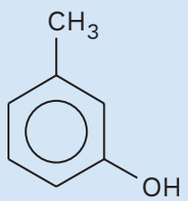
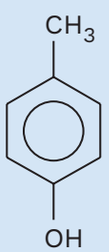
3.



1-ethyl-4-methyl spiro[2,5]oct-5-ene

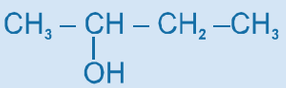
COMMON & IUPAC NAMES OF SOME HALIDES

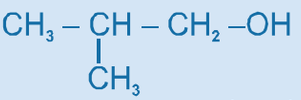
1. $CH_3CH_2CH(Cl)CH_3$ Common name : sec-butyl chloride IUPAC name : 2-chlorobutane	2. $(CH_3)_3CCH_2Br$ Common name : neo-pentyl bromide IUPAC name : 1-bromo-2,2-dimethyl propane
3. $(CH_3)_3CBr$ Common name : tert-butyl bromide IUPAC name : 2-bromo-2-methyl propane	4. $CH_2 = CHCl$ Common name : Vinyl chloride IUPAC name : 1-chloroethene
5. $CH_2 = CHCH_2Br$ Common name : Allyl bromide IUPAC name : 2-bromoprop-1-ene	6.  Common name : o-chlorotoluene IUPAC name : 1-chloro-2-methylbenzene or 2-chlorotoluene
7.  Common name : Benzyl chloride IUPAC name : chlorophenylmethane	8. CH_2Cl_2 Common name : Methylene chloride IUPAC name : Dichloromethane

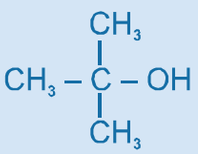
9. $CHCl_3$ Common name : Chloroform IUPAC name : Trichloromethane	10. $CHBr_3$ Common name : Bromoform IUPAC name : Tribromomethane
11. CCl_4 Common name : Carbon tetrachloride IUPAC name : Tetrachloromethane	12. $CH_3CH_2CH_2F$ Common name : n-propyl fluoride IUPAC name : 1-fluoropropane
13.  Common name : o-cresol IUPAC name : 2-methyl phenol	14.  Common name : m-cresol IUPAC name : 3-methyl phenol
15.  Common name : p-cresol IUPAC name : 4-methyl phenol	

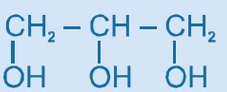
Alcohols

1. $CH_3–OH$ Common name : Methyl alcohol IUPAC name : Methanol	2. $CH_3–CH_2–CH_2–OH$ Common name : n-propyl alcohol IUPAC name : Propan-1-ol
3. $CH_3 – \underset{\displaystyle OH}{\underset{\vert}{CH}} – CH_3$ Common name : Isopropyl alcohol IUPAC name : Propan-2-ol	4. $CH_3–CH_2–CH_2–CH_2–OH$ Common name : n-butyl alcohol IUPAC name : Butan-1-ol

5. 
Common name : sec-butyl alcohol
IUPAC name : Butan-2-ol

6. 
Common name : Iso-butyl alcohol
IUPAC name : 2-methyl propan-1-ol

7. 
Common name : tert-butyl alcohol
IUPAC name : 2-methyl propan-2-ol

8. 
Common name : Glycerol
IUPAC name : Propane-1,2,3-triol

Ethers

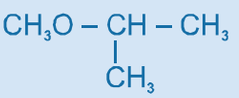
1. CH_3OCH_3
Common name : Dimethyl ether
IUPAC name : Methoxy methane

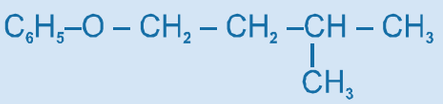
2. $C_2H_5OC_2H_5$
Common name : Diethyl ether
IUPAC name : Ethoxy ethane

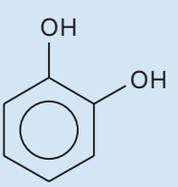
3. $C_6H_5OCH_3$
Common name : Methyl phenyl ether (anisole)
IUPAC name : Methoxyo benzene

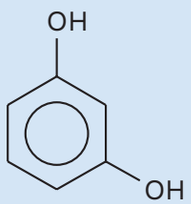
4. $C_6H_5OCH_2CH_3$
Common name : Ethyl phenyl ether (phenetole)
IUPAC name : Ethoxy benzene

5. $C_6H_5O(CH_2)_6–CH_3$
Common name : Heptyl phenyl ether
IUPAC name : 1-phenoxy heptane

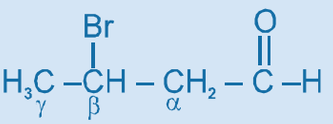
6. 
Common name : Methyl isopropyl ether
IUPAC name : 2-metoxy propane

7. 
Common name : Phenyl isopentyl ether
IUPAC name : 3-methyl butoxy benzene

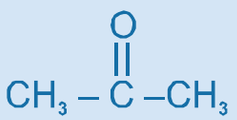
8. 
Common name : Catechol
IUPAC name : Benzene-1,2-diol

9. 

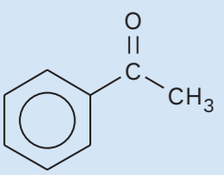
Common name : Resorcinol
IUPAC name : Benzene-1,3-diol

10. 

