

# CHAPTER 1

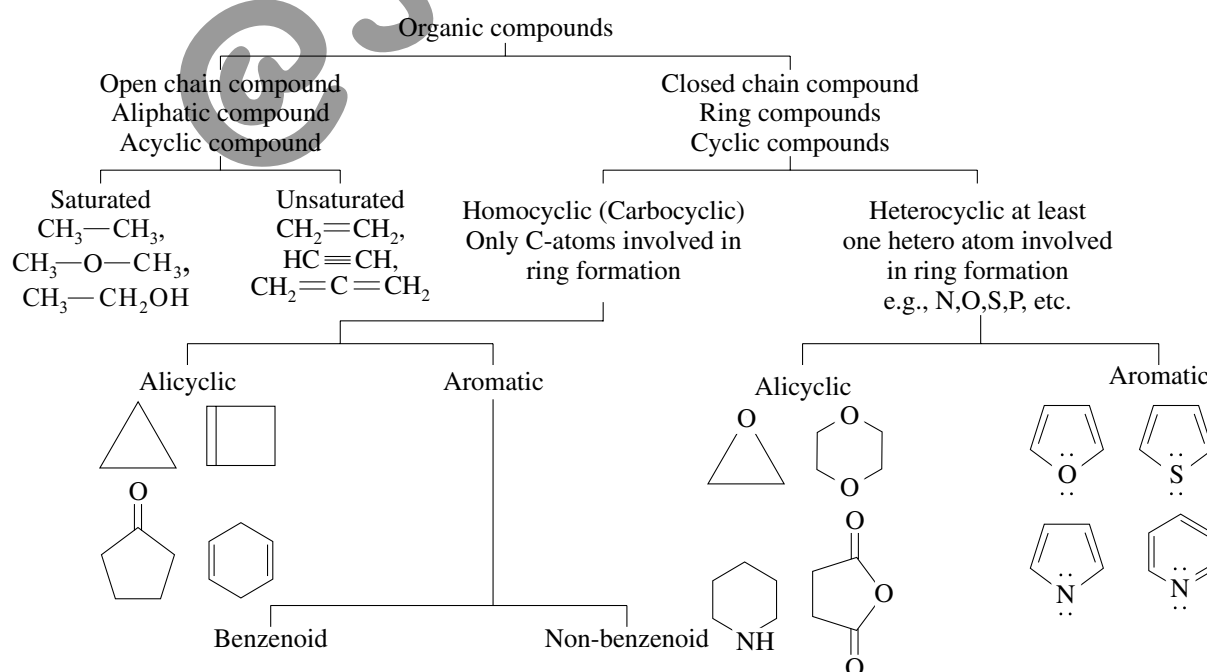
## Classification and Nomenclature

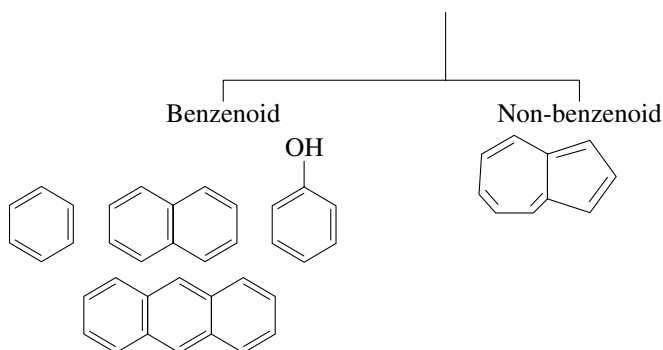
### INTRODUCTION

- ✦ Organic substances are mainly found in living organisms like animals and plants.
- ✦ The first synthesised organic substance is urea discovered by Whölar.
- ✦ Organic substances mainly contain C and H and one or more additional elements like oxygen, nitrogen, sulfur, phosphorous, halogens.
- ✦ **Catenation:** The self-linking tendency by covalent bond in non-metals whose co-valency is 2 or more than 2, known as catenation.
- ✦ Carbon shows to maximum catenation property.
- ✦ Maximum covalency of carbon is 4.
- ✦ Carbon atoms join together by single, double or triple bond that gives carbon Skeleton.

### CLASSIFICATION OF ORGANIC COMPOUNDS

All the known organic compounds have been divided in the following manner:





The four valencies of carbon atom can be represented by the following way:

| Structure                                    | $\sigma$ bonds | $\pi$ bonds | Hybridisation | Shape                       | Bond Angle      | No. of Bond angles |
|----------------------------------------------|----------------|-------------|---------------|-----------------------------|-----------------|--------------------|
| $\begin{array}{c}   \\ -C- \\   \end{array}$ | 4              | 0           | $sp^3$        | Tetrahedral<br>(Non planar) | $109^\circ 28'$ | 6                  |
| $\begin{array}{c}   \\ -C= \\ \end{array}$   | 3              | 1           | $sp^2$        | Planar (Trigonal)           | $120^\circ$     | 3                  |
| $-C\equiv$                                   | 2              | 2           | $sp$          | Linear                      | $180^\circ$     | 1                  |
| $=C=$                                        | 2              | 2           | $sp$          | Linear                      | $180^\circ$     | 1                  |

### Determination of Hybridisation

- It is based upon 'electron pair' (ep) of hybrid atom.

$$\text{e.p.} = \sigma \text{ bond} + \ell \text{p} + (-\text{ve}) \text{ charge}$$

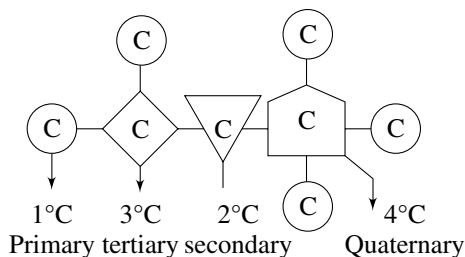
| No. of ep.    | 2    | 3      | 4      |
|---------------|------|--------|--------|
| Hybridisation | $sp$ | $sp^2$ | $sp^3$ |

### Identification of Carbon

#### 1. Primary, Secondary, Tertiary, and Quaternary carbon

There are four types of carbons in the carbon chain.

- Primary carbon:** A carbon atom attached to one (or no) other carbon atom is termed primary carbon or  $1^\circ$  carbon atom.
- Secondary carbon:** A carbon atom attached to two other carbon atoms is termed secondary carbon or  $2^\circ$  carbon atom.
- Tertiary carbon:** A carbon atom attached to three other carbon atoms is termed tertiary carbon or  $3^\circ$  carbon atom.
- Quaternary carbon:** A carbon atom attached to four other carbon atoms is termed quaternary carbon or  $4^\circ$  carbon atom.



## Identification of Hydrogen

- Nature of H, just same as the nature C through which it is joined  
The hydrogen atoms attached to primary, secondary and tertiary carbon atoms are correspondingly termed as primary, secondary and tertiary hydrogen atoms respectively.

## Type of Structure

- Normal structure – prefix “n” is used for unbranched carbon chain
- Iso structure – prefix “iso” is used when one methyl group is attached on 2<sup>nd</sup> carbon from either terminal.
- Neo structure – prefix “neo” is used when two methyl group is attached on 2<sup>nd</sup> carbon from either terminal.

## Homologous Series

Series of such compounds in which the various members have similar structural features and similar chemical properties but the successive members differ in their molecular formula by  $\text{CH}_2$  known as homologous series.

## General Characteristics

- All compounds in the series composed of some element
- All compounds have same general formula.
- Molar mass of adjacent member differ by 14.
- All compounds in the series have similar chemical properties however different physical properties.

## Naming of Organic Substance

- Common name or Trivial name
- Derived name
- I.U.P.A.C Name and Geneva Names system

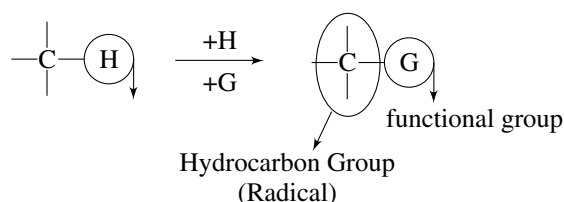
### [1] Common name or Trivial name system

**Type 1** Common name based on source:

- This type of nomenclature is based on their source of origin known as trivial name.

| Substance                                                                   | Source of origin                 | Trivial Name     |
|-----------------------------------------------------------------------------|----------------------------------|------------------|
| $\text{CH}_4$                                                               | Marsh places                     | Marsh gas        |
| $\text{CH}_3\text{—OH}$                                                     | Destructive Distillation of wood | Wood spirit      |
| $\begin{array}{c} \text{H—C—OH} \\    \\ \text{O} \end{array}$              | Red ant (Formica)                | Formic acid      |
| $\text{CH}_3\text{—COOH}$                                                   | Acetum (Vinegar)                 | Vinegar          |
| $\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—COOH}$                           | Butter                           | Butyric acid     |
| $\begin{array}{c} \text{NH}_2\text{—C—NH}_2 \\    \\ \text{O} \end{array}$  | Urine                            | Urea (Carbamide) |
| $\begin{array}{c} \text{CH}_3\text{—CH—COOH} \\   \\ \text{OH} \end{array}$ | Lactum (Milk)                    | Lactic acid      |

### Type 2 Common name radicals

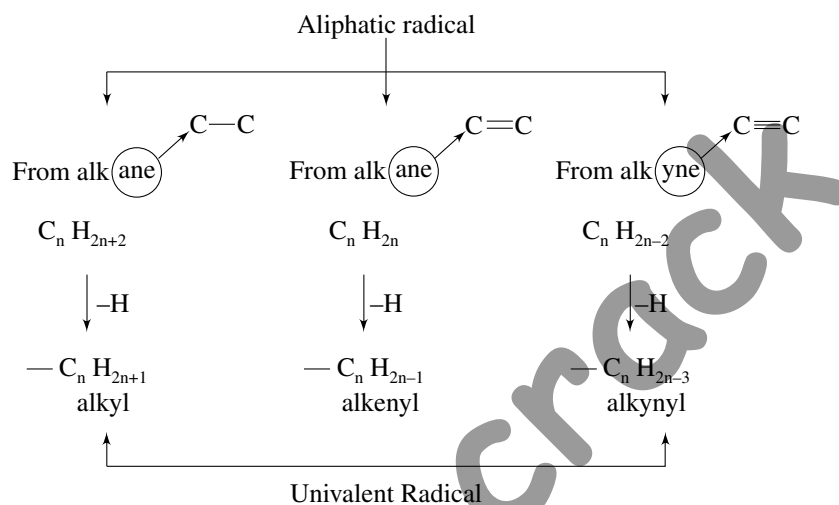


**Radical (– R)**

- It is framework of only C and H
- It is formed by the removal of at least one H from hydrocarbon
- It influences physical property of substance.

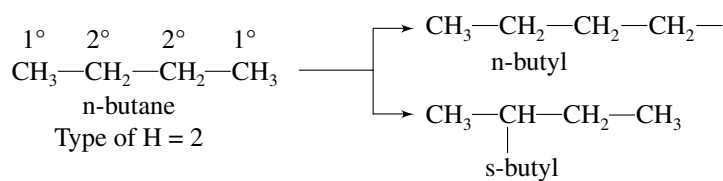
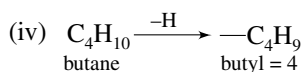
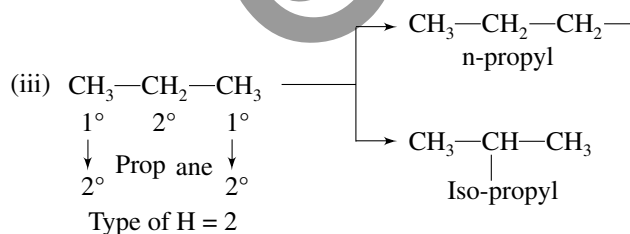
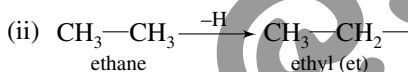
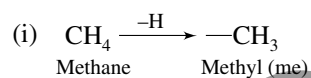
**Type of Radical**

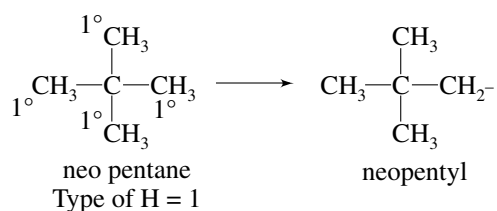
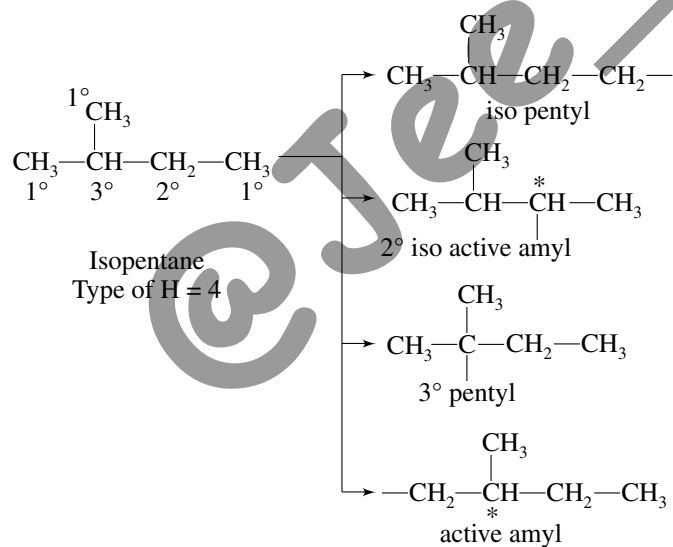
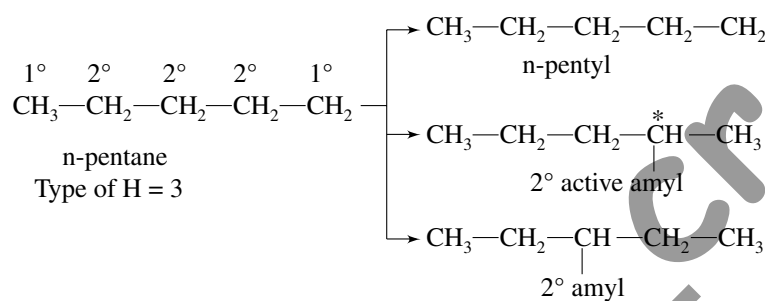
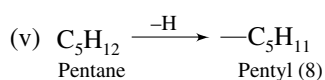
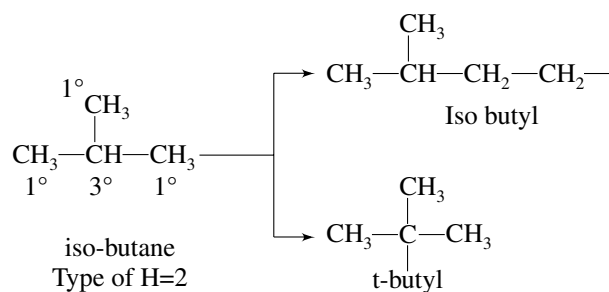
(1) **Aliphatic Radical:** Those radical which are formed by aliphatic hydrocarbon.

**1. Alkyl Radical**

- Common name = Alk + yl

| Alk          | meth | eth | prop | but | pent | hex | hept | oct | non | dec |
|--------------|------|-----|------|-----|------|-----|------|-----|-----|-----|
| No of carbon | 1C   | 2C  | 3C   | 4C  | 5C   | 6C  | 7C   | 8C  | 9C  | 10C |

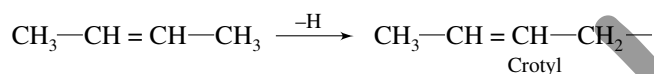
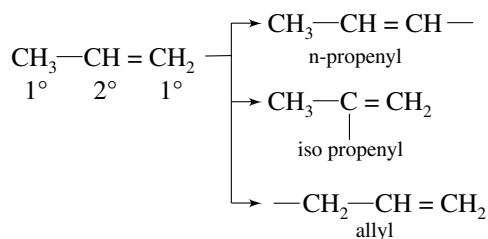
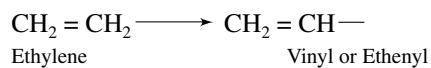




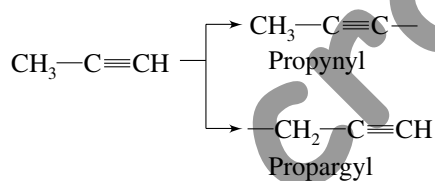
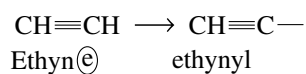
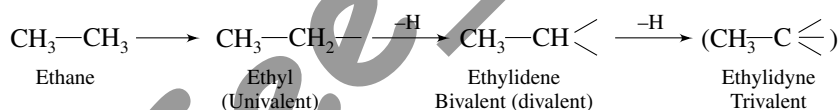
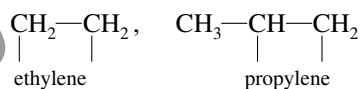
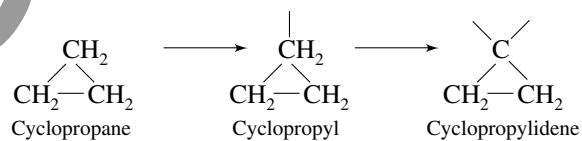
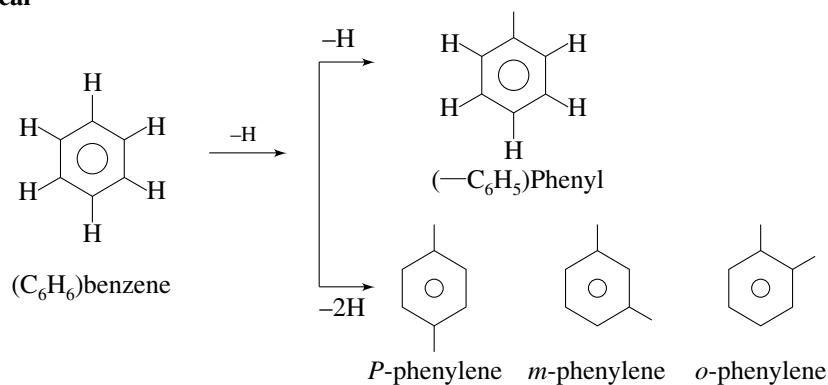
**Note:** Chiral C(\*) containing 5C alkyl always named as active amyl

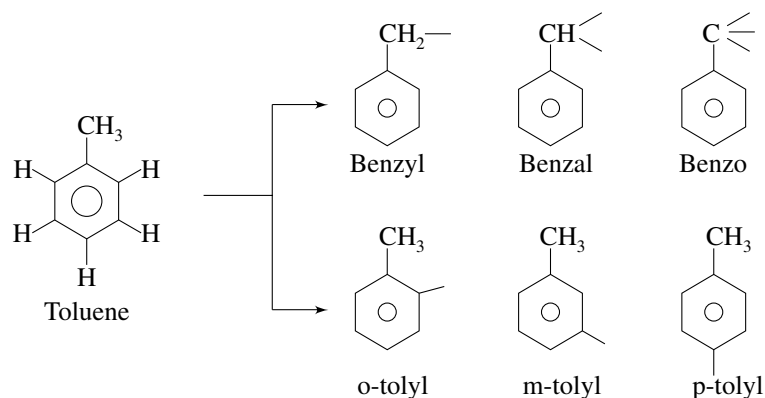
**2. Alkenyl Radical**

Common name = alk + en + yl

**3. Alkynyl Radical**

Common name = alk + yn + yl

**• Polyvalent Radical****Case-I:** Removal of more than one H from same carbon.**Case-II:** Removal of more than one H from adjacent carbon.**(2) Alicyclic Radical****(3) Aromatic Radical**



**Type 3** Common name of alkane:

- It is given by using prefix n, iso, neo.

