# Nomenclature of Organic Compounds

Mainly three systems are adopted for naming an organic compound:

(i) Common Names or Trivial System
(ii) Derived System
(iii) IUPAC system or Geneva System

## Common or Trivial System

On the basis of

- Source
- Property
- Discovery
- Structure

(i) On the basis of source from which they were obtained.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Organic Compound</th>
<th>Trivial Name</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CH₃OH</td>
<td>Wood spirit or Methyl spirit</td>
<td>Obtained by destructive distillation of wood.</td>
</tr>
<tr>
<td>2.</td>
<td>NH₂CONH₂</td>
<td>Urea</td>
<td>Obtained from urine</td>
</tr>
<tr>
<td>3.</td>
<td>CH₄</td>
<td>Marsh gas (fire damp)</td>
<td>It was produced in marsh places.</td>
</tr>
<tr>
<td>4.</td>
<td>CH₃COOH</td>
<td>Vinegar</td>
<td>Obtained from Acetum - i.e. Vinegar</td>
</tr>
<tr>
<td>5.</td>
<td>COOH</td>
<td>Oxalic acid</td>
<td>Obtained from oxalis plant.</td>
</tr>
<tr>
<td>6.</td>
<td>HCOOH</td>
<td>Formic acid</td>
<td>Obtained from formicus [Red ant]</td>
</tr>
<tr>
<td>7.</td>
<td>CH₃ – CH – COOH</td>
<td>Lactic acid</td>
<td>Obtained from lactous (milk)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>CH₂ – COOH</td>
<td>Malic acid</td>
<td>Obtain from Apple</td>
</tr>
<tr>
<td>9.</td>
<td>CH(OH)COOH</td>
<td>Butyric acid</td>
<td>Obtained from butter.</td>
</tr>
<tr>
<td>10.</td>
<td>C₃H₂CH₂COOH</td>
<td>Caproic acid</td>
<td>Obtained from goats.</td>
</tr>
<tr>
<td>11.</td>
<td>C₂H₅OH</td>
<td>Grain alcohol</td>
<td>Obtained from barley.</td>
</tr>
</tbody>
</table>
(ii) On the basis of property
1. Glucose - Sweet in test
2. Glycol - Sweet poisonous
3. Glycerol - Sweet
   (Glycys - Sweet)

(iii) On the basis of discovery
1. RMgX (Grigard Reagent)
2. R₂Zn (Frankland reagent)

(iv) On the basis of structure

<table>
<thead>
<tr>
<th>S.No.</th>
<th>No. of Carbon atom</th>
<th>Word Root</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>1C</td>
<td>Meth</td>
</tr>
<tr>
<td>(ii)</td>
<td>2C</td>
<td>Eth</td>
</tr>
<tr>
<td>(iii)</td>
<td>3C</td>
<td>Prop</td>
</tr>
<tr>
<td>(iv)</td>
<td>4C</td>
<td>But</td>
</tr>
<tr>
<td>(v)</td>
<td>5C</td>
<td>Pent</td>
</tr>
<tr>
<td>(vi)</td>
<td>6C</td>
<td>Hex</td>
</tr>
<tr>
<td>(vii)</td>
<td>7C</td>
<td>Hept</td>
</tr>
<tr>
<td>(viii)</td>
<td>8C</td>
<td>Oct</td>
</tr>
<tr>
<td>(ix)</td>
<td>9C</td>
<td>Non</td>
</tr>
<tr>
<td>(x)</td>
<td>10C</td>
<td>Dec</td>
</tr>
</tbody>
</table>

Common Names for Hydrocarbon Derivatives

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Compound</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>R – X</td>
<td>Alkyl halide</td>
</tr>
<tr>
<td>2.</td>
<td>R – OH</td>
<td>Alkyl alcohol</td>
</tr>
<tr>
<td>3.</td>
<td>R – SH</td>
<td>Alkyl thio alcohol</td>
</tr>
<tr>
<td>4.</td>
<td>R – NH₂</td>
<td>Alkyl amine</td>
</tr>
<tr>
<td>5.</td>
<td>R–O–R</td>
<td>Dialkyl ether</td>
</tr>
<tr>
<td>6.</td>
<td>R–C–R</td>
<td>Dialkyl ketone</td>
</tr>
<tr>
<td>7.</td>
<td>R–NH–R</td>
<td>Dialkyl amine</td>
</tr>
<tr>
<td>8.</td>
<td>R–N–R</td>
<td>Trialkyl amine</td>
</tr>
<tr>
<td>9.</td>
<td>R–O–R’</td>
<td>Alkyl alkyl’ ether</td>
</tr>
<tr>
<td>10.</td>
<td>R–C–R’</td>
<td>Alkyl alkyl’ ketone</td>
</tr>
<tr>
<td>11.</td>
<td>R–NH–R’</td>
<td>Alkyl alkyl’ amine</td>
</tr>
<tr>
<td>12.</td>
<td>R–N–R’</td>
<td>Alkyl alkyl’ alkyl’ amine</td>
</tr>
</tbody>
</table>

R is termed as alkyl -
GROUPS

Atom or a group of atoms which possess any ‘free valency’ are called as Groups.
If their are two structure of same molecular formula then some prefix (n, iso, neo) are used two differentiate them.

Normal group : –
(a) It is represented by ‘n’.
(b) Groups having no branch (Straight chain).
(c) Free bond will come either on lst carbon atom or on last carbon atom.
   n – butyl \( \text{CH}_3 – \text{CH}_2 – \text{CH}_2 – \text{CH}_2 – \)
   n – propyl \( \text{CH}_3 – \text{CH}_2 – \text{CH}_2 – \)

Iso group : –
When one methyl group is attached to the second last carbon of the straight carbon chain is named as iso group.

\[ \begin{align*}
\text{H}_3\text{C} &= \text{CH} \quad \text{CH}_3 – \text{CH} – \text{CH}_2 – \quad \text{CH}_3 – \text{CH} – \text{CH}_2 – \text{CH}_2 – \\
& \text{Isopropyl} \quad \text{Isobutyl} \quad \text{Isopentyl}
\end{align*} \]

Exception :
\[ \begin{align*}
\text{CH}_3 – \text{C} – \text{CH}_2 – \text{CH} – \text{CH}_2 – & \quad \text{CH}_3 – \text{C} – \text{CH} – \text{CH}_2 – \\
& \text{CH}_3 \quad \text{CH}_3 \\
(i) \text{ Iso octyl} & \quad (ii) \text{ Iso heptyl}
\end{align*} \]

Neo group : –
(a) When two methyl groups on second last carbon of a straight carbon chain is attached to other four carbon atom group is named as neo group.
(b) It is represented by following structure -
\[ \quad \text{C} – \text{C} – \text{C} \quad \text{C} – \text{C} – \text{C} – \text{C} \quad \text{Neo pentyl} \]
(c) There should be one 4° carbon and atleast three methyl group on 4° carbon.

NOTE : (Optically Active) = If all valency are attached to different atoms.