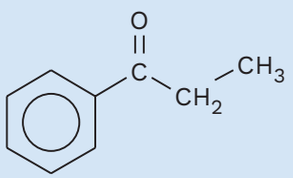
IUPAC name : β-bromobutyraldehyde

11. 

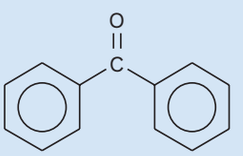
Common name : Acetone

12. 

Common name : Acetophenone

13. 

Common name : Propiophenone

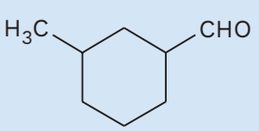
14. 

Common name : Benzophenone
IUPAC name : 1,1-diphenyl methanone

Aldehydes

1. HCHO
Common name : Formaldehyde
IUPAC name : Methanal

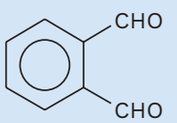
2. CH_3CHO
Common name : Acetaldehyde
IUPAC name : Ethanal

3. 

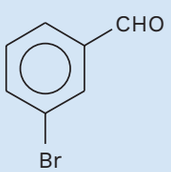
Common name : 3-methyl cyclohexane
IUPAC name : 3-methylcyclohexane carbaldehyde

4. $CH_3CH_2CH_2CH_2CHO$
Common name : Valeraldehyde
IUPAC name : Pentanal

5. $CH_2 = CH–CHO$
Common name : Acrolein / Acrylaldehyde
IUPAC name : Prop-2-enal

6. 

Common name : Phthaldehyde
IUPAC name :
Benzene-1,2-dicarbaldehyde

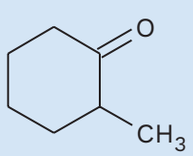
7. 

Common name : m-bromo benzaldehyde
IUPAC name : 3-bromo benzene carbaldehyde

Ketones

1. $CH_3COCH_2CH_2CH_3$
Common name : Methyl n-propyl ketone
IUPAC name : Pentan-2-one

2. $(CH_3)_2CHCOCH(CH_3)_2$
Common name : Diisopropyl ketone
IUPAC name : 2,4-dimethylpentan-3-one

3. 

Common name : 2-methyl cyclo hexanone
IUPAC name : 2-methyl cyclohexanone

4. $(CH_3)_2C = CHCOCH_3$
Common name : Mesityl oxide
IUPAC name : 4-methylpent-3-en-2-one

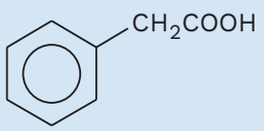
Carboxylic Acids

1. $HCOOH$
Common name : Formic acid
IUPAC name : Methanoic acid

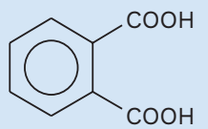
2. CH_3COOH
Common name : Acetic acid
IUPAC name : Ethanoic acid

3. CH_3CH_2COOH
Common name : Propionic acid
IUPAC name : Propanoic acid

4. $(CH_3)_2CHCOOH$
Common name : Isobutyric acid
IUPAC name : 2-methyl propanoic acid

5. 

Common name : Phenylacetic acid
IUPAC name : 2-phenyl ethanoic acid

6. 

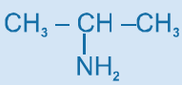
Common name : Phthalic acid
IUPAC name : Benzene-1,2-dicarboxylic acid

7. $HOOC–CH_2 – CH(COOH) – CH_2–COOH$
IUPAC name : Propane-1,2,3-tricarboxylic acid

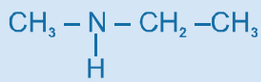
Amines

1. $CH_3 – CH_2 – NH_2$
Common name : Ethylamine
IUPAC name : Ethanamine

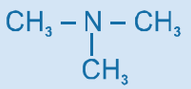
2. $CH_3 – CH_2 – CH_2 – NH_2$
Common name : n-propylamine
IUPAC name : Propan-1-amine

3. 

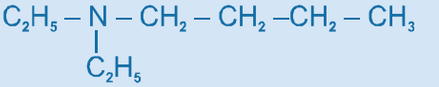
Common name : Iso-propyl amine
IUPAC name : Propan-2-amine

4. 

Common name : Ethyl methyl amine
IUPAC name : N-methylethanamine

5. 

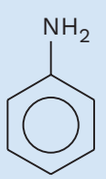
Common name : Trimethylamine
IUPAC name : N, N-dimethylmethanamine

6. 

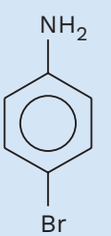
Common name : N, N-diethyl butylamine
IUPAC name : N, N-diethyl butanamine

7. $NH_2 - CH_2 - CH = CH_2$
Common name : Allylamine
IUPAC name : Prop-2-en-1-amine

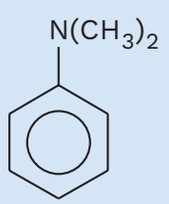
8. $NH_2 - (CH_2)_6 - NH_2$
Common name : Hexamethylene diamine
IUPAC name : Hexane-1,6-diamine

9. 

Common name : Aniline
IUPAC name : Aniline or benzenamine

10. 

Common name : p-bromo aniline
IUPAC name : 4-bromobenzenamine or 4-bromo aniline

11. 

Common name : N, N-dimethylaniline
IUPAC name : N, N-dimethylbenzenamine