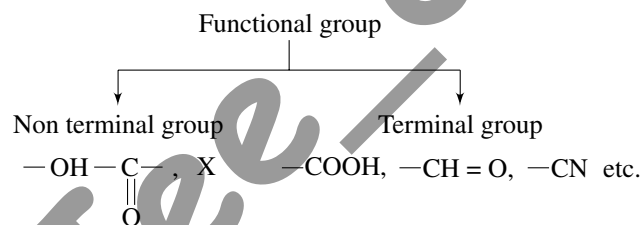
**Type 4** Common name of alkene:

- Common name = Alkylene

- In more than 3 carbon containing alkene

- For straight chain-prefix  $\alpha$ ,  $\beta$ ,  $\gamma$ ,  $\delta$ , etc. is used to locate the position of double bond at 1, 2, 3, 4. carbon, respectively from nearest terminal.
- For branched alkene- iso, neo prefix used but only when double bond at terminal carbon.

**Type 5** Common name for functional group containing substance.



**Case-I:** Substance containing non terminal functional group

- Common name  $\rightarrow$  Name of radical + Name of functional group.

| S.No. | Functional group                                                       | Group name     |
|-------|------------------------------------------------------------------------|----------------|
| 1     | $-\text{SO}_3\text{H}$                                                 | Sulphonic acid |
| 2     | $-\text{X}$ ( $-\text{F}$ , $-\text{Cl}$ , $\text{Br}$ , $-\text{I}$ ) | halide         |
| 3     | $-\text{OH}$                                                           | alcohol        |
| 4     | $-\text{SH}$                                                           | thio alcohol   |
| 5     | $-\text{O}-$                                                           | ether          |
| 6     | $-\text{S}-$                                                           | thio ether     |
| 7     | $-\text{C}(=\text{O})-$                                                | ketone         |
| 8     | $-\text{NH}_2-\text{NH}-, -\text{N}-$                                  | amine          |

- In polyvalent group, more than one radical present.

- More than one same radical, expressed by numerical prefix  
2 – di, 3 – tri, 4 – tetra, etc.
- Different radical always write in alphabet manner.

According to this system name of any compound is given according to the representative compound of the homologous series. This system is reserved for following homologous series.

| Series | Name of Homologous series | Name of Representative compound | Structure of group                                                         |
|--------|---------------------------|---------------------------------|----------------------------------------------------------------------------|
| 1      | Alkane                    | Methane                         | $\begin{array}{c}   \\ -C- \\   \end{array}$                               |
| 2      | Alkene                    | Ethylene                        | $>C=C<$                                                                    |
| 3      | Alkyne                    | Acetylene                       | $-C\equiv C-$                                                              |
| 4      | Alcohol                   | Carbinol                        | $\begin{array}{c}   \\ -C-OH \\   \end{array}$                             |
| 5      | Aldehyde                  | Acetaldehyde                    | $\begin{array}{c}   \\ -C-CHO \\   \end{array}$                            |
| 6      | Ketone                    | Acetone                         | $\begin{array}{c}   & &   \\ -C & -C & -C- \\ &    & \\ & O & \end{array}$ |
| 7      | Carboxylic acid           | Acetic acid                     | $\begin{array}{c}   \\ -C-COOH \\   \end{array}$                           |

### [3] IUPAC name system or Geneva name system:

1. A given compound can be assigned only one name.
2. A given name can clearly direct in writing of one and only one molecular structure.
3. The system can be applied in naming complex organic compounds.
4. The system can be applied in naming multifunctional organic compounds.
5. This is a simple, systematic and scientific method for nomenclature of organic compound.

### IUPAC Nomenclature of Aliphatic Compounds:

The name of an organic compound consists of three parts:

- Word root
- Prefix
- Suffix

**Word root:** It is given on the basis of number of C in parent chain.

| No of C   | 1C   | 2C  | 3C   | 4C  | 5C   | 6C  | 7C   | 8C  | 9C  | 10C | 11C   | 12C   | 20C   |
|-----------|------|-----|------|-----|------|-----|------|-----|-----|-----|-------|-------|-------|
| Word root | meth | eth | prop | but | pent | hex | hept | oct | non | dec | undec | dodec | Eicos |

**Prefix:** It is given on the basis of the side chain in parent chain

- (i) All alkyl radical works as side chain
- (ii) Some of the given functional group always behave as side chain

| S.No. | Functional group                                                      | Side chain (prefix) |
|-------|-----------------------------------------------------------------------|---------------------|
| 1.    | $-X$                                                                  | Halo                |
| 2.    | $-OR$                                                                 | Alkoxy              |
| 3.    | $\begin{array}{c} -C & -C- \\ & \diagdown \quad / \\ & O \end{array}$ | Epoxy               |
| 4.    | $-NO_2$                                                               | Nitro               |
| 5.    | $-N=O$                                                                | Nitroso             |
| 6.    | $-N=N-$                                                               | Azo                 |

- (iii) Rest functional group (except above) may be work as side chain according to their priority with respect to other functional group.

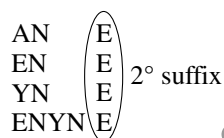
## Suffix

**Primary suffix:** It is given by the bonding nature between C–C in selected parent chain.

| S.No. | Bonding nature (PC)                       | 1° Suffix |
|-------|-------------------------------------------|-----------|
| 1.    | –C–C–<br>(All single bond)                | ANE       |
| 2.    | –C=C–<br>(At least one)                   | ENE       |
| 3.    | –C≡C–<br>(At least one)                   | YNE       |
| 4.    | –C=C–C≡C–<br>(Both (=) bond and (≡) bond) | (ENYNE)   |

**Secondary suffix:** It is given on the basis of principal functional group present in parent chain.

- 2° Suffix always written after 1° Suffix as follows.

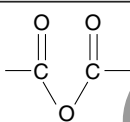
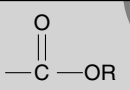
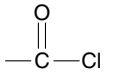
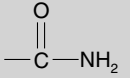
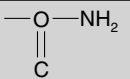


**Note:** ‘e’ cancelled only when 1st alphabet of 2° suffix is vowel (a,i,e,o,u)

**Arrangement of prefixes, Root word and Suffixes:**

IUPAC Name = prefix (es) + word root + Primary suffix + Secondary suffix

**Priority table of functional group (selection of Principal functional group)**

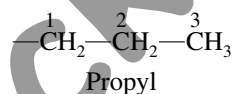
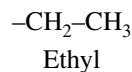
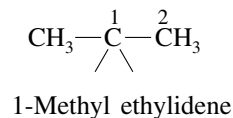
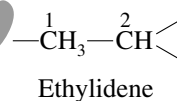
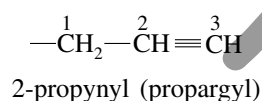
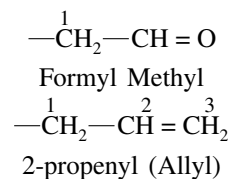
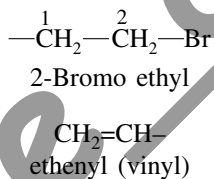
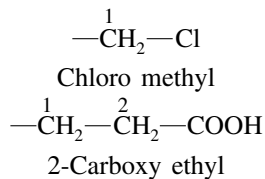
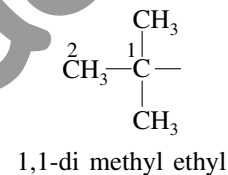
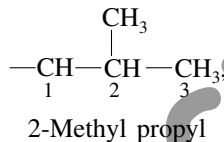
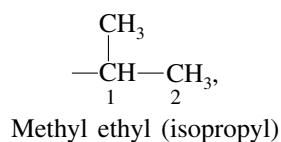
| Functional group                                                                    | Prefix                           | 2° Suffix        |
|-------------------------------------------------------------------------------------|----------------------------------|------------------|
| –COOH                                                                               | carboxy                          | Oic Acid         |
| –SO <sub>3</sub> H                                                                  | sulpho                           | Sulphonic Acid   |
|  | –                                | Oic anhydride    |
|  | alkoxy carbonyl or carbo alkoxy  | Oate             |
|  | chloro formyl or Chloro carbonyl | Oyl chloride     |
|  | carbamoyl                        | Amide            |
| –C≡N                                                                                | cyano                            | Nitrile          |
| –N≡C                                                                                | isocyano                         | Iso carbonitrile |
| –CH=O                                                                               | formyl / oxo                     | AL               |
|  | keto or oxo                      | ONE              |
| –OH                                                                                 | hydroxy                          | OL               |
| –SH                                                                                 | mercapto                         | Thiol            |
| –NH <sub>2</sub>                                                                    | amino                            | Amine            |

**Salient features of priority table:**

- (1) Above given table shows decreasing priority of functional group.
- (2) When only one of above functional group is present in parent chain, then this functional group behave as 2° suffix, known as Principal Functional group.
- (3) When more than one of above functional groups is present then higher priority functional group is the principal functional group (2° suffix) and rest are least priority functional groups will be represented by prefix.
- (4) Mostly 2° Suffix C will be included in word root.
- (5) Prefix, C never included in word root except only ketone.

**IUPAC Naming of Side Chain (Radical)**

- Numbering always start from free valency containing carbon
- Ending always with 'yl'

**Simple radicals****Complex radicals****Important Points**

1. Repetition of side chain expressed by numerical prefix 2-di, 3-tri, 4-tetra etc.
2. Repetition of complicated side chain expressed by numerical prefix 2-bis, 3-tris, etc.
3. Different side chain is always written in alphabet manner
4. If alphabet order is same then least locant number side chain written at 1<sup>st</sup> place
5. If di, tri prefix included in complicated side chain then these prefixes include in alphabet comparison.

**Rules of I.U.P.A.C Naming****Rule 1: Selection of parent chain (PC)**

Parent chain must be contain following in given order of priority:

|                                                 |   |                                    |   |                             |   |                                 |   |                                |
|-------------------------------------------------|---|------------------------------------|---|-----------------------------|---|---------------------------------|---|--------------------------------|
| Maximum number of<br>Principal functional group | > | Maximum number<br>of multiple bond | > | Maximum number<br>of carbon | > | Maximum number<br>of side chain | > | Lowest set of<br>locant number |
|-------------------------------------------------|---|------------------------------------|---|-----------------------------|---|---------------------------------|---|--------------------------------|

**Note:** For open chain substance selection always start and end at terminal carbon.

**Rule 2: Least locant number rule**

Numbering of parent chain start from the terminal that has through which functional group, multiple bond, side chain must have least locant number or lowest set of locant number in given order.

|                                                         |
|---------------------------------------------------------|
| Principal functional group > Multiple bond > side chain |
|---------------------------------------------------------|

**Rule 3: Alphabet rule**

This rule comes into existence only when least locant number rule does not apply.

When different member of similar category like functional group, multiple bond, side chain are present at equivalent position from either of terminal, then alphabetically preferred member of same category gets least locant number.

**Special Case**1. *Use of some special suffix:*

When more than two similar terminal functional groups are directly attached with Parent chain or directly attached with ring then according to latest IUPAC convention carbon atom of these functional group is not included in the parent chain even that they work as a Principal functional group (2° suffix)

- Latest 2° suffix of terminal functional group are given below:

| Functional group  | 2° suffix         |
|-------------------|-------------------|
| COOH              | Carboxylic acid   |
| COOR              | Carboxylate       |
| COCl              | Carbonyl chloride |
| CONH <sub>2</sub> | Carboxamide       |
| C≡N               | Carbo nitrile     |
| CH=O              | Carbaldehyde      |

2. *Use of some special prefix:*

In IUPAC naming O, S, N, Se atom can also be included in parent chain like carbon. The presence of these atom is expressed with special prefix given below with suitable locant no.

| Atom | Prefix |
|------|--------|
| O    | Oxa    |
| S    | Thia   |
| N    | Aza    |
| Se   | Selena |

**IUPAC Nomenclature of Alicyclic Compounds**

- (1) Rules 1,2,3 apply as usual like in open chain.
- (2) Additional prefix cyclo is used just before word root.
- (3) Numbering of cyclic parent chain starts at any C of ring according to rule-2 and 3
- (4) We never count number of C of ring and outside ring simultaneously
- (5) When both open and closed chain have same feature than closed chain will be selected as a parent chain.

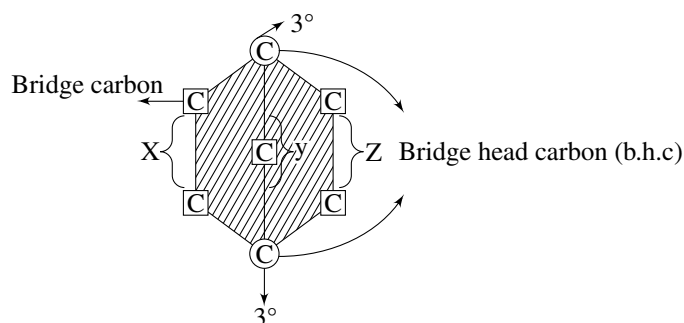
**IUPAC Nomenclature Aromatic Compounds:**

1. The common name of aromatic substance is also recognised as their I.U.P.A.C. name.
2. When benzene ring selected as parent chain

|                                 |
|---------------------------------|
| Word root + 1° suffix ⇒ Benzene |
|---------------------------------|

**IUPAC Nomenclature of Bicyclo Compounds:**

Such cyclic substance two lines are fused together in such a way that they have two common tertiary carbon with ring or one side is common, known as bicyclo substance.

**General rules of naming:**

1. Additional prefix bicyclo is used
2. In big bracket write number of bridge carbon of all three direction individually in decreasing order separated by commas.
3. Word root is given on the basis of total number of carbon present in a bicyclic part

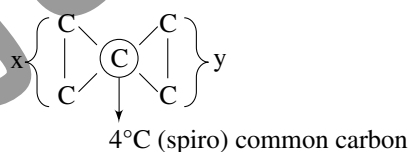
$$\text{Number of C in bicycle ring} = x + y + z + 2$$

## 4. Numbering of Bicyclo ring.

- (i) Numbering always starts from one of the b.h.c (Bridge head carbon).
- (ii) It is proceed along higher number of bridge carbon site to next b.h.c.
- (iii) Again proceed along second higher bridge, carbon site.
- (iv) Finally terminate along least bridge carbon site.

**IUPAC Nomenclature of Spiro compounds:**

Such cyclic substance in which two rings are fused together in such a ways that they have only one common carbon, is known as spiro substance.

**General rule of naming:**

1. Additional prefix spiro is used
2. In big bracket write number of carbon of two rings individually except common carbon in increasing order.
3. Word root is given on the basis of total number of carbon present in a spiro ring.

$$\text{Number of C in spiro ring} = x + y + 1$$

## 4. Numbering of spiro ring.

- (i) Numbering always starts from adjacent common carbon in smaller ring.
- (ii) Proceed along smaller ring to spiro carbon.
- (iii) Finally terminate along bigger ring.