Amyl group : –
\[ \begin{align*}
\text{CH}_3 – \text{CH}_2 – \text{C} – \text{CH}_2 – & \quad \text{CH}_3 – \text{CH}_2 – \text{CH} – \text{CH}_2 – \text{CH}_3 \\
\text{Active amyl} & \quad \text{Secondary amyl} \quad \text{Active secondary amyl} \quad \text{Active iso secondary amyl}
\end{align*} \]
Secondary group : –
(a) The carbon having free valency attached to two carbon is called secondary carbon.
(b) It is represented by following structure. \( C - \overset{\text{C}}{\text{-\text{-}\text{-\text{-}}} C \text{-}} \)

\[
\text{eg. (i) } CH_3 - \overset{\text{CH}}{\text{-\text{-\text{-\text{-}}} CH_2 - \text{-\text{-\text{-\text{-}}} \text{-\text{-\text{-\text{-}}} CH}} \text{, } \text{(secondary butyl)}
\text{ (ii) } CH_3 - \overset{\text{CH}}{\text{-\text{-\text{-\text{-}}} CH_2 - \text{-\text{-\text{-\text{-}}} \text{-\text{-\text{-\text{-}}} CH_2 - \text{-\text{-\text{-\text{-}}} CH}} \text{, (secondary pentyl)}
\]

Tertiary group : –
(a) The carbon having free valency attached to three other carbon.
(b) It is represented by following structure -
\[
\text{eg. (i) } CH_3 \overset{\text{C-}}{\text{-\text{-\text{-\text{-}}} CH_3}} \text{ (Tertiary butyl)}
\text{ (ii) } CH_3 \overset{\text{C-}}{\text{-\text{-\text{-\text{-}}} \text{-\text{-\text{-\text{-}}} \text{-\text{-\text{-\text{-}}} CH}} \text{, (Tertiary pentyl)}
\]

Alkyl group : –
When a hydrogen is removed from Alkane (saturated hydrocarbon) then alkyl group is formed.
A bond is vacant on alkyl group on which any functional group may come.

\[
\text{alkane} \xrightarrow{-\text{H}} \text{Alkyl -}
\]
\[
\text{\( (C_{n}H_{2n+2}) \) } \text{ (\( C_{n}H_{2n+1} \))}
\]

\[
\text{e.g. (i) } CH_4 \xrightarrow{-\text{H}} CH_3 - \text{Methane Methyl}
\]
\[
\text{ (ii) } CH_3 - CH_3 \xrightarrow{-\text{H}} CH_3 - CH_2 - \text{Ethane ethyl}
\]
\[
\text{ (iii) } CH_3 - CH_2 - CH_3 \xrightarrow{-\text{H}} \text{n-Propyl iso-Propyl}
\]
\[
\text{ (iv) } CH_3 - CH_2 - CH_2 - CH_3 \xrightarrow{-\text{H}} \text{n-Butyl Sec. Butyl}
\]
\[
\text{ (v) } CH_3 - CH_3 - CH_2 \xrightarrow{-\text{H}} \text{iso-buty l}
\]
(vi) \( \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 
 \( \text{n-pentane} \) 
 \( \rightarrow \) 
 \( \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 
 \( \text{n-pentyl} \) 
 \( \rightarrow \) 
 \( \text{CH}_2-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 
 \( \text{active secondary amyl} \) 
 \( \rightarrow \) 
 \( \text{C}_2\text{H}_5-\text{CH}-\text{C}_2\text{H}_4 \) 
 \( \text{secondary amyl} \)

(vii) \( \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 
 \( \text{CH}_3 \) 
 \( \text{iso-pentane} \) 
 \( \rightarrow \) 
 \( \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 
 \( \text{CH}_3 \) 
 \( \text{iso-pentyl} \) 
 \( \rightarrow \) 
 \( \text{C}_2\text{H}_5-\text{CH}-\text{C}_2\text{H}_4 \) 
 \( \text{active amyl} \) 
 \( \rightarrow \) 
 \( \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2 \text{CH}_3 \) 
 \( \text{Active isosecondary amyl} \)

(viii) \( \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 
 \( \text{CH}_3 \) 
 \( \text{neo-pentane} \) 
 \( \rightarrow \) 
 \( \text{CH}_3-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 
 \( \text{CH}_3 \) 
 \( \text{neo-pentyl} \)

Alkenyl group: 

\[ \text{alkene} \xrightarrow{\text{H}} \text{Alkenyl} \]

\[ (\text{C}_n\text{H}_{2n}) \quad (\text{C}_n\text{H}_{2n-1}) \]

\[ \text{CH}_2 = \text{CH} - \quad \text{CH}_2 = \text{CH} - \text{CH}_2 - \quad \text{CH}_3 - \text{CH} = \text{CH} - \]

\[ \text{Vinyl} \quad \text{Allyl} \quad \text{Propenyl (1-propenyl)} \]

\[ \text{CH}_3 - \text{C} = \text{CH}_2 \]

\[ \text{Isopropenyl (1-methyl-1-ethenyl)} \]
Alkynyl group –

\[
\text{alkyne} \xrightarrow{-\text{H}} \text{Alkynyl} - \\
(C_nH_{2n-2}) \quad (C_nH_{2n-3})
\]

CH = C – CH₃ – C = C –
Ethynyl Propargyl (2-propynyl) Propynyl (1-propynyl)

Alkylidene group –

\[
\text{alkane} \xrightarrow{-2\text{H}} \text{Alkylidene} -
\]

\[\begin{array}{c}
\text{from same carbon} \\
\text{from different carbon}
\end{array}\]

Alkylene group

\[
\text{alkane} \xrightarrow{-2\text{H}} \text{Alkylene} -
\]

\[\begin{array}{c}
\text{from same carbon} \\
\text{from different carbon}
\end{array}\]

Position of double bond : –

In an unsaturated hydrocarbon if the position of double bond is on 1ˢᵗ or last carbon then its prefix will be α (alpha) if it is on 2ⁿᵈ carbon it is termed as β (Beta) & the γ (gamma), δ (delta) and so on.

eg. \( \text{H}_2\text{C} = \text{CH} - \text{CH}_2 - \text{CH}_3 \) α - butylene
\( \text{H}_3\text{C} - \text{CH} = \text{CH} - \text{CH}_2 \) β - butylene
\( \text{H}_3\text{C} - \text{CH}_2 - \text{CH} = \text{CH}_2 \) α - butylene
\( \text{H}_2\text{C} = \text{CH} - \text{CH}_3 \) or \( \text{H}_2\text{C} - \text{CH} = \text{CH}_2 \) (Both are same positions, propylene)

\( \text{H}_3\text{C} - \text{C} = \text{CH}_2 \) Isobutylene
\( \text{CH}_3 - \text{CH} - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH}_3 \) γ - hexylene
\( \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \) δ - octylene

**COMMON - NAMING OF DIHALIDES**

(a) When two same halogen atoms are attached to the same carbon such compounds are called Gemdihalides.

(b) Common names of such compounds are alkylidene halides

\[
\text{eg. :} \quad \begin{array}{c}
\text{CH}_3 - \text{CH} < \text{Cl} \\
\text{Ethylidene chloride}
\end{array} \quad \begin{array}{c}
\text{CH}_3 - \text{CH} - \text{CH} < 1 \\
\text{Isobutylidene iodide}
\end{array}
\]

Exception : Methylidene halide (wrong) \( \text{CH}_3 - \text{CH} < X \) \( X \) = halogen

Methylene halide (right)
(c) When two same halogen atoms are attached to adjacent carbon, these are called as vicinal dihalides. Common names of such compounds are alkylene halide.

\[
\begin{align*}
\text{eg.} & & \text{CH}_3 - \text{CH} - \text{CH}_2 & \quad \text{Propylene Iodide} & & \text{H}_3\text{C} - \text{C} - \text{CH}_2 - \text{Cl} & \quad \text{Isobutylene chloride} \\
\end{align*}
\]

(d) When two same halogen atoms are attached at the two ends of a carbon chain its common naming will be polymethylene halide. ‘poly’ word indicates the number of \(-\text{CH}_2-\) groups.

\[
\begin{align*}
\text{Poly} & & \text{di} & & \text{tri} & & \text{tetra} & & \text{penta} & & \text{Hexa} \\
\end{align*}
\]

\[
\begin{align*}
\text{eg.} & & \text{CH}_2 - \text{CH}_2 - \text{CH}_2 & & \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 \\
\text{Trimethylene Iodide} & & \text{Br} & & \text{Br} & & \text{Pentamethylene Bromide} \\
\end{align*}
\]

Exception :
\[
\begin{align*}
\text{CH}_2 - \text{X} & & \text{dimethylene halide} & & \text{Wrong} \\
\text{CH}_2 - \text{X} & & \text{ethylene halide} & & \text{Right} \\
\end{align*}
\]

**COMMON - NAMING OF DI-HYDROXY COMPOUNDS**

(a) When two \(-\text{OH}\) groups are attached to adjacent carbon atoms they are termed as alkylene glycol.