## SOLVED EXAMPLE

1. Ethyl methyl vinyl amine has the structure—

- (1)  $\text{CH}_3\text{CH}_2-\text{N}(\text{CH}_3)-\text{CH}_2\text{CH}=\text{CH}_2$
- (2)  $\text{CH}_3\text{CH}_2-\text{N}(\text{CH}_3)-\text{CH}=\text{CH}_2$
- (3)  $\text{CH}_2=\text{CH}-\text{N}(\text{CH}_3)-\text{CH}=\text{CH}_2$
- (4)  $\text{CH}_3-\text{N}(\text{CH}_3)-\text{CH}=\text{CH}_2$

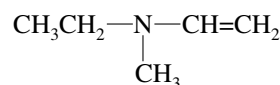
Sol. [2]

Ethyl  $\rightarrow -\text{C}_2\text{H}_5$

Methyl  $\rightarrow -\text{CH}_3$

Vinyl  $\rightarrow -\text{CH}=\text{CH}_2$

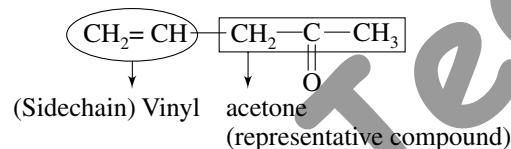
3-alkyl containing amine must be 3° amine



2. Derived name of  $\text{CH}_2=\text{CH}-\text{CH}_2\text{CO}-\text{CH}_3$  is

- (1) 1-Pentene-1-one (2) Allyl methyl ketone
- (3) 4-Pentene-2-one (4) Vinyl acetone

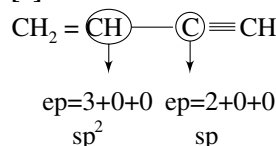
Sol. [4]



3. The hybrid state C-atoms which are attached to single bond with each other in the following structure are—  $\text{CH}_2=\text{CH}-\text{C}\equiv\text{CH}$

- (1)  $\text{sp}^2$ ,  $\text{sp}$  (2)  $\text{sp}^3$ ,  $\text{sp}$
- (3)  $\text{sp}^2$ ,  $\text{sp}^2$  (4)  $\text{sp}^2$ ,  $\text{sp}^3$

Sol. [1]



4. The third member of the family of alkenynes has molecular formula—

- (1)  $\text{C}_6\text{H}_6$  (2)  $\text{C}_5\text{H}_6$
- (3)  $\text{C}_6\text{H}_8$  (4)  $\text{C}_4\text{H}_4$

Sol. [3]

General formula of alkenyne  $\rightarrow \text{C}_n \text{H}_{2n-4}$

For 1<sup>st</sup> member  $n = 4$

2<sup>nd</sup> member  $n = 5$

3<sup>rd</sup> member  $n = 6$

$\therefore$  Molecular formula =  $\text{C}_6\text{H}_{2 \times 6 - 4} = \text{C}_6\text{H}_8$

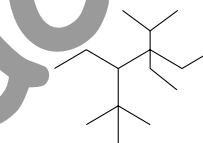
5. Which of the following is not correctly matched?

- (1) Acetonitrile  $\text{CH}_2 = \text{CHCN}$
- (2) Allyl chloride  $\text{CH}_2 = \text{CH} - \text{CH}_2\text{Cl}$
- (3) s-Butyl group  $\text{CH}_3 - \text{CH}(\text{CH}_3) - \text{CH}_2\text{H}_5$
- (4) Ethylidene chloride  $\text{CH}_3 - \text{CH}(\text{Cl})_2$

Sol. [1]

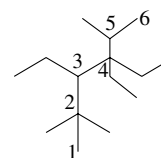
Aceto nitrile  $\rightarrow \text{CH}_3 - \text{C} \equiv \text{N}$  but given  $\text{CH}_2 = \text{CHCN}$  so it is incorrectly matched.

6. The correct IUPAC name of the following compound is



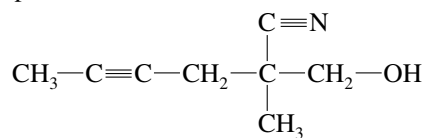
- (1) 3-ethyl-3-isopropyl-4-tert-butyl hexane
- (2) 3, 3, 4-triethyl-2, 5, 5-trimethyl hexane
- (3) 3, 4-diethyl-4-isopropyl-2, 2-dimethyl hexane
- (4) 3, 4, 4triethyl-2, 2, 5-trimethyl hexane

Sol. [4]



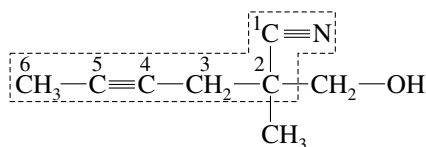
Parent chain must contain maximum number of side chain.

7. What is the IUPAC name of the following compound?



- (1) 2-cyano-2-methyl hex-4-yne-ol
- (2) 2-hydroxy methyl-2-methyl-hex-4-yne-nitrile
- (3) 2-methyl-2-hydroxy methyl hex-5-yne-nitrile
- (4) 1-cyano-2-hydroxymethyl-2-methyl-4-hexyne

Sol. [3]



2-methyl-2-hydroxy methyl hex-5-yne-nitrile  
Word root = 6C (Hex)

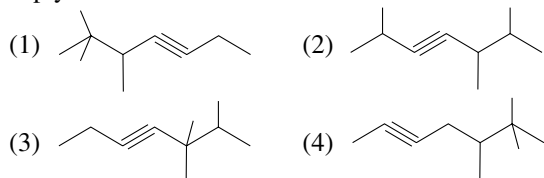
Side chain =  $-\text{CH}_3$  (methyl) and  $-\text{CH}_2-\text{OH}$  (Hydroxymethyl)

1° suffix  $\rightarrow$  yne

2° suffix  $\rightarrow$  -CN (Nitrile)

Principal functional group must have least locant number.

8. Which is the correct structure 5, 6, 6-trimethyl-3-heptyne?

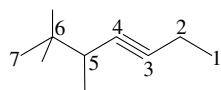


Sol. [1]

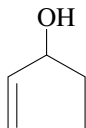
Parent chain must have 7C

1 suffix  $\rightarrow$  yne at 3<sup>rd</sup> C

Three methyl side chain at 5, 6, 6

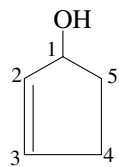


9. The correct IUPAC name of the compound is



- (1) Cyclo pent-1-en-3-ol  
(2) Cyclo pent-2-en-1-ol  
(3) 3-hydroxy cyclo pentene  
(4) None of these

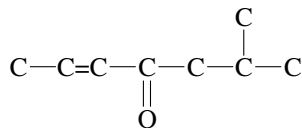
Sol. [2]



Principal functional group have priority than multiple bond (rule-2)

Cyclo pent-2-en-1-ol

10. The correct IUPAC name of the compound is



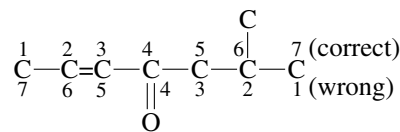
- (1) 2-methyl hept-5-en-4-one  
(2) 6-methyl-4-oxo-2-heptene  
(3) 6-methyl hept-2-en-4-one  
(4) None of these

Sol. [3]

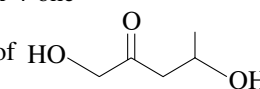
- Numbering of parent chain according to least locant number rule.

- Priority order  $\rightarrow$

functional group > Multiple bond > side chain.



6-methyl hept -2-en-4-one

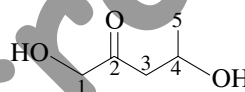
11. The IUPAC name of  is-

- (1) 3-hydroxybutanoic acid  
(2) 4-methyl-2-oxo-1, 4-butanediol  
(3) 1, 4-dihydroxy-4-methyl-2-butanone  
(4) 1, 4-dihydroxy-2-pentanone

Sol. [4]

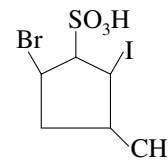
Principal functional group ketone must have least locant number.

-OH group works as side chain.



1, 4-dihydroxy-2-pentanone

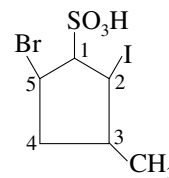
12. The correct IUPAC name of the compound is



- (1) 2-iodo-3-methyl-5-bromocyclo pentane sulphon-ic acid  
(2) 5-Bromo-4-methyl-5-iodocyclo pentane sulphon-ic acid  
(3) 5-Bromo-3-iodo-2-methylcyclo pentane sulphon-ic acid  
(4) 5-Bromo-2-iodo-3-methylcyclopentane sulphon-ic acid

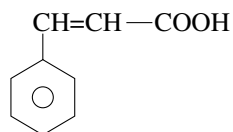
Sol. [4]

- Cyclic chain selected as parent chain.
- $-\text{SO}_3\text{H}$  is principal functional group.
- Br, -I,  $-\text{CH}_3$  are side chain.
- Apply least locant number rule.



5-Bromo-2-iodo-3-methylcyclopentane sulphonic acid

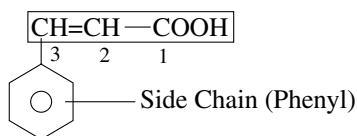
13. The correct IUPAC name of the compound is



- (1) Cinamic acid
- (2) 3-phenyl-2-propenoic acid
- (3)  $\beta$ -phenyl acrylic acid
- (4) 1-phenyl-2-propenoic acid

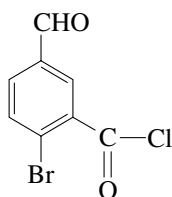
Sol. [2]

- Open chain contains  $-\text{COOH}$  group so it is selected as parent chain.



3-phenyl-2-propenoic acid

14. The IUPAC name of the following compound is



- (1) 4-bromo-3-chloroformyl benzaldehyde
- (2) 2-bromo-5-formyl benzene carboxyl chloride
- (3) 2-chloro carbonyl bromobenzene
- (4) 6-bromo-3-formylbenzo-3-yl chloride

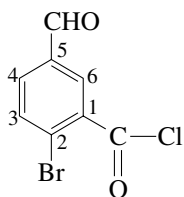
Sol. [2]

- Benzene ring must be selected as parent chain.
- $-\text{C}-\text{Cl}$  group is principal functional group.



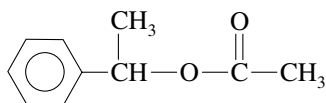
- $-\text{CH}=\text{O}$ ,  $-\text{Br}$ , are side chain.

- Numbering of benzene ring according to least locant number rule.



2-bromo-5-formyl benzene carboxyl chloride

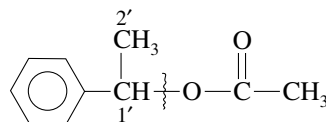
15. The IUPAC name of



- (1) 1-phenyl ethyl ethanoate
- (2) 1-acetoxyethylbenzene
- (3) ethoxycyclohexyl ketone
- (4) ethyl cyclohexanecarboxylate

Sol. [1]

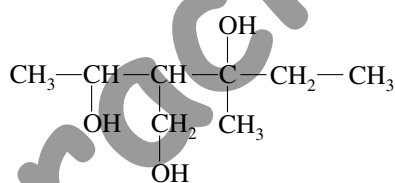
- Principal functional group is ester
- Open chain selected as parent chain.



side chain parent chain

1-phenyl ethyl ethanoate

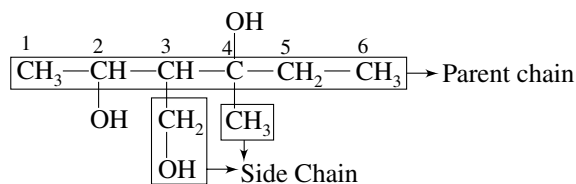
16. The correct IUPAC name of the compound is



- (1) 3-hydroxy methyl-4-methyl hexane-2,4-diol
- (2) 2-(1-hydroxy ethyl)-4-methyl pentane-1,3-diol
- (3) 4-hydroxy methyl-3-methyl hexane-2,4-diol
- (4) None of these

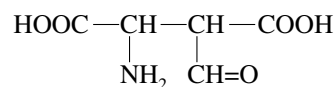
Sol. [1]

- Parent chain must have maximum number of principal functional group ( $-\text{OH}$ ) with maximum number of carbon.
- Numbering of parent chain according to least locant number rule.



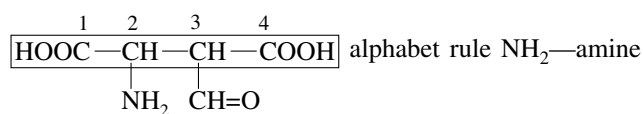
3-hydroxy methyl-4-methyl hexane-2,4-diol

17. The correct IUPAC name of the compound is



- (1) 3-amino-2-formyl butane-1, 4-dioic acid
- (2) 3-amino-2, 3-dicarboxy propanal
- (3) 2-amino-3-formyl butane-1, 4-dioic acid
- (4) 1-amino-2-formyl succinic acid

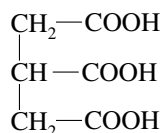
Sol. [3]



Although CHO group is before  $\text{NH}_2$  but after deciding top most in order group ( $\text{COOH}$ ) next groups are arranged alphabetically. So numbering is done from left to right.

Prefix for  $\text{NH}_2$ - group is amino and for CHO- group is formyl.

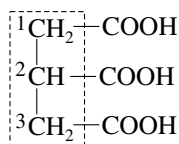
18. The correct IUPAC name of the compound is



- (1) 1, 2, 3-tricarboxy-propane
- (2) 3-carboxy-1, 5-pentane dioic acid
- (3) propane-1, 2, 3-tri carboxylic acid
- (4) none of these

Sol. [3]

When more than two terminal functional groups are directly attached with parent chain then no such group carbon included in word root; according to the latest IUPAC convention 2° suffix is carboxylic acid ( $-\text{COOH}$ )

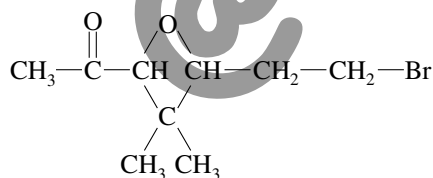


Propane-1, 2, 3-tri carboxylic acid (1st Choice)

3-carboxy-1, 5-pentane dioic acid (2nd Choice)

1, 2, 3-tricarboxy-propane (3rd Choice)

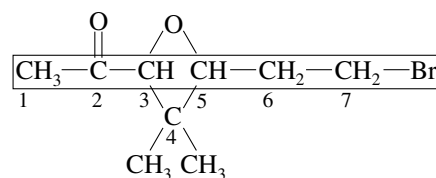
19. The correct IUPAC name of the compound is



- (1) 7-bromo-3, 5-epoxy-4,4-dimethyl-2-heptanone
- (2) 7-bromo-3, 5-epoxy-4, 4-dimethyl-2-oxo heptane
- (3) 1-bromo-3, 5-epoxy-4,4-dimethyl-6-heptanone
- (4) 1-bromo-4, 4-dimethyl-5-oxo-heptane

Sol. [1]

- Numbering of parent chain according to the least locant number rule.
- Priority order  $\rightarrow$   
functional group > Multiple bond > side chain.



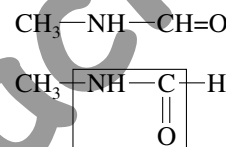
7-bromo-3, 5-epoxy-4,4-dimethyl-2-heptanone

20. The correct IUPAC name of the compound is



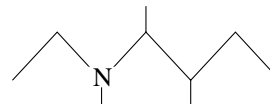
- (1) N-formyl methanamine
- (2) N-methyl methanamide
- (3) Methylanino methanal
- (4) N-methy-N-formyl amino methane

Sol. [2]



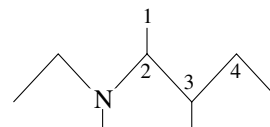
- Principal functional group is amide ( $-\text{CONH}-$ )

21. The correct IUPAC name of the compound is



- (1) N-Ethyl-N, 3-dimethyl-2-amino pentane
- (2) N-ethyl-N, 3-dimethyl-2-pentanamine
- (3) N-Ethyl-N, 3-Dimethyl-4-pentanamine
- (4) 2-(Ethylmethyamino)-3-methyl pentane

Sol. [2]



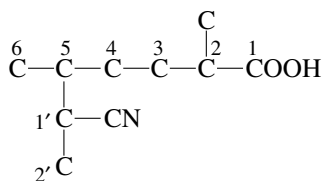
N-ethyl-N, 3-dimethyl-2-pentanamine

22. A compound named 5-(1-cyanoethy)-2-methyl hexanoic acid has something wrong according to IUPAC. What is its correct IUPAC name?

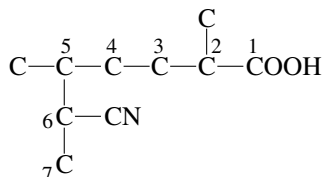
- (1) 5-ethyl cyanide-2-methyl hexanoic acid
- (2) 6-cyano-2, 5-dimethyl heptanoic acid
- (3) 6-cyano-5-methyl-2-heptanoic acid
- (4) 6-carboxy-2, 3-dimethyl heptanenitrile

Sol. [2]

- Parent chain must have 6C with  $\text{COOH}$  group.
- Side chain  $-\text{CH}-\text{CH}_3$  and  $-\text{CH}_3$   
|  
CN
- So that possible structure is

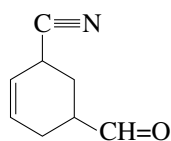


- Correct numbering of parent chain is



6-cyano-2, 5-dimethyl heptanoic acid

23. The correct IUPAC name of the compound is

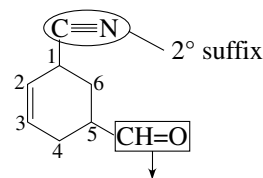


5-formyl cyclo hex-2-en-carbonitrile

- (1) 3-cyano cyclo hex-5-en-carbaldehyde
- (2) 5-cyano cyclo hex-3-en-carbaldehyde
- (3) 5-formyl cyclo hex-2-en-carbonitrile
- (4) 3-formyl cyclo hex-5-en-carbonitrile

Sol. [3]

- Numbering of parent chain according to least locant number rule.
- Priority order →  
functional group > Multiple bond > side chain.



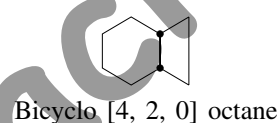
5-formyl cyclo hex-2-en-carbonitrile

24. The correct IUPAC name of the compound is



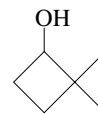
- (1) Bicyclo [4, 2, 0] octane
- (2) Bicyclo [2, 4, 0] octane
- (3) Bicyclo [4, 2, 0] hexane
- (4) None of these

Sol. [1]



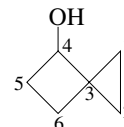
Bicyclo [4, 2, 0] octane

25. The correct IUPAC name of the compound is



- (1) Spiro [3,2] hexan-4-ol
- (2) Spiro [2,3] hexan-2-ol
- (3) Spiro [2,3] hexan-4-ol
- (4) Spiro [3,2] hexan-2-ol

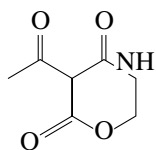
Sol. [3]



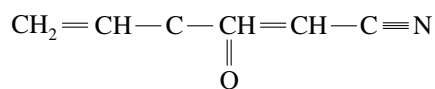
Spiro [2,3] hexan-4-ol

## EXERCISE 1

1. Identify which functional group is **Not** present in the following compound?

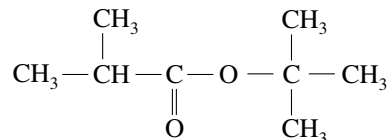


- (1) Ketone
  - (2) Ester
  - (3) Amide
  - (4) Ether
2. The number of olefinic bonds in the given compound is—



- (1) 2
- (2) 3
- (3) 1
- (4) 4

3. The common name of given ester is—



- (1) Neo butyl isobutyrate
- (2) t-Butyl n-butyrate
- (3) t-Butyl isobutyrate
- (4) Iso butyl isobutyrate

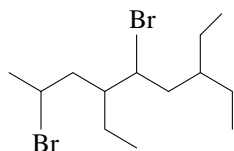
4. The derived name of  $\text{CH}_3-\text{C}(\text{CH}_3)_2-\text{C}(\text{CH}_3)(\text{C}_2\text{H}_5)-\text{OH}$  is

- (1) t-Butyl ethyl methyl carbinol
- (2) t-Butyl ethyl methyl methanol
- (3) t-Butyl methyl ethyl carbinol
- (4) t-Butyl methyl ethyl methanol

- CC1CCCC(O)C1

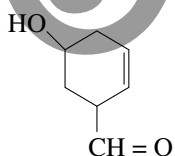
- (1) 3, 3-dichloro-4-methyl cyclohexanol  
 (2) 1, 1-dichloro-6-methyl-3-cyclohexanol  
 (3) 1, 1-dichloro-2-methyl-5-cyclohexanol  
 (4) 2, 2-dichloro-1-methyl-4-cyclohexanol

16. The systematic name of the given structure is

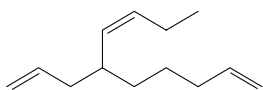


- (1) 2, 5-dibromo-4, 7-diethyl octane  
 (2) 4, 7-dibromo-2, 5-diethyl octane  
 (3) 5, 8-dibromo-6-methyl-3-methyl nonane  
 (4) 2, 5-dibromo-4-ethyl-7-methyl nonane
17. One of the names given below violates an important IUPAC convention. Which is that name?
- (1) 2-cyclopropyl-2-methyl propane  
 (2) 2-bromo-4-chlorobutane  
 (3) Ethyl pentane  
 (4) 3-bromo-1, 1-dichlorocyclohexane
18. A hydrocarbon X has molar mass 84 but contains no double or triple bonds. Also X has no methyl locant. How many different IUPAC name can be assigned to X?
- (1) 2  
 (2) 3  
 (3) 4  
 (4) 6
19. Which of the following is an incorrect name according to the IUPAC?
- (1) 2-cyclopropyl butane  
 (2) 1-bromo-2, 2-dichloro cyclobutane  
 (3) Cyclohexyl cyclohexane  
 (4) 1-cyclobutyl cyclobutane

20. What is the correct IUPAC name of the compound?



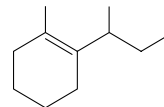
- (1) 3-hydroxy cyclo hex-2-ene-1-carbaldehyde  
 (2) 5-hydroxy cyclo hex-2-ene-1-al  
 (3) 3-formyl-Cyclo hex-4-ene-1-ol  
 (4) 5-hydroxy cyclo hex-2-ene-carbaldehyde
21. What is the correct IUPAC name of the following compound?



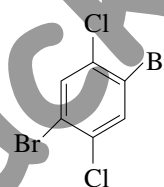
- (1) 4-(1-propenyl)-1, 8-nonadiene  
 (2) 5-(2-propenyl)-3, 9-decadiene

- (3) 6-(2-propenyl)-1, 7-decadiene  
 (4) 4-(1-butenyl)-1, 8-nonadiene

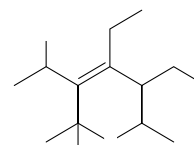
22. IUPAC name of the given compound is



- (1) 2-methyl-1-(1'-methyl propyl) cyclohexene  
 (2) 1-(1'-methyl propyl)-2-methyl cyclohexene  
 (3) 2-Methyl-1-(1'-methyl ethyl) cyclohexene  
 (4) None of these
23. What is the correct IUPAC name of the following compound?

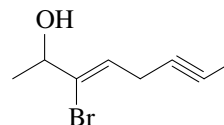


- (1) 2, 5-dibromo-1, 4-dichlorobenzene  
 (2) 1, 4-dibromo-3, 5-dichlorobenzene  
 (3) 3, 5-dibromo-1, 4-dichlorobenzene  
 (4) 1, 4-dibromo-2, 5-dichlorobenzene
24. The IUPAC name of the structure



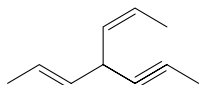
is

- (1) 3-t-butyl-4-ethyl-5-isopropyl-2-methyl-3-heptene  
 (2) 4, 5-diethyl-2, 2, 6-trimethyl-3-(1-methylethyl)-3-heptene  
 (3) 3-(1, 1-dimethyl ethyl)-4, 5-diethyl-2, 6-dimethyl-3-heptene  
 (4) 4-ethyl-2, 2-dimethyl-3, 5-bis (1-methylethyl)-3-heptene
25. What is the correct IUPAC name of the compound shown below?

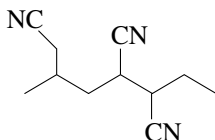


- (1) 3-bromo-3-octen-5-yne-2-ol  
 (2) 3-bromo-3-octen-6-yne-2-ol  
 (3) 6-bromo-5-octen-2-yne-7-ol  
 (4) None of these

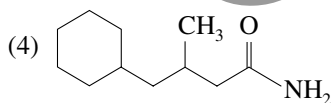
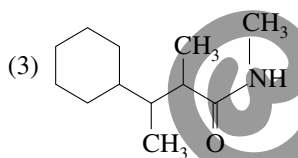
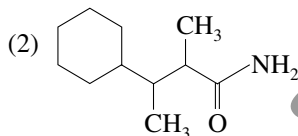
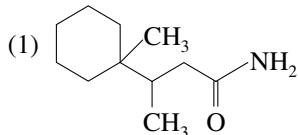
26. What is correct IUPAC name of the following compound?



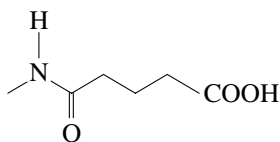
- (1) 4-(2-propenyl)-hepta-2, 5-diene
  - (2) 4-(1'-propenyl) hepta-2, 5-diene
  - (3) 4-(1-propenyl)-2-heptene-5-yne
  - (4) 4-(1-propenyl)-5-heptene-2-yne
27. What is the correct IUPAC name of the compound?



- (1) 3-cyano-2, 5-dimethyl heptanedinitrile
  - (2) 5-cyano-3, 6-dimethyl heptanedinitrile
  - (3) 2, 5-dimethyl-1, 3, 7-heptanedinitrile
  - (4) 2-methyl hexane-1, 4, 5 tricarbonitrile
28. Which is the correct structure of 3-cyclohexylmethyl butanamide?

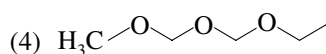
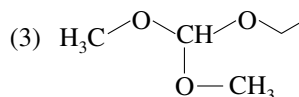
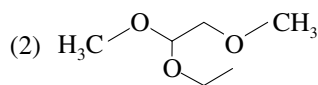
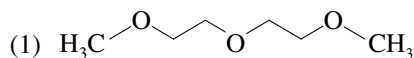


29. What is the correct IUPAC name of the following compound?

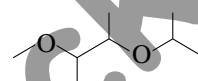


- (1) 3-(N-methyl amino) carbonyl propanoic acid
- (2) 3-carboxy (N-methyl) propanamide
- (3) 4-(N-methyl amino)-4-oxobutanoic acid
- (4) 3-(N-methyl carbamoyl) propanoic acid

30. Which is the correct structure of compound 1-methoxy-2-(2-methoxy ethoxy) ethane?



31. What is the correct IUPAC name of

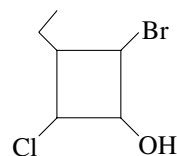


- (1) 2-methoxy-3-(methyl propoxy) butane
- (2) 2, 3-dioxy-2, 4-dimethyl butane
- (3) 3, 4, 6-trimethyl-2, 5-dioxa octane
- (4) both (1) and (3)

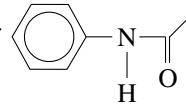
32. The IUPAC name of  $\text{CH}_3-\text{O}-\text{C}(=\text{O})-\text{CH}_2-\text{C}(=\text{O})-\text{OH}$  is:

- (1) 2-carbomethoxy ethanoic acid
- (2) 2-Acetoxy ethanoic acid
- (3) 2-Ethanoyloxy acetic acid
- (4) 2-Ethanoyloxyethanoic acid

33. Correct IUPAC name of the given compound is:

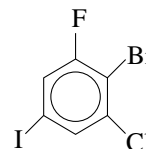


- (1) 2-bromo-3-ethyl-4-chlorocyclobutanol
- (2) 4-bromo-1-chloro-3-ethylcyclobutanol
- (3) 3-bromo-4-chloro-3-ethyl cyclohydroxybutane
- (4) 2-bromo-4-chloro-3-ethylcyclobutanol

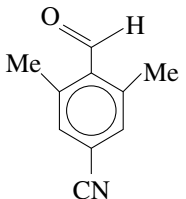
34. The IUPAC name of  compound is

- (1) N-phenylaminoethanone
- (2) N-phenylethanamide
- (3) N-phenylmethanamide
- (4) N-phenylaminomethane

35. The correct IUPAC name of

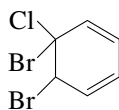


- (1) 1-bromo-2-chloro-6-fluoro-4-iodobenzene
- (2) 1-bromo-6-chloro-2-fluoro-4-iodobenzene
- (3) 2-bromo-1-chloro-3-fluoro-5-iodobenzene
- (4) 2-bromo-3-chloro-1-fluoro-5-iodobenzene

36. IUPAC Name of  is:

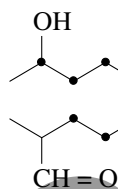
- (1) 4-oxo-2, 6-dimethyl benzene carbonitrile
- (2) 4-Cyano-2, 6-dimethyl benzaldehyde
- (3) 4-formyl 3,5-dimethyl benzonitrile
- (4) None of these

37. What is correct IUPAC name of the compound shown below?



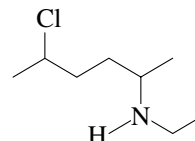
- (1) 5, 6-dibromo-6-chloro-1, 3-cyclohexadiene
- (2) 2, 3-dibromo-2-chloro-1, 4-cyclohexadiene
- (3) 1, 2-dibromo-1-chloro-3, 5-cyclohexadiene
- (4) 5, 6-dibromo-5-chloro-1, 3-cyclohexadiene

38. Write the IUPAC name given



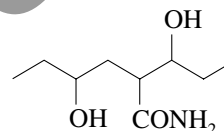
- (1) 2-methyl-1-(3'-hydroxy butyl)-6-heptenal
- (2) 9-hydroxy-2-methyl-5-decene
- (3) 1-(3'-hydroxy butyl)-2-methyl- 6-heptenal
- (4) None of these

39. What is the correct IUPAC name of the compound?



- (1) 4-chloro-N-ethyl-1-methyl-1-pentanamine
- (2) 5-chloro-N-ethyl-2-hexanamine
- (3) 5-chloro-N-ethyl-1-hexanamine
- (4) 2-chloro-N-ethyl-5-hexanamine

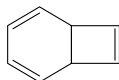
40. What is the correct IUPAC name of the compound shown below?



- (1) 3, 6-dihydroxy-4-octanamide
- (2) 3, 6-dihydroxy-5-octanenamide
- (3) 4-hydroxy-2-(1-hydroxy propyl) hexanamide
- (4) 3-hydroxy-2-(2-hydroxy butyl) pentanamide

## EXERCISE 2

1. The number of  $sp^2-sp^2$  sigma bonds in the compound given molecule below is:

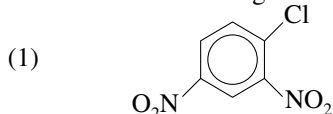


- (1) 1
- (2) 3
- (3) 4
- (4) 5

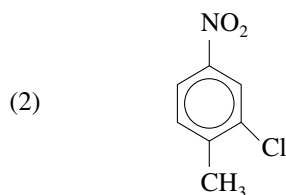
2. In compound  $HC\equiv C-CH_2-CH=CH-CH_3$  the  $C_2-C_3$  bond is the type of-

- (1)  $sp-sp^2$
- (2)  $sp^3-sp^3$
- (3)  $sp-sp^3$
- (4)  $sp^2-sp^2$

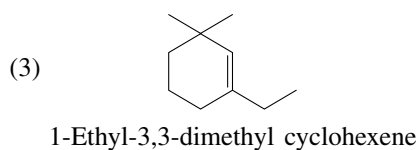
3. Which of the following is correctly named?



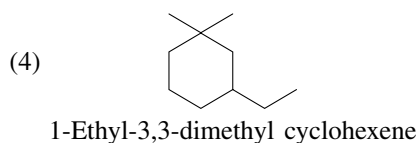
4-Chloro-1,3-dinitro benzene



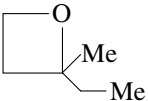
4-Methyl-5-chloronitro benzene



1-Ethyl-3,3-dimethyl cyclohexene

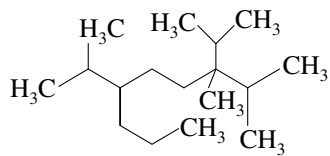
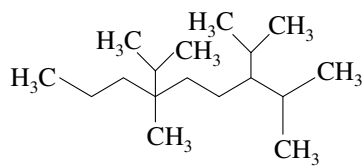
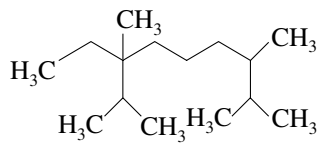
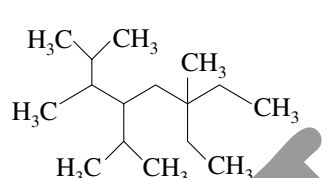


1-Ethyl-3,3-dimethyl cyclohexene

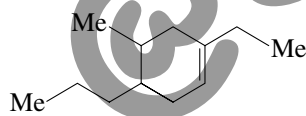
4. IUPAC name of  is:

- (1) 2-Ethyl-3-methyl epoxy butane
- (2) 4-Ethyl-4-methyl oxetane
- (3) 2-Ethyl-2-methyl oxetane
- (4) 2-methyl-2-ethyl oxetane

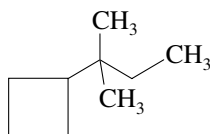
5. The correct structure of compound 3, 6-diisopropyl-2,6-dimethyl nonane is

- (1) 
- (2) 
- (3) 
- (4) 

6. According to IUPAC convention, what is the name to the compound given below?



- (1) 1-ethyl-5-methyl-4-propyl cyclohexene
  - (2) 2-ethyl-4-methyl-5-propyl cyclohexene
  - (3) 5-ethyl-1-methyl-2-propyl-4-cyclohexene
  - (4) 4-ethyl-2-methyl-1-propyl-4-cyclohexene
7. According to IUPAC convention, the correct name of the following compounds is

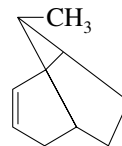


- (1) 1-(1, 1-dimethylpropyl) cyclobutane
- (2) 1-cyclobutyl-1, 1-dimethyl propane

(3) 2-cyclobutyl-2-methyl butane

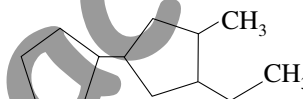
(4) 1-(1-methylbutyl) cyclobutane

8. What is the systematic IUPAC name of the following compound?



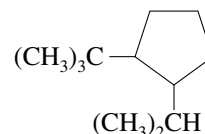
- (1) 8-methyl bicyclo [3, 2, 1] oct-3-ene
- (2) 8-methyl bicyclo [3, 2, 1] oct-2-ene
- (3) 6-methyl bicyclo [3, 2, 1] oct-2- ene
- (4) 6-methyl bicyclo [1, 2, 3] oct-2-ene

9. According to IUPAC convention, name of the following compound is



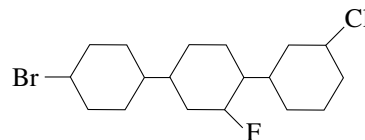
- (1) 2-ethyl-4-methyl-1-cyclopentyl cyclopentane
- (2) 2-ethyl-1-methyl-4-cyclopentyl cyclopentane
- (3) 1-cyclopentyl-3-ethyl-4- methyl cyclopentane
- (4) 4-cyclopentyl-1-ethyl-2- methyl cyclopentane

10. The correct IUPAC name of given substance is



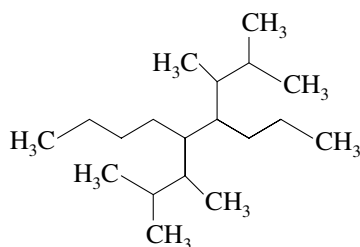
- (1) 1-isopropyl-2-ter-butyl cyclopentane
- (2) 1-ter-butyl-2-isopropyl cyclopentane
- (3) 2-isopropyl-1-ter-butyl cyclopentane
- (4) 2-ter-butyl-1-isopropyl cyclopentane

11. According to IUPAC convention, the systematic name of the compound given below is

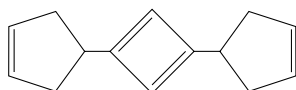


- (1) 1-(3-chlorocyclohexyl)-4-(4-bromocyclohexyl)-2-fluorocyclohexane
- (2) 5-(4-bromocyclohexyl)-2-(3-chlorocyclohexyl)-1-fluorocyclohexane
- (3) 4-(4-bromocyclohexyl)-1-(3-chlorocyclohexyl)-2-fluorocyclohexane
- (4) 1-(4-bromocyclohexyl)-4-(3-chlorocyclohexyl)-3-fluorocyclohexane

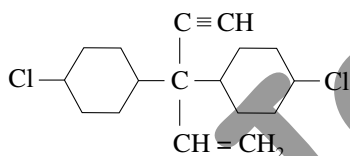
12. What is the correct IUPAC name of the compound shown below?