\[
\begin{align*}
\text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 & & \text{OH} & & \text{OH} \\
\text{Butylene glycol} & & \text{Active amylene glycol} \\
\end{align*}
\]

(b) When two \(-\text{OH}\) group are attached at the two ends of a carbon chain, these compounds are named as polymethylene glycol.

\[
\begin{align*}
\text{Poly} & & \rightarrow \text{Number of CH}_2 \text{ groups.} \\
\end{align*}
\]

\[
\begin{align*}
\text{eg.} : & & \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 & & \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 \\
\text{Tetra methylene glycol} & & \text{OH} & & \text{OH} & & \text{Hexamethylene glycol} \\
\end{align*}
\]

Exception :
\[
\begin{align*}
\text{CH}_2 - \text{OH} & & \text{Dimethylene glycol} & & \text{Wrong} \\
\text{CH}_2 - \text{OH} & & \text{Ethylene glycol} & & \text{Right} \\
\end{align*}
\]
PROBLEMS

Make the structure of following organic compounds -
1. Isopropyldene Bromide 2. Active amyylene Iodide
3. Isobutylene glycol 4. Isobutylene 5. Trimethylene glycol

ANSWERS

1. CH₃-CBr

2. CH₃-C-CH₂-I

3. CH₃-C-CH₂-OH

4. H₂C-C=CH₂

5. CH₂=CH₂-CH₂

COMMON-NAMING OF THE FUNCTIONAL GROUP HAVING CARBON

(Common naming for Hydrocarbon derivatives)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Functional group</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>O -C-OH</td>
<td>-ic Acid</td>
</tr>
<tr>
<td>(ii)</td>
<td>O -C-O-C-</td>
<td>-ic anhydride</td>
</tr>
<tr>
<td>(iii)</td>
<td>O -C-O-R</td>
<td>-ate</td>
</tr>
<tr>
<td>(iv)</td>
<td>O -C-NH₂</td>
<td>-amide</td>
</tr>
<tr>
<td>(v)</td>
<td>O -C-X</td>
<td>-yl halide</td>
</tr>
<tr>
<td>(vi)</td>
<td>O -C-H</td>
<td>-aldehyde</td>
</tr>
<tr>
<td>(vii)</td>
<td>- C = N</td>
<td>-o-nitrile</td>
</tr>
<tr>
<td>(viii)</td>
<td>-N = C</td>
<td>-o-isonitrile</td>
</tr>
</tbody>
</table>

Prefix: -

1 Carbon → Form-

2 Carbon → Acet-

3 Carbon → Propion-

4 Carbon → Butyr → Normal

5 Carbon →

Valer → Normal

→ Iso

→ Secondary

→ Tertiary

3 C + (=) double bond = Acryl-

4 C + double bond = Croton-
**NOMENCLATURE OF ESTER**

The group which is attached to the oxygen is written as alkyl & the remaining structure is named on the basis of Functional Group suffix.

- **Methyl formate**
  - $\text{H} - \text{C} - \text{O} - \text{CH}_3$
- **Methyl formate**
  - $\text{CH}_3 - \text{O} - \text{C} - \text{H}$
- **Acetic acid**
  - $\text{CH}_3 - \text{C} - \text{O} - \text{H}$
- **Methyl acetate**
  - $\text{CH}_3 - \text{C} - \text{O} - \text{CH}_2 - \text{CH}_3$
- **Ethyl acetate**
  - $\text{CH}_3 - \text{CH}_2 - \text{C} - \text{O} - \text{CH}_2 - \text{CH}_3$
- **Ethyl propionate**
  - $\text{CH}_3 - \text{CH}_2 - \text{C} - \text{O} - \text{CH}_2 - \text{CH}_3$
- **Ethyl acrylate**
  - $\text{CH}_2 = \text{CH} - \text{C} - \text{O} - \text{CH}_2 - \text{CH}_3$
- **Methyl crotonate**
  - $\text{CH}_3 - \text{CH} = \text{CH} - \text{C} - \text{O} - \text{CH}_3$

**NOMENCLATURE OF ANHYDRIDE**

Rule: - Add the total number of carbon atoms & divide it by 2, the subscript will give you the number of C - atom. Now name it according to suffix use for anhydride.

$$\frac{\text{Total}}{2} = \text{Substract}$$

$$\frac{4}{2} = 2$$

- Acetic anhydride

$$\frac{6}{2} = 3$$

- Propionic anhydride
If \( R \neq R' \), you need not to find out substrate.

\[
\begin{align*}
\text{eg.} & \quad \text{O} \quad \text{O} \\
& \quad \text{CH}_3\text{-C-O-C-C}_2\text{H}_5
\end{align*}
\]

Acetic propionic anhydride (right)
Propionic Acetic anhydride (wrong)
Divide it in two parts as above & name it by suffixing ic anhydride (alphabetically)

\[
\begin{align*}
\text{eg.} & \quad \text{O} \quad \text{O} \\
& \quad \text{CH}_3\text{-CH-C-O-C-C}_2\text{H}_5 \\
& \quad \text{C}_2\text{H}_4\text{-CH-C-O-C-C}_2\text{H}_5
\end{align*}
\]

Butyric propionic anhydride Isobutyric Secondary valeric anhydride

\[
\begin{align*}
\text{CH}_2\text{=CH-C-O-C-O} \\
\text{CH}_2\text{=CH-C-O}
\end{align*}
\]

Acrylic anhydride

**SOLVED EXAMPLE**

**Q.1** Which of the following is not a neo structure:-

(A) C-C-C  
(B) C-C-C-C-C  
(C) C-C-C  
(D) C-C-C-C

**Ans.** C

**Sol.** A carbon must be attached with four carbons.

**Q.2** Acryl aldehyde is -

(A) A saturated aldehyde  
(B) An alkene  
(C) A polymer  
(D) An unsaturated aldehyde

**Ans.** D

**Sol.** \( \text{CH}_2=\text{CH}-\text{CHO} \) unsaturated aldehyde.

**Q.3** The common name of the compound \( \text{CH}_2=\text{CH-C}=\text{CH}=\text{CH}_2 \) is -

(A) Divinyl ketone  
(B) Diallyl ketone  
(C) Both A and B  
(D) None

**Ans.** A

**Sol.** \( \text{CH}_2=\text{CH} \) is called as vinyl group.
Q.4 Common name of \( \text{CH}_2=\text{CH} \cdot \text{CN} \) is:
(a) acrylonitrile  (b) vinyl cyanide  (c) allyl cyanide  (d) allyl nitrile
(A) a, b and d  (B) a, and b  (C) only b  (D) a, b and c
Ans. B

Q.5 The number of possible alkyl groups of iso octane are -
(A) 1  (B) 3  (C) 5  (D) 6
Ans. B

\[ \text{CH}_3 - \text{CH} = \text{C} - \text{CH} - \text{CH} - \text{CH} - \text{CH} - \text{CH}_3 \]
\[ 1 + 1 + 1 = 3 \]

Q.6 Write the common names of the following compounds
1. \( \text{CH}_3 - \text{CH}_2 - \text{CN} \)
2. \( \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{I} \)
3. \( \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{F} \)
4. \( \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{Cl} \)
5. \( \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{OH} \)
6. \( \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{C} - \text{NH}_2 \)
7. \( \text{CH}_2 = \text{CH} - \text{SH} \)
8. \( \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{NH}_2 \)
9. \( \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{OH} \)
10. \( \text{CH}_3 - \text{C} - \text{CH}_2 - \text{SH} \)
11. \( \text{CH}_3 - \text{C} = \text{CH}_2 \)
12. \( \text{CH} = \text{C} - \text{CH}_2 - \text{Br} \)

ANSWERS
1. Ethyl cyanide
2. Isobutyl iodide
3. Active amyl fluoride
4. Iso pentyl chloride
5. Active amyl alcohol
6. Tertiary hexyl amine
7. Vinyl thio alcohol
8. Active secondary amyl amine
10. Neopentyl thio alcohol
11. Isopropenyl amine
12. Propargyl Bromide
Q.1 Which of the following are secondary radicals:

(a) CH₃ - CH - C₂H₅ (b) CH₂ = C - CH₃ (c) CH₂=CH- (d) (CH₃)₂CH-

(A) a, b, c (B) a, d, c (C) b, c, d (D) a, b, d

Q.2 Common name of the structure CH₂ - OH

(A) Ethylene Glycol (B) Ethene dialcohol (C) Glycerol (D) Ethylene alcohol

Q.3 Common name of the compound CH₃ - CH₂ - C - NH₂ is:

(A) Acetamide (B) Propionamide (C) Butyramide (D) Acetic amide

Q.4 The structure of 2–butenyl radical is:

(A) CH₃ - CH - C₂H₅ (B) CH₃-CH=CH-CH₂-

(C) CH₃ - CH₂ - C - CH₃ (D) CH₂ = CH₂ - C - CH₃

Q.5 Which one is structure of Maleic acid

(A) HO - C - C - H (B) HO - CH - COOH

(C) HO - CH - COOH (D) H - C - C - OH

Q.6 Common name of the structure CH₂ - C - O - CH = CH₂ is:

(A) vinyl acetate (B) acryle acetate (C) methyl acrylate (D) Vinyl ethanoate

Q.7 Which is the structural formula of isoprene

(A) CH₃ - C = CH₂ (B) CH₂ = C - CH = CH₂

(C) CH₂ = C - CH = CH₂ (D) CH₃-CH=CH–CH₃
Q.8 The number of gem dihalides possible with the molecular formula $\text{C}_2\text{H}_4\text{X}_2$ and $\text{C}_3\text{H}_6\text{X}_2$ is given by the set:
(A) 1, 2  
(B) 2, 1  
(C) 2, 2  
(D) 1, 1

Q.9 Common name of the compound $\text{C}_6\text{H}_5\text{CHO}$
(A) Anisole  
(B) Benzaldehyde  
(C) Salicylaldehyde  
(D) None of these

ANSWERS
Q.1(D)  Q.2(A)  Q.3(B)  Q.4(B)  Q.5(D)  Q.6(A)  Q.7(B)  Q.8(A)  Q.9(B)

PROBLEMS

Q.1 Write down the structures of the following -
1. Di allyl amine
2. Tri methyl amine
3. Di isobutyl ether
4. Di isopentyl ketone
5. Di Active amyl amine
6. Di normal propyl ether
7. Tri neopentyl amine

Q.2 Write down the common names of the following:

1. $\text{CH}_3-\text{C} -\text{N} = \text{C} - \text{CH}_3$
2. $\text{CH}_3 - \text{C} - \text{C} - \text{Cl} - \text{CH}_3$
3. $\text{CH}_3 - \text{CH}_2 - \text{CH} - \text{C} - \text{NH}_2 - \text{CH}_3$

Ans.(1)
1. $\text{CH}_2 - \text{CH} - \text{CH}_2 - \text{NH} - \text{CH}_2 - \text{CH} - \text{CH}_2$
2. $\text{CH}_3 - \text{N} - \text{CH}_3$

3. $\text{CH}_3 - \text{CH} - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH} - \text{CH}_3$
4. $\text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{C} - \text{CH}_2 - \text{CH} - \text{CH}_3$

5. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{NH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
6. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$

7. $\text{CH}_3 - \text{C} - \text{H}_2 - \text{N} - \text{CH}_2 - \text{C} - \text{CH}_3$

Ans. (2)
1. Tertiary valero-isonitrile  
2. Isobutryl chloride  
3. Secondary Valer amide
**DERIVED SYSTEM**

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

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of Homologous series</th>
<th>Derived Name</th>
<th>Structure of group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Alkane</td>
<td>Methane</td>
<td>-C-</td>
</tr>
<tr>
<td>2.</td>
<td>Alkene</td>
<td>Ethylene</td>
<td>&gt;C=C&lt;</td>
</tr>
<tr>
<td>3.</td>
<td>Alkyne</td>
<td>Acetylene</td>
<td>-C = C-</td>
</tr>
<tr>
<td>4.</td>
<td>Alkanol</td>
<td>Carbinol</td>
<td>-C-OH</td>
</tr>
<tr>
<td>5.</td>
<td>Alkanal</td>
<td>Acetaldehyde</td>
<td>-C-CHO</td>
</tr>
<tr>
<td>6.</td>
<td>Alkanoic acid</td>
<td>Acetic acid</td>
<td>-C-COOH</td>
</tr>
<tr>
<td>7.</td>
<td>Alkanoyl halide</td>
<td>Acetyl halide</td>
<td>-C-COX</td>
</tr>
<tr>
<td>8.</td>
<td>Alkanamide</td>
<td>Acetamide</td>
<td>-C-CO-H₂</td>
</tr>
<tr>
<td>9.</td>
<td>Alkanone</td>
<td>Acetone</td>
<td>-C-C-O-</td>
</tr>
</tbody>
</table>

**Types of Ethylene:** (Symmetrical & Unsymmetrical)

(a) **Symmetrical:** – In the given two alkyl groups one group is attached to the one carbon of ethylene & next on the next carbon.

(b) **Unsymmetrical:** – When both the given groups are attached on the same carbon.

Note: Symmetrical & Unsymmetrical: – Terms are used only when two alkyl groups are given.

eg.

- Symmetrical dimethyl ethylene
- Unsymmetrical dimethyl ethylene
- Symmetrical ethyl methyl ethylene
- Tri methyl ethylene
- Tetra methyl ethylene
- Dimethyl acetylene
PROBLEMS

Write down the derived names of the following compounds

1. \( \text{CH}_2 = \text{CH} - \text{CH}_2 - \text{C} = \text{C} - \text{H} \)
2. \( \text{CH}_3 - \text{C} - \text{OH} \)
3. \( \text{CH}_3 - \text{CH}_2 - \text{C} - \text{OH} \)
4. \( \text{CH}_3 - \text{C} - \text{C} - \text{H} \)
5. \( \text{CH}_3 - \text{CH}_2 - \text{C} - \text{C} - \text{H} \)
6. \( \text{CH}_3 - \text{C} - \text{C} - \text{OH} \)
7. \( \text{CH}_3 - \text{C} - \text{CH}_3 \)
8. \( \text{CH}_3 - \text{CH}_2 - \text{C} - \text{CH}_2 \)
9. \( \text{CH}_3 - \text{C} - \text{CH}_3 \)
10. \( \text{CH}_3 - \text{C} - \text{C} - \text{CH}_3 - \text{CH}_3 \)

ANSWERS

1. Allyl acetylene
2. Tri methyl carbinol
3. Ethyl methyl carbinol
4. Tri methyl acetaldehyde
5. Ethyl methyl acetaldehyde
6. Di methyl acetic acid
7. Tri methyl methane
8. Ethyl di methyl methane
9. Tetra methyl methane
10. Tertiary butyl Isopropyl methane.
IUPAC NOMENCLATURE

The name consists of three parts:

Prefix + Word root + Suffix


Primary Prefix: It represents the nature of the principal/parent chain.

<table>
<thead>
<tr>
<th>Nature of chain</th>
<th>Primary Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acyclic / Non-cyclic</td>
<td>-</td>
</tr>
<tr>
<td>Cyclic</td>
<td>Cyclo</td>
</tr>
<tr>
<td>Bicyclic</td>
<td>Bicyclo</td>
</tr>
<tr>
<td>Tricyclic</td>
<td>Tricyclo</td>
</tr>
<tr>
<td>Spiro</td>
<td>Spiro</td>
</tr>
</tbody>
</table>

Secondary prefix: It represents substituents.

Word root: It represents the number of carbon atoms in the principal/parent chain.