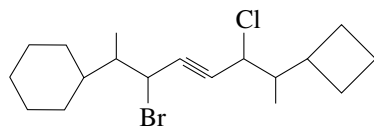
- (1) 4-butyl-2, 3 6, 7-tetramethyl-5-propyl octane  
 (2) 4, 5-bis (1, 2-dimethyl propyl) nonane  
 (3) 5-(1, 2-dimethyl isopropyl)-2, 3-dimethyl-4-propyl nonane  
 (4) Both '2' and '3' are correct
13. What is the correct IUPAC name of the compound shown below?



- (1) Bis (cyclopentenyl) cyclobutadiene  
 (2) 1, 3-bis (3-cyclopentenyl) cyclobutadiene  
 (3) Dicyclopentene cyclobutadiene  
 (4) 4-[3-(3-cyclopentenyl)-1, 3-cyclobutadienyl] cyclopentene
14. What is the correct IUPAC name of the compound shown below?

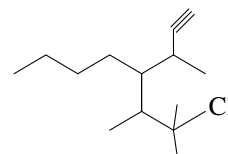


- (1) 3, 3-bis-(chlorocyclohexyl) 1-penten-4-yne  
 (2) bis-(4-chlorocyclohexyl) 4-penten-1-yne  
 (3) 3, 3-bis-(4-chlorocyclohexyl)-1-penten-4-yne  
 (4) 3, 3-bis(4-chlorohexyl)-3-ethynyl prop-1-ene
15. What is the correct IUPAC name of the compound shown below?

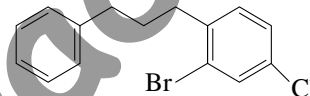


- (1) 5-bromo-2-chloro-1-cyclobutyl-6-cyclohexyl-1,6-dimethyl-3-hexyne  
 (2) 6-bromo-3-chloro-2-cyclobutyl-7-cyclohexyl-4-octyne  
 (3) 3-bromo-6-chloro-7-cyclobutyl-2-cyclohexyl-4-octyne  
 (4) 5-bromo-2-chloro-1-cyclobutyl-6-cyclohexyl-1-methyl-3-heptyne

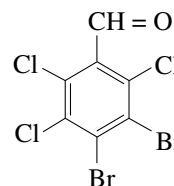
16. What is the correct IUPAC name of the compound shown below?



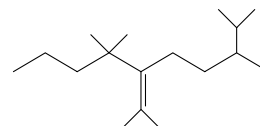
- (1) 4-butyl-6-chloro-3, 5, 6-trimethyl-1-heptyne  
 (2) 4-butyl-6-chloro-3, 5, 6, 6-tetramethyl-1-heptyne  
 (3) 4-butyl-2-chloro-2, 3, 5-trimethyl-6-heptyne  
 (4) 4-(2-chloro-1, 2-dimethylpropyl)-3methyl-1-octyne
17. What is the correct IUPAC name of the following compound?



- (1) 1-(2-bromo-4-chlorophenyl)-3-phenyl propane  
 (2) 3-bromo-2-(3-phenylpropyl) chlorobenzene  
 (3) 1-bromo-5-chloro-2-(3-phenylpropyl) benzene  
 (4) 2-bromo-4-chloro-1-(3-phenylpropyl) benzene
18. What is the correct IUPAC name of the compound given below?

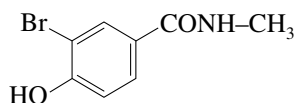


- (1) 3, 4-dibromo-2, 5, 6-trichlorobenzaldehyde  
 (2) 1, 2-dibromo-3, 5, 6-trichlorobenzaldehyde  
 (3) 4, 5-dibromo-3, 3, 6-trichlorobenzaldehyde  
 (4) 5, 6-dibromo-1, 2, 4-trichlorobenzaldehyde
19. The IUPAC name of the compound shown below is

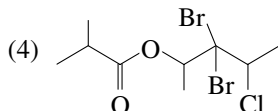
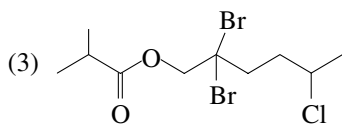
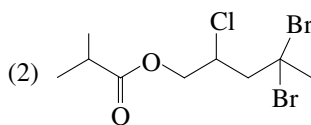
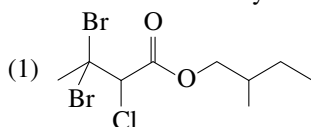


- (1) 2, 4,4-timethyl-3-(3,4-dinethyl pentyl) hept-2-ene  
 (2) 2-isopropyl-6, 6-dimethyl 5-(methyl ethenyl) nonane  
 (3) 2-(methyl ethyl)-5-isopropylidene-6, 6-dimethyl nonane  
 (4) 2,6,7-trimethyl-3-(1', 1'-dimethyl butyl) oct-2-ene

20. What is the correct IUPAC name of the compound shown below?



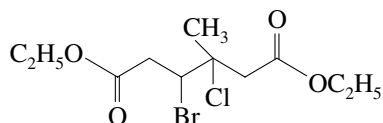
- (1) 4-aminocarbonyl-3-bromo N-methyl phenol
  - (2) 3-bromo-4-hydroxy N-methyl benzene carboxamide
  - (3) 5-bromo-4-hydroxy N-methylbenzene carboxamide
  - (4) N-methyl 4-amido-3-bromophenol
21. Which of the following is correct structure of 3,3-dibromo-2-chlorobutyl 2-methyl propanoate?



22. Which is the correct structure of 2-(2-cyclohexenyl) cyclopropanol?

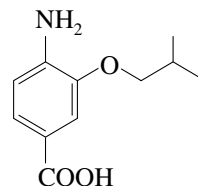


23. What is the correct IUPAC name of the compound given below?



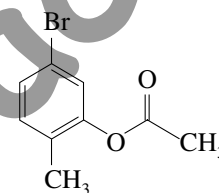
- (1) 3-bromo-4-chloro-4-methyl ethyl hexanedioate
- (2) Diethyl 4-bromo-3-chloro-3-methyl hexanedioate
- (3) Ethyl 4-bromo-3-chloro-3-methyl hexanedioate
- (4) Diethyl 3-bromo-4-chloro-4-methyl hexanedioate

24. What is IUPAC name of the compound given below?

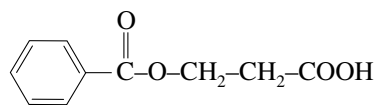


- (1) 4-carboxy-2-(2'-methyl propoxy) aniline
- (2) 4-amino-5-(2'-methyl propoxy) benzoic acid
- (3) 4-amino-3-(2'-methyl propoxy) benzoic acid
- (4) 4-amino-3-(2'-methyl propoxy) carboxy benzene

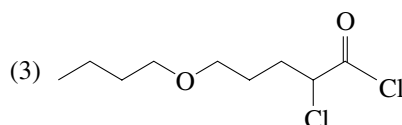
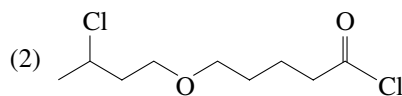
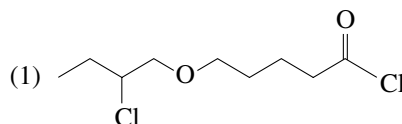
25. The correct IUPAC name of the compound given below is

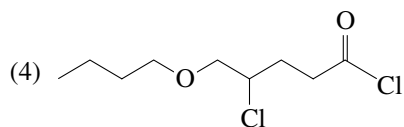


- (1) 5-bromo-2-methyl phenyl ethanoate
  - (2) 3-bromo-6-methyl phenyl ethanoate
  - (3) 4-bromo-2-{oxy-(1-oxoethyl)} toluene
  - (4) Methyl 5-bromo-2-methyl benzoate
26. What is the correct IUPAC name of the compound shown below?

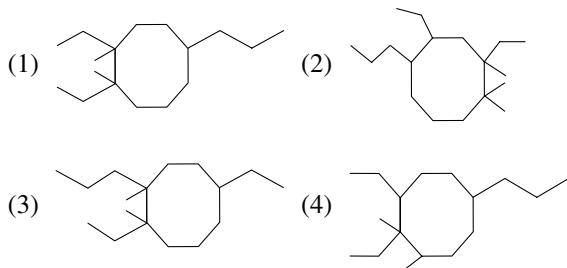


- (1) 3-carboxy phenyl propanoic acid
  - (2) 3-(benzoyloxy) propanoic acid
  - (3) 3-hydroxy-3-oxoethyl benzoate
  - (4) 3-oxyphenyl carboxy propanoic acid
27. The correct structure of 5-(2-chlorobutoxy) pentanoyl chloride is

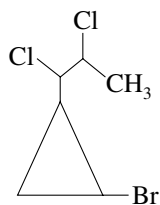




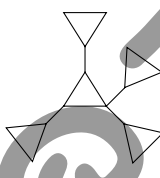
28. The correct structural formula of 1,2-diethyl-1, 8-dimethyl-5-propyl cyclooctane is



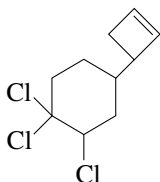
29. The correct IUPAC name of the compound shown below is



- (1) 1-bromo-2-(1, 2-dichloropropyl) cyclopropane  
 (2) 2-bromo-1-(1, 2-dichloropropyl) cyclopropane  
 (3) 1-bromocyclopropyl-1, 2-dichloro propane  
 (4) 1-(2-bromocyclopropyl)-1, 2-dichloropropane
30. What is the IUPAC name of the compound shown below?

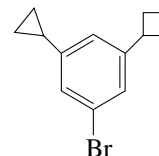


- (1) Tetracyclopentyl cyclopropane  
 (2) Pentacyclopentane  
 (3) 1, 2, 2, 3-tetracyclopentyl cyclopropane  
 (4) 1, 1, 2, 3-tetracyclopentyl cyclopropane
31. What is the correct IUPAC name of the compound shown below?

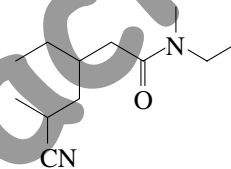


- (1) 1, 1, 2-trichloro-4-cyclobutenyl cyclohexane  
 (2) 3-trichlorocyclohexyl cyclobutene  
 (3) 3-(3, 4, 4-trichlorocyclohexyl) cyclobutene  
 (4) 3, 4, 4-trichloro-1-cyclobutenyl cyclohexane

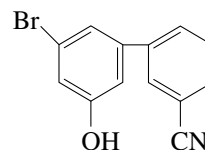
32. What is the correct IUPAC name of the compound shown below?



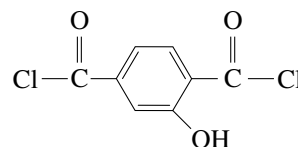
- (1) 3-bromo-1-cyclobutyl-5-cyclopropyl benzene  
 (2) 3-bromo-1-cyclopropyl-5-cyclobutyl benzene  
 (3) 1-bromo-5-cyclobutyl-3-cyclopropyl benzene  
 (4) 1-bromo-3-cyclobutyl-5-cyclopropyl benzene
33. What is the correct IUPAC name of the following compound?



- (1) 3-(2-cyanopropyl)-N-ethyl N-methyl pentanamide  
 (2) N-ethyl-3-(2-cyanopropyl) N-methyl pentanamide  
 (3) N, 3-diethyl-5-cyano N-methyl hexanamide  
 (4) 5-cyano-N, 3-diethyl N-methyl hexanamide
34. What is the correct IUPAC name of the compound shown below?

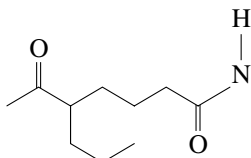


- (1) 3-bromo-5-(3'-cyanophenyl) phenol  
 (2) 5-bromo-3-(3'-cyanophenyl) phenol  
 (3) 3-(3'-hydroxy-5'-bromophenyl) benzonitrile  
 (4) 3-(3'-bromo-5'-hydroxy phenyl) benzonitrile
35. What is the correct IUPAC name of the given compound?



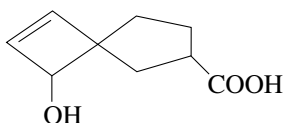
- (1) 2-hydroxy-1, 4-benzene dicarbonyl chloride  
 (2) 2, 4-dichloro carbonyl phenol  
 (3) 3-hydroxy-1, 4-benzene dicarbonyl chloride  
 (4) 1, 4-dicarbonyl chloride-3-hydroxy benzene

36. In the IUPAC name of the following compound, there is something wrong. Find the mistake.

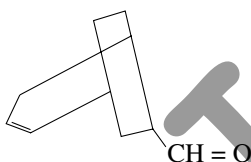


N-ethyl-6-oxo-5 propyl heptanamide

- (1) Principal functional group is incorrectly chosen
  - (2) Incorrect prefix for locant is used
  - (3) Parent chain is incorrectly selected
  - (4) Locants name is not written in order of priority recommended by IUPAC
37. IUPAC name of the following compound is:

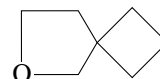


- (1) 1-hydroxy spiro [3, 4] oct-2-ene-6-carboxylic acid
  - (2) 6-carboxy spiro [3, 4] oct-2-ene-1-ol
  - (3) 3-hydroxy spiro [3,4] oct-1-ene-6-carboxylic acid
  - (4) 2-carboxy spiro [3,4] oct-7-ene-6-ol
38. The IUPAC name of the following compound is:



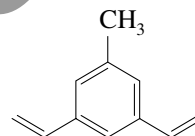
- (1) Bicyclo [2,3,2] non-2-ene-6-carbaldehyde
- (2) Bicyclo [3,2,2] non-5-ene-2-carbaldehyde
- (3) Bicyclo [3,2,2] non-2-ene-6-carbaldehyde
- (4) Bicyclo [3,2,0] non-2-ene-6-carbaldehyde

39. What is the correct IUPAC name of the compound shown below?



- (1) 6-oxa spiro [2,3] octane
- (2) 6-oxa spiro [4,3] octane
- (3) 6-oxa spiro [3,3] heptane
- (4) 6-oxa spiro [3,4] octane

40. What is the correct IUPAC name of the following compound?

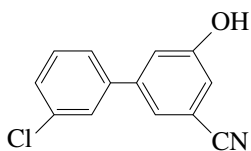


- (1) 3, 5-diethenyl toluene
- (2) 1, 3-diethenyl-5-methyl benzene
- (3) 3-ethenyl-5-methyl styrene
- (4) 1, 3, 5-triethenylmethyl benzene

### EXERCISE 3

#### One and More Than One Option Correct Type Question

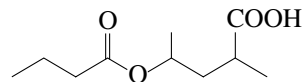
1. The correct statement regarding the given compound is/are



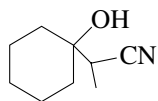
- (1) Suffix of the name would be-ol
- (2) Suffix of the name would be-nitrile
- (3) Parent ring has two locants besides principal functional group

- (4) Locant phenyl group is at fifth position of parent ring

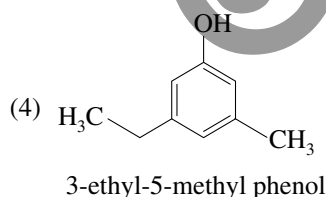
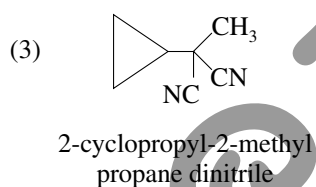
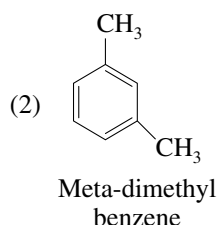
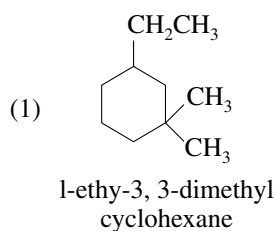
2. What is/are true regarding the compound?



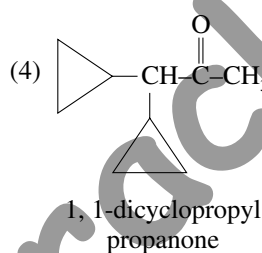
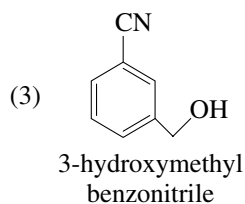
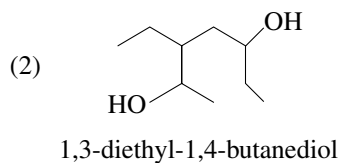
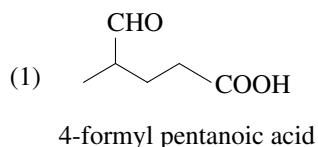
- (1) It is a carboxy ester
  - (2) It is an alkanoyloxy acid
  - (3) Its IUPAC name is 4-carboxy-2-pentyl butanoate
  - (4) Its IUPAC name is 4-butanoyloxy-2-methyl pentanoic acid
3. What is/are wrong according to IUPAC convention in the following naming?



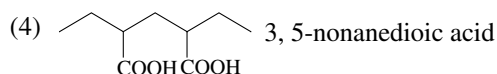
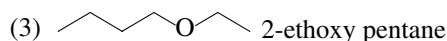
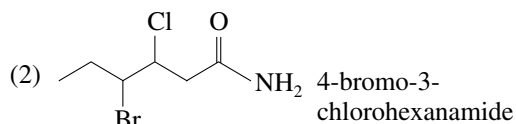
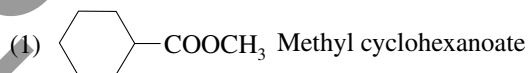
- (1) Parent chain is incorrectly selected  
 (2) Parent chain has only three carbons  
 (3) Its IUPAC name is 1-(1-hydroxycyclohexyl)-1-methyl ethanenitrile  
 (4) Its IUPAC name is 2-(1-hydroxycyclohexyl) propanenitrile
4. Which of the following compound(s) and their IUPAC name is/are wrongly matched?



5. Which of the following compounds and their names are correctly matched?



6. Which of the following structures and IUPAC name are incorrectly matched?



7. If an alkane  $C_{10}H_{22}$  has a quaternary carbon, two tertiary carbons and six methyl groups, which of the following could be one of its correct IUPAC name?

- (1) 1,2-dimethyl-1-tertiarybutyl butane  
 (2) 3-ethyl-2,2,4-trimethyl pentane  
 (3) 2,2,3,4-tetramethyl hexane  
 (4) 2,3,4,5-tetramethyl hexane

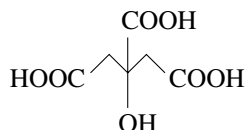
### Statement Type Question

- (1) If both Statement-I and Statement-II are correct and Statement-II is the correct explanation for Statement-I  
 (2) If both Statement-I and Statement-II are correct and Statement-II is not the correct explanation for Statement-I

(3) If Statement-I is correct and Statement-II is incorrect

(4) If Statement-I is incorrect and Statement-II is correct

8. **Statement-I:** The IUPAC name of citric acid is 2-hydroxy-propane-1, 2, 3-tricarboxylic acid.



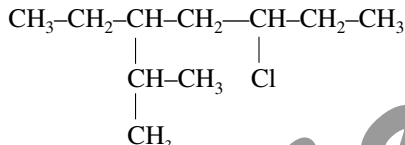
citric acid

**Statement-II:** When an unbranched C atom is directly linked to more than two like-functional groups, then it is named as a derivative of the parent alkane which does not include the C atoms of the functional group.

9. **Statement-I:** The IUPAC name of  $\text{CH}_3\text{-CH=CH-C}\equiv\text{C-H}$  is pent-3-en-1-yne and not pent-2-en-4-yne.

**Statement-II:** Lowest locant rule for multiple bond is preferred.

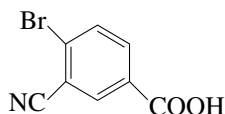
10. **Statement-I:** The IUPAC name for



Is 5-chloro-3-ethyl-2-methyl heptane and not 3-chloro-5-isopropyl heptane.

**Statement-II:** The parent carbon chain should contain larger number of alkyl substituents.

11. **Statement-I:** IUPAC name of the compound given below is 4-bromo-3-cyanobenzoic acid

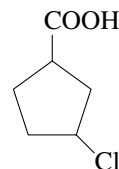


**Statement-II:**  $\text{-COOH}$  has higher priority than a cyanide group.

12. **Statement-I:** Dimethyl benzene can have three different IUPAC names

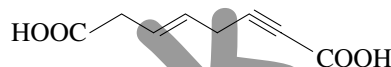
**Statement-II:** All three different names are for three positional isomers.

13. **Statement-I:** Following compound has its IUPAC name 3-chlorocyclopentanoic acid



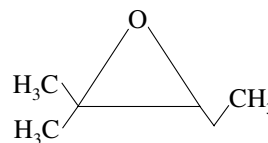
**Statement-II:**  $\text{COOH}$  is the principal functional group of compound which determines the suffix name.

14. **Statement-I:** IUPAC name of the following compound is oct-2-en-5-ynedioic acid



**Statement-II:** Double bond has preference over triple bond.

15. **Statement-I:** IUPAC name of the following compound is 2-ethyl-3, 3-dimethyl oxirane.



**Statement-II:** In oxirane, numbering starts from oxygen atom of the ring.

## Comprehension Type Question

### Passage #1 Q. 16–18

An aromatic compound has one cyanide and two chloride groups on benzene ring. In IUPAC system, cyanide has higher priority than chloride group, therefore determine suffix of parent name of the compound.

16. How many different IUPAC names can be assigned to the above mentioned compound?

(1) 2 (2) 3  
(3) 4 (4) 6

17. What is IUPAC name of the compound above which is most polar?

(1) 2, 3-dichlorobenzonitrile  
(2) 2, 4-dichlorobenzonitrile  
(3) 2, 6-dichlorobenzonitrile  
(4) 3, 4-dichlorobenzonitrile

18. Which is IUPAC name of the compound above which is least polar?

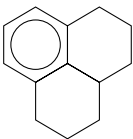
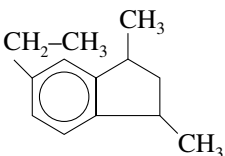
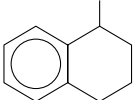
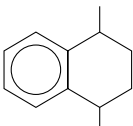
(1) 2, 3-dichlorobenzonitrile  
(2) 2, 5-dichlorobenzonitrile

(3) 3, 4-dichlorobenzonitrile

(4) 3, 5-dichlorobenzonitrile

**Column Matching Type Question**

19. Match the column. (Matrix):

| Column-I<br>Compounds                                                                   | Column-II<br>Number of Benzylic<br>hydrogen |
|-----------------------------------------------------------------------------------------|---------------------------------------------|
| (A)    | (P) 2                                       |
| (B)    | (Q) 3                                       |
| (C)   | (R) 4                                       |
| (D)  | (S) 5                                       |

**Code**

| A     | B | C | D |
|-------|---|---|---|
| (1) S | R | Q | P |
| (2) R | S | P | Q |
| (3) S | P | R | Q |
| (4) Q | R | S | P |

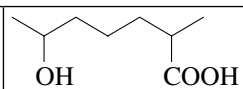
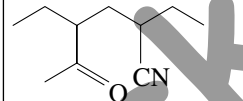
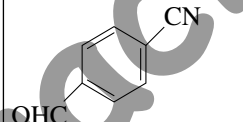
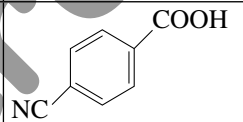
20. Match the IUPAC names from column-I with their features from column-II. There may be more than one match for the quantity from Column-I with the quantities from Column-II

| Column-I                             | Column-II                                                                            |
|--------------------------------------|--------------------------------------------------------------------------------------|
| (A) 3, 3, 4, 4-tetramethyl-1-pentyne | (P) has only three carbon collinear                                                  |
| (B) 2-butyne                         | (Q) has four carbon colinear                                                         |
| (C) 1-butyne                         | (R) substitution of H by Cl gives single product                                     |
| (D) 2, 2, 5, 5-tetramethyl-3-hexyne  | (S) substitution of H by Cl gives three different products (excluding stereoisomers) |

**Code**

| A       | B   | C   | D   |
|---------|-----|-----|-----|
| (1) P   | Q   | R   | S   |
| (2) P,S | Q,R | P,S | Q,R |
| (3) P,Q | R,S | P,R | Q,S |
| (4) P,R | PS  | Q,R | R,S |

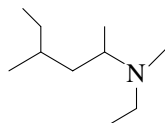
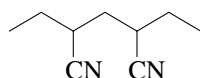
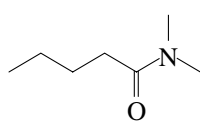
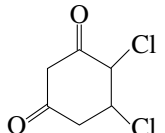
21.

| Column-I                                                                                 | Column-II                                  |
|------------------------------------------------------------------------------------------|--------------------------------------------|
| (A)   | (P) Name end with suffix 'anoic acid'      |
| (B)   | (Q) Name end with suffix 'carboxylic acid' |
| (C)   | (R) Name end with suffix 'nitrile'         |
| (D)  | (S) Parent chain/ring has six carbon atoms |

**Code**

| A     | B   | C   | D   |
|-------|-----|-----|-----|
| (1) P | R,S | R,S | Q,S |
| (2) Q | R,S | R,S | Q,S |
| (3) R | Q,S | P,R | R,S |
| (4) S | P,Q | R,S | Q,S |

22. Match the general formula from Column-I with the class they belong to in Column-II

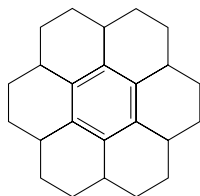
| Column-I                                                                                  | Column-II                                |
|-------------------------------------------------------------------------------------------|------------------------------------------|
| (A)  | (P) has tertiary N-atom                  |
| (B)  | (Q) has tertiary carbon atom             |
| (C)  | (R) has five carbons in the parent chain |
| (D)  | (S) has six carbons in the parent chain  |

**Code**

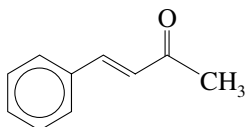
| A         | B     | C   | D   |
|-----------|-------|-----|-----|
| (1) P,R,S | P,R   | Q   | S   |
| (2) Q     | P,R,S | P,S | Q,S |
| (3) P,Q,S | Q,R   | P,R | Q   |
| (4) Q,SP, | R     | S   | P   |

**Single Digit Integer Type Question**

23. Total number of  $\alpha$ -hydrogen in the given following compound is:

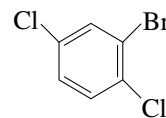


24. How many carbon atom present in the parent chain in the given following compound?

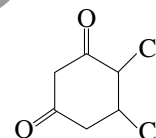


25. If the following compound is correctly named according to IUPAC convention what would be sum of

the numbers representing positions of three halide locants?



26. In the compound 7-ethyl 3-nonene-2, 5, 8-tricarboxylic acid, how many atoms are in  $sp^2$ -hybridisation state?
27. In 3-formyl-2-methyl benzoic acid, what is the maximum number of hydrogen atoms which may lie in one single plane?
28. When name of hydrocarbon 3-(1-butenyl)-1, 5-hexadiene is rewritten correctly according to IUPAC convention, what would be the number of carbon atoms in the parent chain.
29. When the following compound is named correctly according to IUPAC convention, what would be the sum of position of two chlorine atoms?



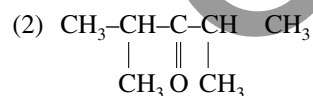
30. How many secondary hydrogens are present in the alkyne named 3-ethyl-4-octyne?

**EXERCISE 4**

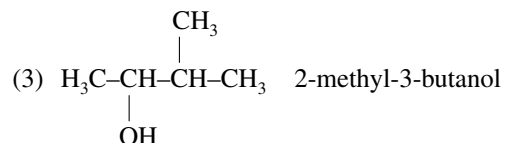
1. Which of the following compounds has incorrect IUPAC name: [AIEEE-2002]



ethyl butanoate



2,4-dimethyl-3-pentanone

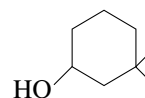


2. The IUPAC name of  $\text{CH}_3\text{COCH(CH}_3\text{)}_2$  is [AIEEE-2003]

- (1) 4-Methylisopropyl ketone  
(2) 3-Methyl-2-butanone

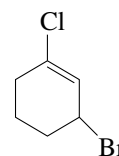
- (3) Isopropylmethyl ketone  
(4) 2-Methyl-3-butanone

3. The IUPAC name of the compound is [AIEEE-2004]



- (1) 3,3-Dimethyl-1-hydroxy cyclohexane  
(2) 1,1-Dimethyl-3-hydroxy cyclohexane  
(3) 3,3-Dimethyl-1-cyclohexanol  
(4) 1,1-Dimethyl-3-cyclohexanol

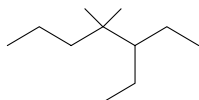
4. The IUPAC name of the compound shown below is [AIEEE-2006]



- (1) 6-Bromo-2-chlorocyclohexene  
(2) 3-Bromo-1-chlorocyclohexene

- (3) 1-Bromo-3-chlorocyclohexene  
 (4) 2-Bromo-6-chlorocyclohex-1-ene

5. The IUPAC name of is- [AIEEE-2007]



- (1) 1, 1-Diethyl-2-dimethylpentane  
 (2) 4, 4-Dimethyl-5, 5-diethylpentane  
 (3) 5, 5-Diethyl-4, 4-dimethylpentane  
 (4) 3-Ethyl-4, 4 dimethylheptane
6. The correct decreasing order of priority for the functional groups of organic compounds in the IUPAC system of nomenclature is [JEE Main-2008]
- (1)  $-\text{SO}_3\text{H}$ ,  $-\text{COOH}$ ,  $-\text{CONH}_2$ ,  $-\text{CHO}$   
 (2)  $-\text{CHO}$ ,  $-\text{COOH}$ ,  $-\text{SO}_3\text{H}$ ,  $-\text{CONH}_2$   
 (3)  $-\text{CONH}_2$ ,  $-\text{CHO}$ ,  $-\text{SO}_3\text{H}$ ,  $-\text{COOH}$   
 (4)  $-\text{COOH}$ ,  $-\text{SO}_3\text{H}$ ,  $-\text{CONH}_2$ ,  $-\text{CHO}$
7. The IUPAC name of neopentane is [JEE Main-2009]

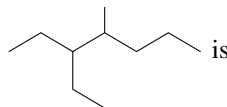
- (1) 2-methylbutane  
 (2) 2,2-dimethylpropane  
 (3) 2-methylpropane  
 (4) 2,2-dimethylbutane

8. The IUPAC name of the compound  $\text{H}_2\text{O}-\text{CH}-\text{CH}_3$  is : [JEE Main Online-2012]



- (1) 1, 2-Epoxy propane (2) Propylene oxide  
 (3) 1, 2-Oxo propane (4) 1, 2-Propoxide

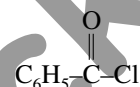
9. The correct IUPAC name of the following compound is



[JEE Main Online-2014]

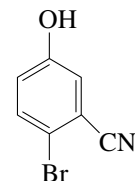
- (1) 4-methyl-3-ethylhexane  
 (2) 3-ethyl-4-methylhexane  
 (3) 3,4-ethylemethylhexane  
 (4) 4-ethyl-3-methylhexane

10. The IUPAC name of the given compound is: [IIT-2006]



- (1) Benzoylchloride  
 (2) Benzenecarbonylchloride  
 (3) Chlorophenyl ketone  
 (4) Phenylchloroketone

11. The IUPAC name of the following compound is- [IIT-2009]



- (1) 4-Bromo-3-cyanophenol  
 (2) 2-Bromo-5-hydroxybenzonitrile  
 (3) 2-Cyano-4-hydroxybromobenzene  
 (4) 6-Bromo-3-hydroxybenzonitrile

## ANSWER KEY

### EXERCISE # 1

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (4)  | 2. (1)  | 3. (3)  | 4. (1)  | 5. (3)  |
| 6. (1)  | 7. (2)  | 8. (2)  | 9. (1)  | 10. (4) |
| 11. (1) | 12. (3) | 13. (3) | 14. (1) | 15. (1) |
| 16. (4) | 17. (2) | 18. (3) | 19. (2) | 20. (3) |
| 21. (3) | 22. (2) | 23. (4) | 24. (4) | 25. (1) |
| 26. (2) | 27. (4) | 28. (4) | 29. (4) | 30. (1) |
| 31. (4) | 32. (1) | 33. (4) | 34. (2) | 35. (3) |
| 36. (3) | 37. (4) | 38. (3) | 39. (2) | 40. (3) |

### EXERCISE # 2

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (3)  | 2. (3)  | 3. (3)  | 4. (3)  | 5. (2)  |
| 6. (1)  | 7. (3)  | 8. (2)  | 9. (4)  | 10. (1) |
| 11. (3) | 12. (3) | 13. (2) | 14. (3) | 15. (2) |
| 16. (4) | 17. (4) | 18. (1) | 19. (4) | 20. (2) |
| 21. (2) | 22. (2) | 23. (2) | 24. (3) | 25. (1) |
| 26. (2) | 27. (1) | 28. (4) | 29. (4) | 30. (4) |
| 31. (3) | 32. (1) | 33. (4) | 34. (4) | 35. (1) |
| 36. (3) | 37. (3) | 38. (3) | 39. (4) | 40. (2) |

**EXERCISE # 3**

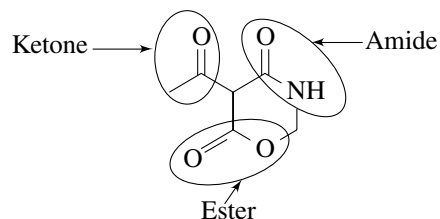
- |          |          |          |          |          |
|----------|----------|----------|----------|----------|
| 1. (2,3) | 2. (2,4) | 3. (1,4) | 4. (1,2) | 5. (3,4) |
| 6. (1,4) | 7. (2,3) | 8. (1)   | 9. (1)   | 10. (1)  |
| 11. (1)  | 12. (1)  | 13. (4)  | 14. (3)  | 15. (4)  |
| 16. (4)  | 17. (3)  | 18. (4)  | 19. (1)  | 20. (2)  |
| 21. (1)  | 22. (3)  | 23. (6)  | 24. (4)  | 25. (7)  |
| 26. (8)  | 27. (4)  | 28. (8)  | 29. (9)  | 30. (6)  |

**EXERCISE # 4**

- |         |        |        |        |         |
|---------|--------|--------|--------|---------|
| 1. (3)  | 2. (2) | 3. (3) | 4. (2) | 5. (4)  |
| 6. (4)  | 7. (2) | 8. (1) | 9. (2) | 10. (2) |
| 11. (2) |        |        |        |         |

**HINT AND SOLUTION**
**EXERCISE # 1**

1. [4]

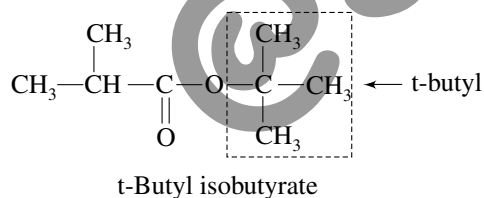


So ether group NOT present

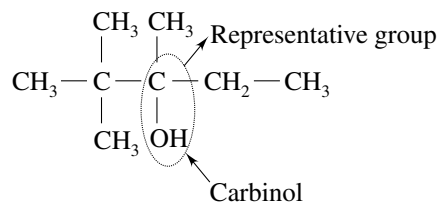
2. [1]

Double bond in between C-C known as olefinic bond.