<table>
<thead>
<tr>
<th>No. of carbon atoms</th>
<th>Word root</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Meth</td>
</tr>
<tr>
<td>2</td>
<td>Eth</td>
</tr>
<tr>
<td>3</td>
<td>Prop</td>
</tr>
<tr>
<td>4</td>
<td>But</td>
</tr>
<tr>
<td>5</td>
<td>Pent</td>
</tr>
<tr>
<td>6</td>
<td>Hex</td>
</tr>
<tr>
<td>7</td>
<td>Hept</td>
</tr>
<tr>
<td>8</td>
<td>Oct</td>
</tr>
<tr>
<td>9</td>
<td>Non</td>
</tr>
<tr>
<td>10</td>
<td>Dec</td>
</tr>
<tr>
<td>11</td>
<td>Undee</td>
</tr>
<tr>
<td>12</td>
<td>Dodec</td>
</tr>
<tr>
<td>13</td>
<td>Tridec</td>
</tr>
<tr>
<td>20</td>
<td>Eicos</td>
</tr>
<tr>
<td>30</td>
<td>Triacont</td>
</tr>
<tr>
<td>40</td>
<td>Tetracont</td>
</tr>
</tbody>
</table>

Primary Suffix: It represents the nature of C–C bonds in the principal/parent chain (whether single bond, double bond or triple bond).

<table>
<thead>
<tr>
<th>Nature of bond</th>
<th>Primary suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saturated C–C single bond</td>
<td>ane</td>
</tr>
<tr>
<td>Nature of bond</td>
<td>Primary suffix</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Unsaturated</td>
<td></td>
</tr>
<tr>
<td>C = C bond</td>
<td>ene</td>
</tr>
<tr>
<td>C ≡ C bond</td>
<td>yne</td>
</tr>
<tr>
<td>2C = C bonds</td>
<td>diene</td>
</tr>
<tr>
<td>2C = C bonds</td>
<td>diyne</td>
</tr>
<tr>
<td>C = C + C = C</td>
<td>ene + yne = énéne</td>
</tr>
</tbody>
</table>

* If secondary suffix starts from a vowel or y then the last "e" of first suffix is omitted. Secondary suffix is used for functional groups.

SATURATED UNBRANCHED HYDROCARBONS

IUPAC name = Word Root + Primary Suffix

e.g.

| CH₄             | Meth + ane | = | Methane |
| CH₃ – CH₃       | Eth + ane  | = | Ethane  |
| CH₃(CH₂)₂CH₃    | Prop + ane | = | Propane |
| CH₃(CH₂)₉CH₃    | Undec + ane| = | Undecane|
| CH₃(CH₂)₁₉CH₃   | Triacont + ane | = | Triacontane |

SATURATED BRANCHED CHAIN HYDROCARBONS

Rules for naming Branches

R - H → R -
Alkane Alkyl substituent
(CₙH₂n+₂) (CₙH₂n+₁)

e.g.

<table>
<thead>
<tr>
<th>Alkane</th>
<th>Alkyl</th>
<th>IUPAC names</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) CH₄</td>
<td>–CH₃</td>
<td>Methyl</td>
</tr>
<tr>
<td>(2) C₂H₆</td>
<td>–C₂H₅</td>
<td>Ethyl</td>
</tr>
</tbody>
</table>
Naming of complex alkyl groups

(i) Longest chain in a branch is selected starting from the same and where it originates from.
(ii) Numbering is started from the originating end of a branch.

3) \( \text{C}_3\text{H}_8 \)

\(-\text{CH}_2\text{CH}_2\text{CH}_3\)

Propyl

\(-\text{CH}_2\text{CH}_3\)

1-Methyl ethyl

4) \( \text{C}_4\text{H}_{10} \)

\(-\text{C}_4\text{H}_9\)

\(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3\)

Butyl

\(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3\)

1-methyl propyl

\(\text{CH}_3\text{CH}_2\text{CH}_3\)

2-methyl propyl

\(\text{H}_3\text{C}-\text{CH}-\text{CH}_2\text{CH}_3\)

1,1-dimethylpropyl

5) \( \)

\(\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3\)

3,3,4-trimethyl-pentyl

SATURATED BRANCHED CHAIN HYDROCARBONS

Rules

1) Longest chain rule: Select the longest possible carbon chain as the parent chain or principal carbon chain. All other carbon chains will be considered as side chain or substituents.

\(\text{C-C-C-C-C-C}\)

Longest chain containing 6 carbon atoms

2) If there is more than one longest chain possible then select the chain which contains maximum number of side chains

\(\text{C-C-C-C-C-C}\)

Correct

\(\text{C-C-C-C-C-C}\)

Incorrect
(3) **Lowest set of locant rule**: The number given to the side chain is locant. While numbering the parent chain, lowest set of locants rule needs to be followed. According to this rule, that set of locants will be considered which has got a lower number at the first point of difference.

\[\begin{align*}
I &= (2, 2, 3, 6, 8) & \text{Correct} \\
II &= (2, 2, 4, 4, 5) & \text{Incorrect}
\end{align*}\]

First point of difference

* First set will be considered in this case.

- 2,4,6-Trimethyldecane (Correct)
- 3,4,5-Trimethyldecane (correct)

(a) Side chains are always written in alphabetical order.

3-Ethyl-2-methylpentane

(b) Di, tri, tetra etc. are not considered in comparing alphabetical order.

3-Ethyl-2,4-dimethyl hexane

(c) If lowest set of locants rule is not applicable then numbering is done according to alphabetical order.

Locant-3, 5 (correct)

Locant-3, 5 (incorrect)

(d) If Di, tri, tetra etc. are part of name of complex name then they considered in alphabetical order.

4-(1,1-Dimethyl)-3, 5-diethylheptane
5-Ethyl-3,4-bis(1-methylethyl)-2-methylheptane

bis, tris, tetrakis are used for complex alkyl substituents

e.g.

(1) \( \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 3-methylpentane

(2) \( \text{CH}_3-\text{CH}_2-\text{CH}-\text{CH}_2-\text{CH}_3 \) 3-ethylhexane

(3) \( \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 3-ethyl-2-methylpentane

(4) \( \text{CH}_3-\text{CH}_2-\text{CH}-\text{CH}_2-\text{CH}_3 \) 3,3-diethyl-2,4-dimethyl-pentane

(5) \( \text{CH}_3-\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 2,2,5-trimethylhexane

(6) \( \text{CH}_3-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 3-Ethyl-4-methylhexane

(7) \( \text{CH}_3-\text{CH}-\text{CH}_2-\text{C}-\text{CH}_2-\text{CH}_2-\text{CH}_3 \) 2-methyl-4-bis(1-methylethyl)heptane
**PROBLEMS**

Give IUPAC Name of following compounds:

1. \( \text{CH}_3\text{CH}_2\text{C} \text{CH}_2\text{CH}_3 \)

2. \( \text{CH}_3\text{C} \text{CH}_3\text{CH}_2\text{CH}_3 \)

3. \( \text{CH}_3\text{CH}_2\text{CH}_3 \)

4. \( \text{CH}_3\text{C} \text{CH}_3\text{CH}_2\text{CH}_3 \)

5. \( \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 \)

6. \( \text{CH}_3\text{CH}_2\text{C} \text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3 \)

7. \( \text{CH}_3(\text{CH}_3)_2\text{C} \text{CH}_2\text{CH}_2\text{CH}_3 \)

8. \( \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3 \)

**ANSWERS**

1. 3,3-Dimethylpentane
2. 3-Ethyl-2,2-dimethylpentane
3. 3,4-Dimethylhexane
4. 4-(1-methylethyl) – 4 – Propyl heptane
5. 3-Ethyl-2,4,5-trimethylethane
6. 4-(1,1-Dimethylethyl)-3-ethyl-4,7-dimethylhexane
7. 4-(1-Methylethyl)-5-propyloctane
8. 7-(1,2-Dimethylpentyl)-5-ethyl tridecane
UNBRANCHED UNSATURATED HYDROCARBON

Numbering of carbon chain

Rule-1: If unsaturated bond is present in the molecule at the terminal carbon, then numbering done from the side of unsaturated carbon.

\[ \text{eg. CH}_2 = \text{CH} - \text{CH}_2 - \text{CH}_2 \rightarrow \text{But-1-ene} \]

\[ \text{eg. CH} = \text{CH} - \text{CH}_2 - \text{CH}_2 \rightarrow \text{But-1-yne} \]

Rule-2: If unsaturated bonds like double bond and triple bond is present at terminal carbon, then numbering always done from double bonded terminal carbon.
(Double bond preferred over triple bond when both bonds are at same position)

\[ \text{eg. CH}_2 = \text{CH} - \text{CH} - \text{CH}_2 \rightarrow \text{But-1-en-3-yne} \]

Rule-3: If unsaturated bonds like double bond or triple bond is present at terminal carbon, then numbering is done from either way.

\[ \text{eg. CH}_2 = \text{CH} - \text{CH} - \text{CH}_2 \rightarrow \text{But-1,3-diene} \]

\[ \text{eg. CH} = \text{CH} - \text{CH} - \text{CH}_2 \rightarrow \text{But-1,3-diyne} \]

Rule-4: If triple bond is present at terminal carbon and double bond is located at any carbon except other terminal carbon. Then numbering is done from triple bond.

\[ \text{CH} = \text{CH} - \text{CH} = \text{CH} - \text{CH}_2 \rightarrow \text{Pent-3-en-1-yne} \]

Rule-5: If double bond is present at terminal carbon and triple bond is present at any other position except other terminal carbon, then numbering is done from double bonded terminal carbon.

\[ \text{eg. CH}_2 = \text{CH} - \text{CH} - \text{CH} = \text{CH}_2 \rightarrow \text{Pent-1-en-3-yne} \]

---

**MCQ**

Q.1 Correct IUPAC nomenclature of the given compound

(A) Hexa-1,5-dien-3-yne  
(B) Hex-3-yn-1,5-diene  
(C) Hex diene  
(D) Hex encyne

Q.2 Which is the correct order for numbering in the given compound.

(A)  
(B)  
(C)  
(D)  

Q.3 Write correct IUPAC name for given compound.

(A) Hexa-2,4-diyne  
(B) But-2,4-diyne  
(C) Pent-2,4-diyne  
(D) Tetra-2,4-diyne

Q.4 Which is correct structure for penta-1,4-diyne

(A)  
(B)  
(C)  
(D)  

---

**ANSWERS**

Q.1 (A)  Q.2 (A)  Q.3 (A)  Q.4 (A)
BRANCHED UNSATURATED HYDROCARBON

Longest chain:

Rule-1: If unsaturated bonds like double bond or triple bond is present in the molecule, then that parent chain is considered which is containing unsaturated bonds like double bond or triple bond.

\[
\begin{align*}
\text{eg. } & CH_3 - CH = CH - CH_2 - CH = CH_2 \rightarrow \text{Parent chain} \\
& \quad \text{CH}_2 - CH_2 - CH_3 \\
\text{eg. } & CH_3 - CH = CH - CH = CH_2 \\
& \quad \text{CH}_2 - CH_2 - CH_3
\end{align*}
\]

Rule-2: A primary suffix is added to the word root to indicate presence at double or triple bond in the parent chain.

For one double bond = Word root + locant + ene
For one triple bond = Word root + locant + yne

In case the parent chain contains two or more double bonds, the prefixes di, tri, tetra, etc. are used before primary suffix.

For two double bonds = Word root + locant + diene
For two triple bonds = Word root + locant + diyne

Numbering of carbon chain:

Rule-1: In branched alkene, select that parent chain which is containing maximum unsaturated double bond or triple bond and follow properly of lowest locant rule.

\[
\begin{align*}
\text{eg. } & \text{Cyclohexyl eth-1-ene} \\
& \text{eg. } \text{CH}_3 - CH = CH - \text{CH} - \text{CH}_2 - \text{CH} = \text{CH}_2 \\
& \quad \text{4, 6-dimethyl hept-2-ene}
\end{align*}
\]

\[
\begin{align*}
\text{eg. } & \text{Cyclohexyl eth-1-yne} \\
& \text{eg. } \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{C} = \text{CH} - \text{CH}_2 \\
& \quad \text{4-Butylhexa-1-4-diene}
\end{align*}
\]

Rule-2: In branched alkene, if unsaturated double bond or triple bond is present in the cyclic ring, then numbering is done from double bonded carbon of the cyclic ring and follow lowest locant rule properly.

\[
\begin{align*}
\text{eg. } & \text{1-ethyl cyclohex-1-ene}
\end{align*}
\]
Q.1 Which is the correct way of numbering in the given compound.

\[
\begin{array}{cccc}
\text{(A)} & 4 & 3 & 2 \\
\text{(B)} & 4 & 3 & 1 \\
\text{(C)} & 4 & 5 & 1 \\
\text{(D)} & 5 & 4 & 1 \\
\end{array}
\]

Q.2 Which is the correct structure for given IUPAC name 2-Ethyl-3-methyl Pent-2-en-1-al.

\[
\begin{array}{cccc}
\text{(A)} & \text{H} & \text{H} \\
\text{(B)} & \text{H} & \text{H} \\
\text{(C)} & \text{H} & \text{H} \\
\text{(D)} & \text{H} & \text{H} \\
\end{array}
\]

Q.3 Which is the correct structure for given IUPAC name 7-ethyl-2, 4, 5, 6-tetramethyl dec-1, 8-diene.

\[
\begin{array}{cccc}
\text{(A)} & \text{H} & \text{H} & \text{H} & \text{H} \\
\text{(B)} & \text{H} & \text{H} & \text{H} & \text{H} \\
\text{(C)} & \text{H} & \text{H} & \text{H} & \text{H} \\
\text{(D)} & \text{H} & \text{H} & \text{H} & \text{H} \\
\end{array}
\]

Q.4 The IUPAC name of the compound is

(A) 3-methyl cyclohexene  (B) 1-methyl cyclohex-2-ene
(C) 6-methyl cyclohexene  (D) 1-methyl cyclohex-5-ene
Q.5 Which is correct match.  
IUPAC Name  

(A)    2-(2'-chloropropyl) hexa-1,3,5-triene

(B)    3,7-dimethyl hepta-1,3,6-triene

(C)    3,4-dimethyl pent-1-en-2-ol

(D)    3-methyl cyclopent-1-yne

Q.6 Which is incorrect match in the following.  
Structure  

(A)    Octa-1-en-4-yne

(B)    4-Ethyl-2-Cyclopropylhex-1-ene

(C)    3,3-dimethyl pent-1-en-4-yne

(D)    2-methyl-3-ethenyl cyclohexa-1,3-diene

ANSWERS

Q.1 (A)  Q.2 (A)  Q.3 (A)  Q.4 (A)  Q.5 (A)  Q.6 (D)
IUPAC NAMING OF ORGANIC COMPOUND CONTAINING FUNCTIONAL GROUPS

In IUPAC nomenclature functional groups are categorized into two types.

Type I: Groups of this type are not considered as functional groups in IUPAC nomenclature. They are considered as substituents & therefore represented by prefix. Type I functional group & their prefix are shown below:

<table>
<thead>
<tr>
<th>Groups</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>- F</td>
<td>fluoro</td>
</tr>
<tr>
<td>- Cl</td>
<td>chloro</td>
</tr>
<tr>
<td>- Br</td>
<td>bromo</td>
</tr>
<tr>
<td>- I</td>
<td>iodo</td>
</tr>
<tr>
<td>- NO₂</td>
<td>nitro</td>
</tr>
<tr>
<td>- NO</td>
<td>nitroso</td>
</tr>
<tr>
<td>- OR</td>
<td>alkoxy</td>
</tr>
<tr>
<td>- C-C-</td>
<td>epoxy</td>
</tr>
</tbody>
</table>

Rules for their nomenclature:

Rule I: If two substituents are present on same position from different ends, then priority is decided on the basis of alphabetical order.

\[
\begin{array}{cccccc}
5 & 4 & 3 & 2 & 1 \\
\text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 \\
\text{Cl} & \text{Br}
\end{array}
\]

Rule II: If multiple bond and type I functional group both are present, the priority is given to multiple bond.

\[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\text{H}_3\text{C} - \text{CH} = \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{Cl}
\end{array}
\]

Rule III: These groups are written is alphabetical order in IUPAC name.

eg.