3. [3]



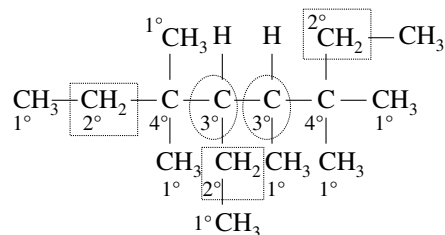
4. [1]



It consist 3-different alkyl radical which wright in alphabet order.

t-Butyl ethyl methyl carbinol

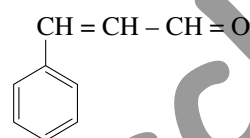
5. [3]



3° Carbon = 2

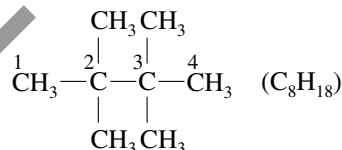
2° Hydrogen = 6

6. [1]



- All C are  $sp^2$  hybridised
- It is planner
- IUPAC name – 3 phenyl-2 propenyl
- CHO group is not directly attach with benzen ring so it is not aromatic aldehyde.

7. [2]

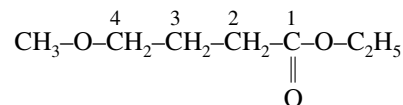


2, 2, 3, 3-tetra methyl butane

This structure have only 1°H

8. [2]

 Principal functional group =  $\text{C}=\text{O}$ 

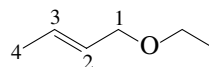
 Side chain =  $\text{OCH}_3$  (methoxy)


Ethyl-4-methoxy butanoate

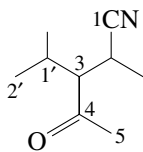
9. [1]

According to proirity of functional group

10. [4]



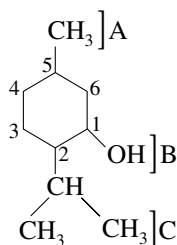
11. [1]



Principal functional group = CN

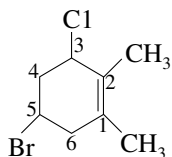
Side chain =  $-\text{C}-$ ,  $\text{CH}_3$ ,  $\text{CH}(\text{CH}_3)_2$ 

12. [3]



$-\text{OH} \Rightarrow$  Principal functional group has 1<sup>st</sup> locant number, then apply locant number rule  $A \rightarrow 5$ ,  $B \rightarrow 1$ ,  $C \rightarrow 2$

13. [3]



$\rightarrow$  Numbering of parent chain start from double bonded C, by using alphabet rule

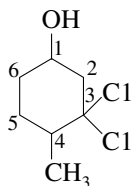
14. [1]

$\rightarrow$  Maximum number of carbon containing ring selected as parent chain

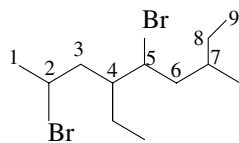
$\rightarrow$  Cyclobutyl methyl is single complicated side chain

15. [1]

For numbering principal functional group ( $-\text{OH}$ ) will be preferred



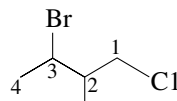
16. [4]



Select longest C chain

17. [2]

In option (2) parent chain is wrongly numbered, the correct numbering is

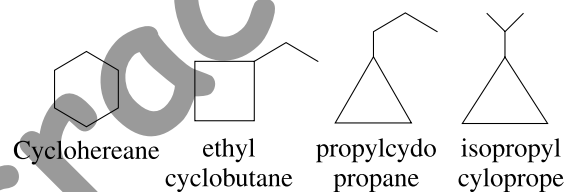


18. [3]

Molar mass = 84 is the multiple of 14

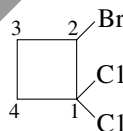
Hence molecular formula =  $(\text{CH}_2)_n$  $\therefore (12 + 2)_n = 84$  $n = 6$  $\therefore$  Molecular formula =  $\text{C}_6\text{H}_{12}$ 

$\times$  has no double bond, it must be cycloalkane. Cycloalkanes without methyl as locant are-



19. [2]

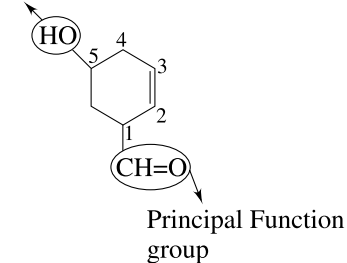
In option (2) parent chain wrongly numbered, correct numbering is



Correct name is 2-bromo-1, 1-dichloro cyclobutane according to least locant number rule

20. [3]

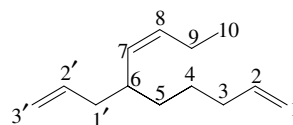
Side chain



Parent chain must contain

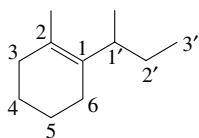
Principal functional group &gt; multiple bond &gt; side chain

21. [3]



Parent chain must contain maximum number of multiple bond and maximum number of C.

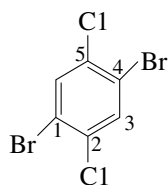
22. [2]



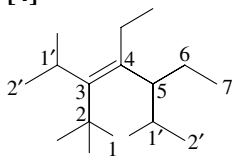
Apply alphabet rule with the preference of double bond

23. [4]

Numbering of parent chain according to alphabet rule

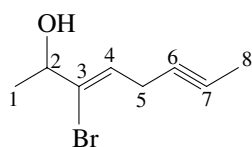


24. [4]

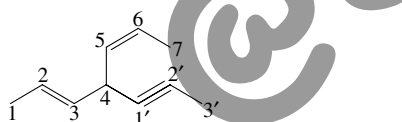


Apply least locant number rule with the preference of multiple bond.

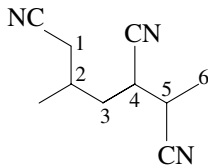
25. [1]



26. [2]

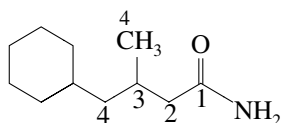


27. [4]



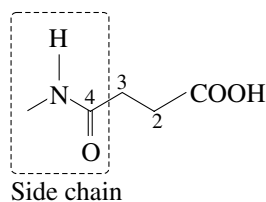
28. [4]

Open chain contain functional group so that it must be parent chain



Ring works as side chain

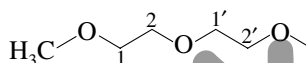
29. [4]



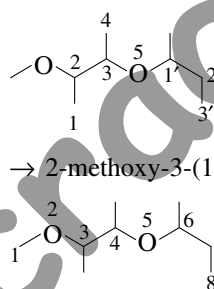
Side chain

3. (N. methyl carbamoyl) propanoic acid

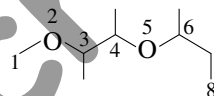
30. [1]



31. [4]



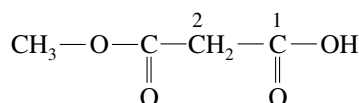
→ 2-methoxy-3-(1' methyl propoxy) butane



As per OXA system

3, 4, 6-trimethyl-2,5-dioxa octane

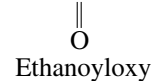
32. [1]



2-carbomethoxy ethanoic acid

Principal functional group = COOH

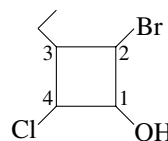
Side Chain = —O—C—CH<sub>2</sub> (esar group)



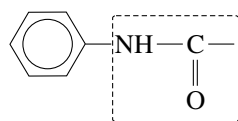
Ethanoyloxy

33. [4]

- Principal functional group = → OH
- Side chain → Bromo Chloro ethyl
- albhabet rule applies

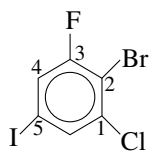


34. [2]



Principal functional group

35. [3]

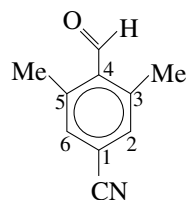


→ Apply locant number rule

→ followed by alphabet rule

2-bromo-1-chloro-3-fluoro-5-iodobenzene

36. [3]

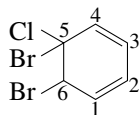


Priority – CN &gt; –CH = O

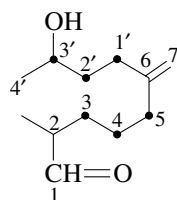
– CN ⇒ Principal functional group

– CH = O ⇒ Side chain

37. [4]

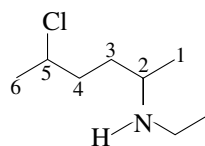


38. [3]

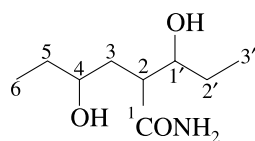


Parent chain must be preferred for numbering  
functional group (–CH=O) > multiple bond (=) > side chain (–OH)

39. [2]

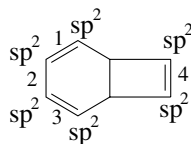


40. [3]

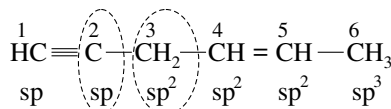


## EXERCISE # 2

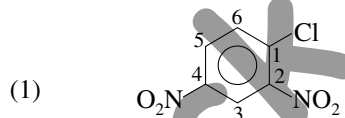
1. [3]

 $sp^2 - sp^2$  sigma bonds = 4

2. [3]

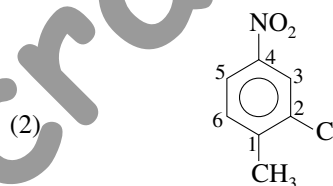


3. [3]



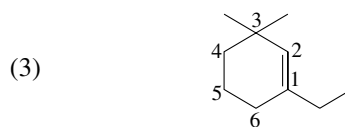
1-Chloro-2,4-dinitrobenzene (correct)

4-Chloro-1,3-dinitrobenzene (Wrong)



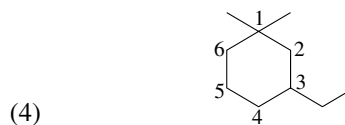
2-chloro-1-methyl-4-nitrobenzene (correct)

4-Methyl-5-chloronitrobenzene (Wrong)



1-Ethyl-3,3-dimethylcyclohexene (Correct)

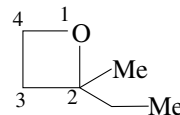
Apply least locant number rule with the preference of multiple bond.



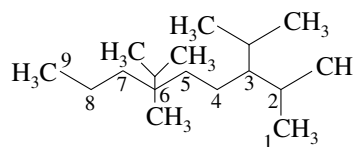
3-Ethyl-1,1-dimethylcyclohexane (correct)

1-Ethyl-3,3-dimethylcyclohexane (wrong)

4. [3]

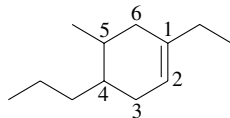


5. [2]



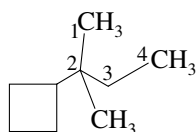
6. [1]

For numbering multiple bond preferred over side chain

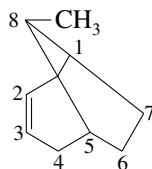


7. [3]

Parent chain must contain greater number of side chain

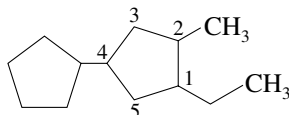


8. [2]

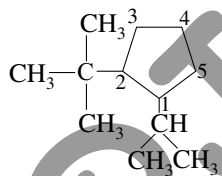


9. [4]

Apply least locant number rule as well alphabet rule

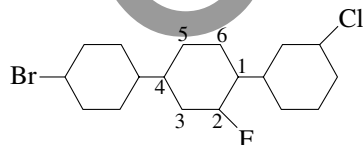


10. [1]



Selection of parent chain by alphabet rule

11. [3]

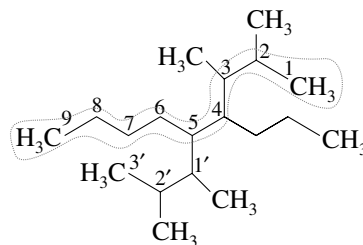


→ parent chain must contain maximum number side chain

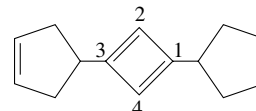
→ numbering of parent chain takes place by least locant number rule

12. [3]

Maximum number of continuous C-present in parent chain



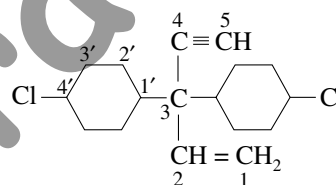
13. [2]



Parent chain must contain maximum number of multiple bond.

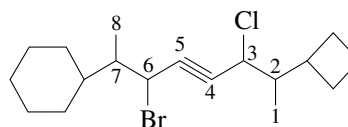
14. [3]

Parent chain must contain maximum number of multiple bond



15. [2] Multiple bond ( $\equiv$ ) containing chain selected as parent chain

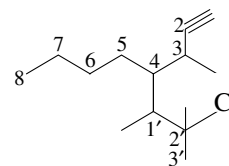
Alphabet rule applicable



16. [4]

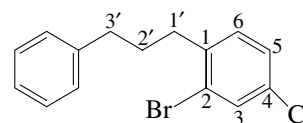
Parent chain must contain following in given priority.

Principal function group > multiple bond > maximum number of carbon.



4-(2-chloro-1,2-dimethylpropyl)-3-methyl-1-octyne

17. [4]

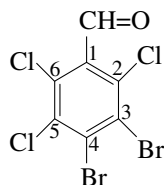


Numbering of parent chain according to least locant number rule.

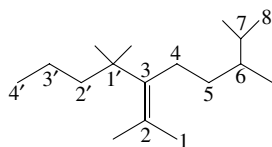
18. [1]

Principal functional group  $\rightarrow$   $-\text{CH}=\text{O}$ 

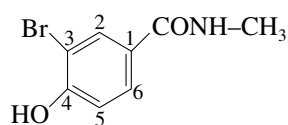
Numbering of parent chain (benzene ring) takes place according to Alphabet rule.



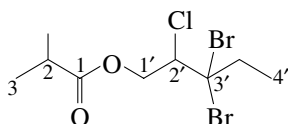
19. [4]



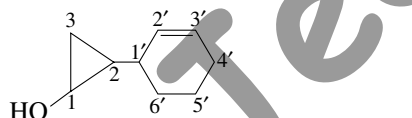
20. [2]



21. [2]

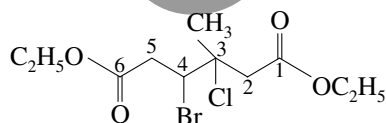


22. [2]

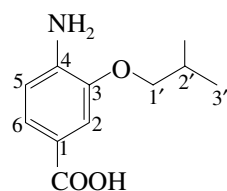


23. [2]

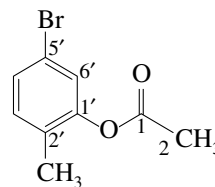
Numbering takes place according to least locant number rule



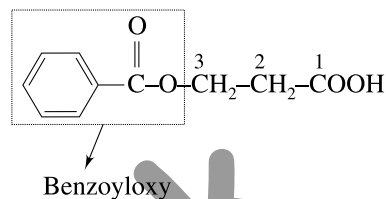
24. [3]



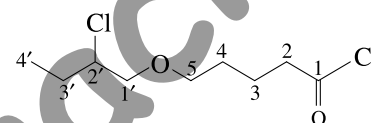
25. [1]



26. [2]

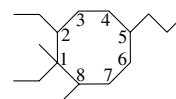


27. [1]



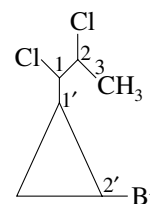
28. [4]

Use alphabet rule as well least locant number rule.