(i) \[
\begin{array}{cccccc}
5 & 4 & 3 & 2 & 1 \\
\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \\
\text{F}
\end{array}
\]

2-fluoropentane

(ii) \[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\text{H}_3\text{C} - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{Cl}
\end{array}
\]

5-chloro-2-fluorohexane

(iii) \[
\begin{array}{cccccc}
1 & 2 & 3 & 4 & 5 \\
\text{H}_3\text{C} - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \\
\text{F}
\end{array}
\]

3-chloro-5-fluorohexane
(iv) $\text{H}_2\text{C} - \text{CH} - \text{CH} - \text{CH} - \text{CH}_3$  
\[ \text{CH}_2 \text{NO}_2 \text{CH}_2 \]  
\[ \text{CH}_3 \text{CH}_3 \]  
3, 5-dimethyl-4-nitro heptane

(v) $\text{CH}_2 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{C} - \text{CH}_2 - \text{CH}_3$  
\[ \text{NO} \quad \text{I} \quad \text{CH}_2 \]  
2-ethyl-4-iodo-6-nitroso hex-1-ene

(vi) $\text{HC} = \text{C} - \text{CH}_2 - \text{CH}_2 - \text{Cl}$  
\[ \text{Cl} \quad \text{CH}_2 \]  
1-chloro-3-chloroethylbuta-1, 3-diene

(vii) $\text{H}_2\text{C} - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_3$  
ethoxy ethane

(viii) $\text{H}_2\text{C} - \text{CH}_2 - \text{O} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$  
1-ethoxy propane

(ix) $\text{H}_2\text{C} - \text{CH}_2 - \text{CH} - \text{O} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$  
2-propoxy butane

(x) $\text{H}_2\text{C} - \text{CH}_2 - \text{CH} - \text{O} - \text{CH} - \text{CH}_3$  
\[ \text{CH}_3 \text{CH}_3 \]  
2-(methyl ethoxy) butane or 2-isopropoxy butane

Epoxides:

(1) $\text{CH}_3 - \text{CH} - \text{CH}_2$  
\[ \text{O} \]  
1, 2-epoxy propane

(2) 
\[ \text{O} \]  
3, 4-epoxy heptane

(3) 
\[ \text{Cl} \]  
2-chloro-5, 6-epoxy octane

(4) 
\[ \text{O} \]  
1, 3-epoxy propane

(5) 
\[ \text{O} \]  
2, 4-epoxy-3-methyl pentane

Type-II: Groups of this type are treated as functional groups and represented by suffix in IUPAC nomenclature. Priority table for functional group.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Functional group</th>
<th>Name</th>
<th>Suffix</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>O</td>
<td>Carboxylic acid</td>
<td>oic acid</td>
<td>Carboxy</td>
</tr>
<tr>
<td>(2)</td>
<td>−SO₃H</td>
<td>Sulphonic acid</td>
<td>sulphonic acid</td>
<td>Sulpho</td>
</tr>
<tr>
<td>(3)</td>
<td>−C−O−C−O</td>
<td>Acid anhydride</td>
<td>oic anhydride</td>
<td>–</td>
</tr>
<tr>
<td>(4)</td>
<td>−C−OR</td>
<td>Ester</td>
<td>oate (alkyl+w.r.+oate)</td>
<td>Alkoxy carbonyl</td>
</tr>
<tr>
<td>(5)</td>
<td>−C−Cl</td>
<td>Acid chloride</td>
<td>oyl chloride</td>
<td>Chlorocarbonyl</td>
</tr>
<tr>
<td>(6)</td>
<td>−C−NH₂</td>
<td>Amide</td>
<td>amide</td>
<td>Carbamoyl</td>
</tr>
<tr>
<td>(7)</td>
<td>C≡N</td>
<td>Cyanide</td>
<td>nitrile</td>
<td>Cyano</td>
</tr>
<tr>
<td>(8)</td>
<td>−N≡C</td>
<td>Isocyanide</td>
<td>isonitrile</td>
<td>Isocyano</td>
</tr>
<tr>
<td>(9)</td>
<td>−CHO</td>
<td>Aldehyde</td>
<td>al</td>
<td>oxo / formyl</td>
</tr>
<tr>
<td>(10)</td>
<td>−C−</td>
<td>Ketone</td>
<td>one</td>
<td>Oxo/Keto</td>
</tr>
<tr>
<td>(11)</td>
<td>−OH</td>
<td>Alcohol</td>
<td>ol</td>
<td>Hydroxy</td>
</tr>
<tr>
<td>(12)</td>
<td>−SH</td>
<td>Thio-alcohol</td>
<td>thiol</td>
<td>Mercapto</td>
</tr>
<tr>
<td>(13)</td>
<td>−NH₂</td>
<td>Amine</td>
<td>amine</td>
<td>Amino</td>
</tr>
<tr>
<td>(14)</td>
<td>(= )</td>
<td></td>
<td>ene</td>
<td></td>
</tr>
<tr>
<td>(15)</td>
<td>(= )</td>
<td></td>
<td>yne</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Double bond & triple bond are not true functional groups.

w.r. → Word Root

**Rule for their nomenclature:**

1. Selection of parent 'C' chain: longest possible 'C' chain with functional group and having maximum number of multiple bonds is selected as parent 'C' chain.

\[
\text{CH}_3 - \text{CH}_2 - \underbrace{\text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3}_{\text{C} \mid \text{OOH}}
\]
(2) Numbering:
(a) Numbering starts from the side of functional group for numbering priority order is given below:
   Functional group > Multiple bonds > Substituents
(b) If chain ending 'C' containing functional group is present then numbering starts from the 'C' of functional group these functional groups are known as DON category functional groups functional groups of this category are shown below:
   - COOH
   - C - O - C -
   - O
   - COOR
   - CONH₂
   - CN
   - CHO
   - COCl

Rule 3: 'e' of primary suffix is dropped if secondary suffix starts from a vowel.

Example of compounds having DON category functional groups:
(i) \( \text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{COOH} \) Butanoic acid
(ii) \( \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_3 \)

\( \text{CH}_2 \text{COOH} \)

2-methyl butanoic acid

(iii) \( \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{C} - \text{Cl} \)

4-ethyl pent-4-en-1-oyl chloride

(iv) \( \text{H} - \text{C} - \text{NH}_2 \)

methanamide

(v) \( \text{CHO} \)

ethanial

(vi) \( \text{NC} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \)

butane nitrile

(vii) \( \text{H}_2\text{N} - \text{C} - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH} - \text{CH}_2 \)

3-ethyl hex-5-en-1-amide

(viii) \( \text{CH}_2 = \text{CH} - \text{CH} - \text{C} - \text{Cl} \)

2-(3-chloropropyl) but-3-en-1-oyl chloride

Cl - \( \text{H}_2\text{C} - \text{H}_2\text{C} - \text{CH}_2 \)
Ester:

\[
\text{alkanoate} \quad \text{alkyl} \quad \rightarrow \quad \text{alkyl alkanoate}
\]

e.g.,

(i) \[\text{CH}_3\text{-C-O-CH}_3\] \quad \text{Methyl ethanoate}

(ii) \[\text{H-C-O-CH}_1\text{-CH}_1\] \quad \text{ethyl methanoate}

(iii) \[\text{CH}_3\text{-CH-CH}_2\text{-C-O-CH}_3\] \quad \text{methyl-4-chloro-3-methyl butanoate}

(iv) \[\text{Cl-CH}_2\text{-O-C-CH}_1\] \quad \text{chloromethylethanoate}

(v) \[\text{H}_3\text{COOCCH}_3\] \quad \text{methyl ethanoate}

(vi) \[\text{H}_3\text{C-H}_2\text{C-CH-C-O-CH}_3\] \quad \text{methyl-2-ethyl butane-1, 4-dioate.}

Anhydride: Nomenclature of anhydride is done on the basis of the carboxylic acid from which it is obtained.