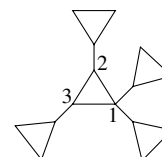
29. [4]

Maximum number side chain must be present in parent chain, when number of C in both (open/close) chain will be same

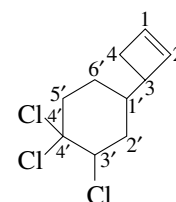


30. [4]

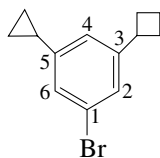
Apply locant number rule



31. [3] Multiple bond containing chain selected as parent chain



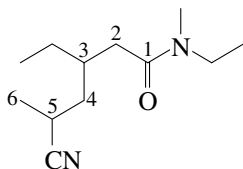
32. [1]



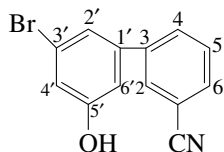
→ Aromatic ring has greater number of substituent, so that it must be parent chain

→ Numbering of parent chain takes place via alphabet rule

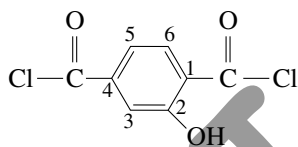
33. [4]



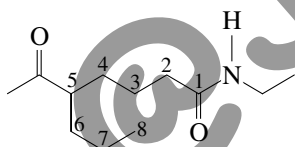
34. [4] Principal functional group ( $-\text{C}\equiv\text{N}$ ). So that  $-\text{C}\equiv\text{N}$  containing chain selected as parent chain.



35. [1]



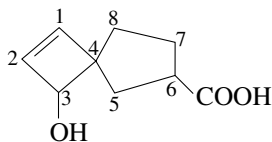
36. [3]



N-ethyl-6-oxo-5-propyl heptanamide (given)

Parent chain has 8 carbon so that given IUPAC name is wrong.

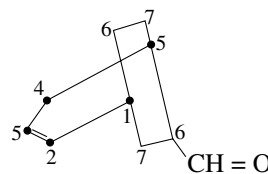
37. [3]



→  $-\text{COOH}$  is Principal functional group

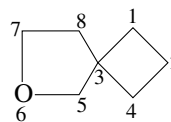
→  $-\text{OH}$  (Side chain)

38. [3]



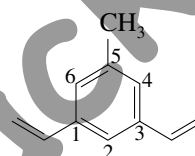
Bicyclo [3,2,2] non-2-cne-6-carbaldehyde

39. [4]



6-oxo-spiro [2,3] octane

40. [2]



1, 3-diethenyl-5-methyl benzene

• Parent chain → benzene

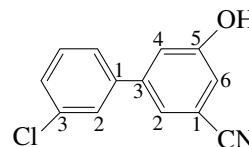
• Side chain → ethenyl, methyl

• Numbering of parent chain according to Alphabet rule

### EXERCISE # 3

1. [2, 3]

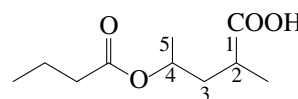
Cyanide has highest priority than hydroxyl group, hence suffix of the name would be nitrile. Other two locants on the parent phenyl ring are equidistant from  $-\text{CN}$ , numbering is done in alphabetical order as:



3-(3-chlorophenyl) 5-hydroxy benzonitrile

2. [2, 4]

Here,  $-\text{COOH}$  has higher priority than ester group, hence the compound is an alkanoyloxy acid, not a carboxy ester, Also,



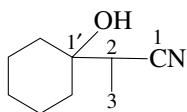
4-butanoyloxy-2-methyl pentanoic



As locant  $\text{R}-\text{C}-$  is named as alkanoyl.

3. [1, 4]

Cyanide has higher priority than hydroxy, compound would be numbered correctly as:



Parent chain has only three carbon.

Correct IUPAC name would be

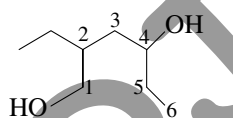
2-(1-hydroxycyclohexyl)propane nitrile.

4. [1, 2]

- (1) Numbering will start from carbon where two methyl groups are present and the name should be 3-ethyl-1, 1-dimethyl cyclohexane.
- (2) Correct IUPAC name is 1, 3-dimethyl benzene (Meta is not used in IUPAC naming)
- (3) It has correct name, carbons of two  $\text{-CN}$  groups are terminals of parent chain.
- (4) It has correct name as  $\text{-OH}$  is the principal functional group with equidistant ethyl and methyl locants. Numbering is done in alphabetical order starting from carbon bearing  $\text{-OH}$  group.

5. [3, 4]

- (1) Mentioned name is incorrect, carbon of  $\text{-CHO}$  is a part of parent chain as it gives the longest chain with more number of locants on it. The correct IUPAC name would be 4-methyl-5-oxopentanoic acid.
- (2) The mentioned name is wrong as it has smaller parent chain. The correct name would be



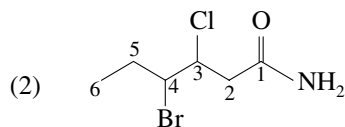
2-ethyl-1,4-hexanediol

- (3) and (4) are correctly named.

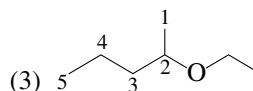
6. [1, 4]

- (1) When carbon containing principal functional group is directly on a ring, normal suffix (here-oate) cannot be used. In present case, carboxylate suffix should have been used and correct IUPAC name would be "methyl cyclohexane carboxylate".
- (4) When there are two carbon containing principal functional groups (now  $\text{-COOH}$ ), their carbon atoms become terminals of the parent chain irrespective of chain length. The correct name of this compound would be 2-butyl-4-ethyl pentane-dioic acid.

(3) and (4) have correct IUPAC names mentioned as:



4-bromo-3-chlorohexanamide



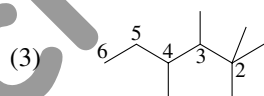
2-ethoxy pentane

7. [2, 3]

In option (1), the longest alkyl chain has not been considered as parent chain. Both (2) and (3) satisfy the given condition.



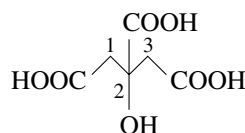
3-ethyl-2,2,4-trimethyl pentane



2,2,3,4-tetramethyl hexane

In (4), there is no quaternary carbon atom.

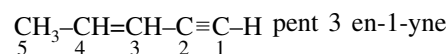
8. [1]



Citric acid

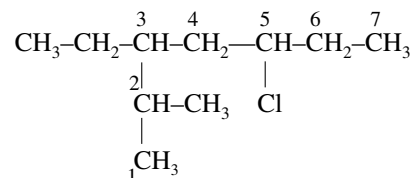
2-hydroxy-propane-1, 2, 3-tricarboxylic acid.

9. [1]



because Numbering takes place according to lowest locant rule.

10. [1]

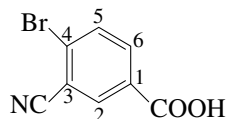


- When parent chain have same number of carbon from either side then maximum substituents contains chain must be preferred

- Numbering takes place according to lowest locant rule.

11. [1]

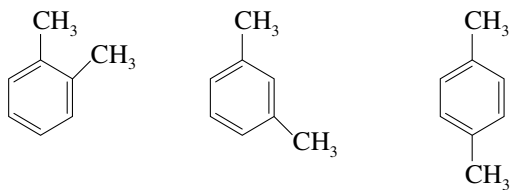
–COOH group has higher priority than –CN, hence numbering is started from the ring carbon where –COOH is present.



4-bromo-3-cyano benzoic acid

12. [1]

There are only three positional isomers possible for dimethyl benzene



1,2-dimethyl benzene    1,3-dimethyl benzene    1,4-dimethyl benzene

Hence, the IUPAC name possible for dimethyl benzene.

13. [4]

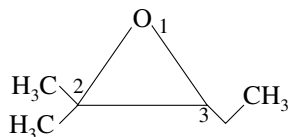
–COOH is directly on cyclopentane ring, its correct IUPAC name would be 3-chlorocyclopentane carboxylic acid.

14. [3]

Double bond has no preference over triple bond. In the given dioic acid, both double and triple bonds are equidistant from terminals, numbering has been done in alphabetical order where 'ene' comes before y of 'yne'.

15. [4]

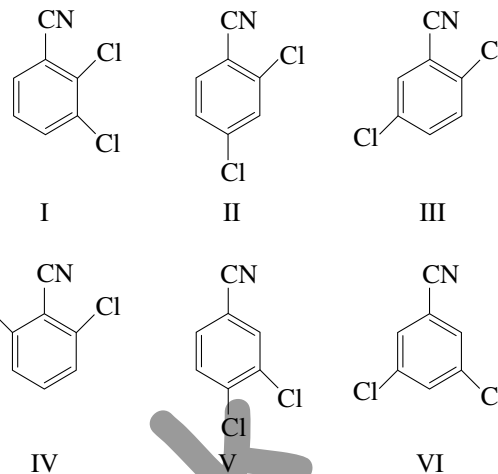
Numbering starts from oxygen in case of oxirane. However, the number series with smaller number at first occasion of difference will be the correct one as:



The correct IUPAC name of this compound is 3-ethyl-2,2-dimethyl oxirane.

16. [4]

The six different isomers of the given compound are



17. [3]

The structure IV is most polar as the resultant of two C–Cl dipole vectors would be aligned with –CN dipole, would be added giving maximum dipole moment.

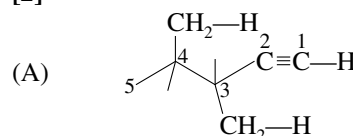
18. [4]

The structure VI is least polar because the resultant of two C–Cl dipole vectors would be at 180° angle to –CN dipole and in opposite direction.

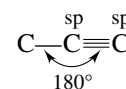
19. [1]

Carbon atom directly attached with benzene ring is benzylic C and H attached to such C- known as benzylic H.

20. [2]

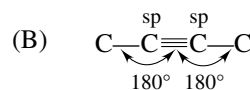


Carbon 1, 2 and 3 are collinear as



Also, it has only three (underline) non-equivalent hydrogen, gives three chloro alkynes in substitution reaction.

(A) → (P, S)

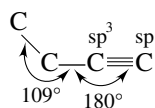


All four carbons are collinear

Also, it has all six hydrogen equivalent, hence only one product after a hydrogen is substituted by chlorine.

(B) → (Q, R)

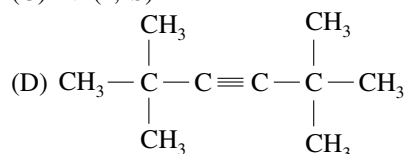
(C)  $\text{CH}_3\text{—CH}_2\text{—C}\equiv\text{C—H}$



Only three carbons collinear

Also, it has three non-equivalent (underline) hydrogens, hence gives three different products after substitution of a H by Cl.

(C) → (P, S)



Hence, the two  $sp$ -hybridised carbons and two  $\alpha$ -carbon bonded to  $sp$  carbons are collinear.

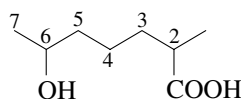
Also, all its hydrogen atoms are equivalent, gives only one chlorinated product on substitution of a H by Cl.

(D) → (Q, R)

21. [1]

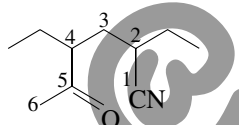
(A) → (P); (B) → (R, S); (C) → (R, S); (D) → (Q, S)]

(A) Naming ending with anionic acid and parent chain has seven carbon atoms.



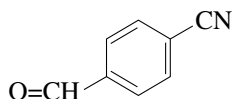
6-hydroxy-2-methyl heptanoic acid

(B) Name ending with nitrile and parent chain six carbon atoms.



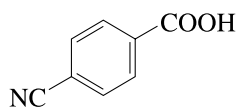
2,4-diethyl-5-oxohexanenitrile

(C) Name ending with nitrile and parent chain has six carbon atoms.



4-formylbenzonitrile

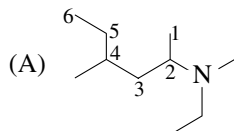
(D) Name ending with suffix nitrile and the parent phenyl ring has six carbon atoms.



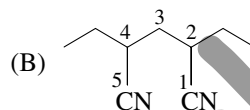
4-cyano benzene carboxylic acid

22. [3]

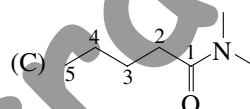
(A) → (P, Q, S); (B) → (Q, R); (C) → (P, R);  
(D) → (Q)



It has  $3^\circ$  N-atom. Parent chain has six carbon atoms. It has C-4 and C-2 tertiary carbon.

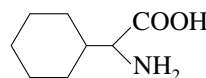


It has no tertiary N-atom. C-2 and C-4 are tertiary carbon. Parent chain has 5 carbon.

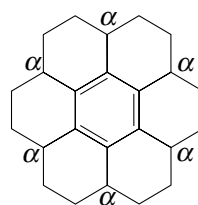


Its nitrogen is tertiary. Parent chain has five carbon.

(D) It has two tertiary carbon. Parent chain has only two carbon.



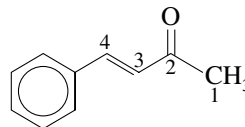
23. [6]



Each indicated  $\alpha$ -C have  $1\alpha$ -H

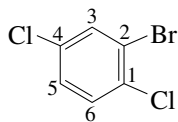
So total number of  $\alpha$ -H = 6.

24. [4]



Functional group containing chain selected as parent chain.

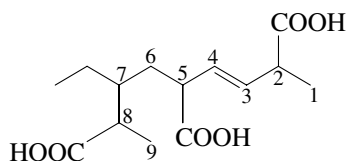
25. [7] Apply least locoint number rule



2-bromo-1,4-dichloro benzene

26. [8]

All three carbon of three  $\text{-COOH}$  are  $\text{sp}^2$ .  
Three oxygen, one in each  $\text{-COOH}$  are  $\text{sp}^2$ .

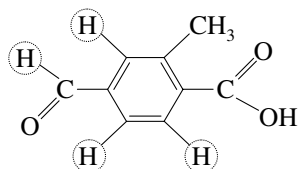


7-ethyl-3-octenoic acid

Both C-3 and C-4 carbons are  $\text{sp}^2$ .

27. [4]

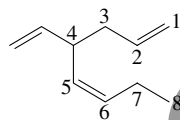
The structure of given compound is



Only hydrogen atoms attached to  $\text{sp}^2$  hybridised carbon atoms can be coplanar. Labelled hydrogens are coplanar.

28. [8]

It has a further longer chain than the one indicated in the given name.

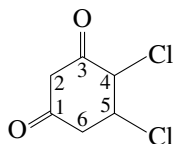


Given: 3-(-1-butenyl)-1, 5-hexadiene

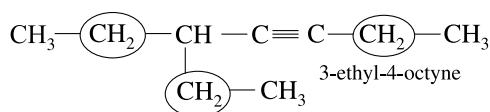
IUPAC: 4-ethenyl-1, 5-octadiene

29. [9]

When this compound is numbered correctly as sum of position of two chlorine atoms is



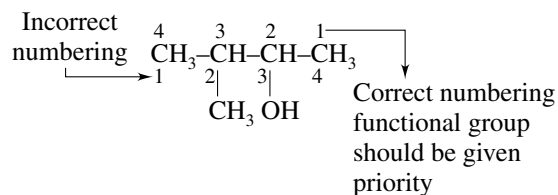
30. [6]



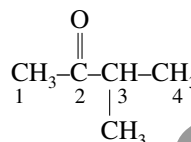
All the hydrogens of  $\text{-CH}_2\text{-}$  are secondary, hence 8 secondary H.

## EXERCISE # 4

1. [3]



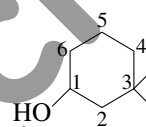
2. [2]



3-methyl butan-2-one or 3-methyl-2-butanone

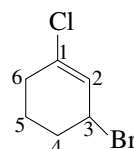
Keto ( $\text{-C=O}$ ) functional group is given priority.

3. [3]



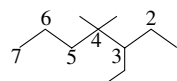
Carbon with  $\text{-OH}$  group is given  $\text{C}_1$ , thus it is 3,3-dimethyl-1-cyclohexanol.

4. [2]



Unsaturation (double bond) is given priority over halogen, So, the correct IUPAC name is 3-Bromo-1-chlorocyclohexene

5. [4]

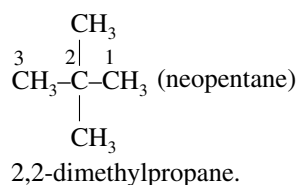


Numbering of parent chain takes place according to least locant number rule thus correct IUPAC name is 3-Ethyl-4, 4 dimethylheptane.

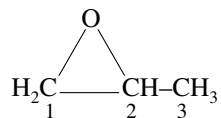
6. [4]

According to priority table of functional group.

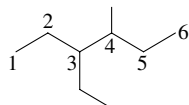
7. [2]



8. [1]

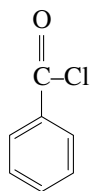


9. [2]



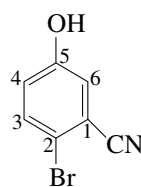
Alphabet rule applicable because least locant number rule failed thus correct IUPAC name is 3-ethyl-4-methylhexane

10. [2]



Parent chain is benzene ring so that correct IUPAC name is Benzenecarbonylchloride

11. [2]



Principal group CN gets 1st locant number followed by least locant number rule thus correct IUPAC name is 2-Bromo-5-hydroxybenzonitrile.