\[
\text{CH}_3\text{-C-OH + CH}_1\text{-C-OH} \quad \xrightarrow{\text{-H}_2\text{O}} \quad \text{CH}_3\text{-C-O-C-CH}_3
\]

ethanoic acid \quad \text{ethanoic anhydride}

\[
\text{CH}_3\text{-C-O-C-CH}_3 \quad \xrightarrow{\text{H}_2\text{O}} \quad \text{CH}_3\text{-C-OH + CH}_1\text{-CH}_2\text{-C-OH}
\]

ethanoic propanoic anhydride
Example of compounds having functional group other than DON category:

1. \[ \text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{CH} - \text{CH}_3 \quad \text{(3-propylheptan-2-ol)} \]
   \[ \text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 \]

2. \[ \text{CH}_2 = \text{CH} - \text{CH}_2 - \text{CH} - \text{CH}_3 \quad \text{3-butyl hex-5-en-2-ol} \]
   \[ \text{H}_3\text{C} - \text{H}_2\text{C} - \text{H}_2\text{C} - \text{CH}_2 \]
3. \[
\text{H}_2\text{C} = \text{C} - \text{CH}_2 - \text{CH}_1
\]
   \[
\text{2-methylpent-1-ene-3-thiol}
\]

4. \[
\text{CH}_2 - \text{CH} - \text{SO}_2\text{H}
\]
   \[
\text{heptane-2, 5-disulphonic acid}
\]

5. \[
\text{CH}_2 - \text{CH} = \text{CH - C} - \text{CH}_2 - \text{C} - \text{CH}_2 - \text{CH}_1
\]
   \[
\text{5-methylene oct-6-en-3-one}
\]

6. \[
\text{3-(1-methyl butyl) pent-3-ene-1-sulphonic acid}
\]

7. \[
\text{3-ethylhexan-2-amine}
\]

8. \[
\text{CH}_2 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH}_1
\]
   \[
\text{N-ethyl pentan-3-amine}
\]

9. \[
\text{N-Chloromethyl-N-methyl pentan-2-amine}
\]

**POLYFUNCTIONAL COMPOUNDS**

**Rule-I:** If more than one functional groups are present then one is selected as principal functional group and represented by suffix. Other functional groups are treated as substituents & represented by prefix.

Selection of principal functional group is done according to priority table

1. \[
\text{HS} - \text{CH}_2 - \text{CH} - \text{C} - \text{OH}
\]
   \[
\text{(3-mercapto-2-methylpropanoic acid)}
\]

2. \[
\text{chloromethanoylchloride}
\]
3. \(\text{H}_2\text{N} \quad \text{NH}_2\) \quad \text{amino methanomide (Urea)}

4. 

\[\text{CN} \quad \text{CN} \quad \text{CN}\]

\(2\text{-ethenyl-2-isocyano propane-1,3-dinitrite}\)

5. 

\(\text{3-oxo pentanal}\)

6. 

\(\text{2-hydroxy-3-oxo pentanoic acid}\)

7. \(\text{O} \quad \text{NH}_2 \quad \text{NH}_2\) \quad \text{2- amino ethanomide}

**Rule-II**: When principal group is selected then there is no use of priority table.

\[\begin{align*}
\text{COOH} \\
\text{H - C - OH}
\end{align*}\]

\(3\text{- amino-2- hydroxy butane -1, 4-dioic acid} \quad \text{(Incorrect)}\)

8. \(\text{H - C - NH}_2\)

\[\begin{align*}
\text{COOH}
\end{align*}\]

\(2\text{- amino -3- hydroxybutane -1, 4-dioic acid} \quad \text{(Correct)}\)

**Rule-III**: If any DON functional group is present as sec. functional group then its 'c' is not included in principal 'c' chain except –CHO group.

9. \(\text{NC} \quad \underline{\text{H.C - H.C - C}} \quad \text{OH}\) \quad \text{3-cyanopropanoic acid}

10. \(\text{CH}_2 - \text{C - OH}\)

\(\text{CH}_2 - \text{C - Cl}\)

\(3\text{- Chloro carbonylpropanoic acid}\)
11. Carbamoyl methanoyl chloride

12. 3-Ethylpent-4-yn-1-amide

Rule-IV: As secondary functional group, if 'C' of -CHO group is included in percent 'c' chain then oxo is used as prefix, otherwise we use formyl group as prefix.

13. 4-oxobutanoic acid

14. 2-formyl butane-1, 4-diamide

15. 3, 5-dioxopentanoyl chloride

IUPAC nomenclature if DON category functional group is present as principal functional group & its 'c' is not included in parent 'c' chain →

| - COOH | Carboxylic acid |
| - COOR | | Carboxylic anhydride |
| - COCl | Carboxylate |
| - CONH₂ | Carbonyl chloride |
| - CN | Carboxamide |
| - CHO | Carbonitrile |
| | Carbaldehyde |

e.g.

1. Cyclohexane carboxylic acid

2. Benzene carboxylic acid

3. Propane-1, 2, 3-tricarbaddehyde
4. \[
\text{CH}_2 - \text{COOH} \\
\text{CH} - \text{CH}_2 - \text{COOH} \\
\text{CH}_2 - \text{COOH}
\]

3-Carboxymethyl pentane-1, 5-dioic acid

5. Cyclohexane-1, 2-dicarboxylic anhydride

SOLVED EXAMPLES

Q.1 The correct IUPAC name of the following compound is

\[ O = \text{CH} - \text{CH}_2 - \text{C} - \text{CH} - \text{CHO} \]

(A) 1, 1-diformyl propanal

(B) 3-formyl butanodial

(C) 2-formyl butanedial

(D) 1, 1, 2-ethane tricarboxaldehyde

Ans. D

Sol. The principal functional group is \(-\text{CHO}, O = \text{CH} - \text{CH}_2 - \text{C} - \text{CH} - \text{CHO}\)

1, 1, 2 – Ethanetricarbaldehyde

Q.2 The correct IUPAC name of compound \(\text{CH}_3 - \text{CH}_2 - \text{C} - \text{CH} - \text{CHO}\) is:

(A) 2-cyano-3-oxopentanal

(B) 2-formyl-3-oxopentenitrile

(C) 2-cyano-1, 3-pentanedione

(D) 1, 3-dioxo-2-cyanopentane

Ans. B

Sol. Here the main functional group is \(-\text{CN}, which\) had nitrile suffix and \text{CHO}\) and \text{CO}\) are taken as substituents.

\[
\begin{align*}
\text{CH}_3 & \quad \text{CHO} \\
\text{O} & \quad \text{CN}
\end{align*}
\]

Q.3 The IUPAC name of compound \(\text{HO} - \text{C} = \text{O} - \text{CH}_2\) is

(A) 2-amino-3-chloro-2-methyl-2-pentenoic acid

(B) 3-amino-4-chloro-2-methyl-2-pentenoic acid

(C) 4-amino-3-chloro-2-methyl-2-pentenoic acid

(D) none of these

Ans. B
Sol. The principal functional group is carboxylic acid (\(-\text{COOH}\))

\[
\begin{align*}
&\text{HO} - ^1\text{C} = \text{O} &\text{C}_2\text{H}_5 \\
&\text{CH}_3 - ^2\text{C} = ^3\text{C} - ^6\text{C} - \text{H} \\
&\text{NH}_2 &\text{Cl} \\
&3\text{-amino-4-chloro-2-methyl-2-pentenoic acid}
\end{align*}
\]

Q.4 IUPAC name of compound CH\(_3\)CH\(_2\)OC\(_2\)H\(_2\)CH\(_2\)CH\(_3\) is

(A) Propyl propanoate  (B) Ethyl butanoate  
(C) Propyl butanoate  (D) Ethyl propanoate

Ans. B

Sol. CH\(_1\) - CH\(_2\) - O - C - CH\(_2\) - CH\(_2\) - CH\(_3\)

---

MCQ

Q.1 The IUPAC name of the compound having structure ClCH\(_2\) - CH\(_2\) - COOH is:

(A) 3-Chloro propanoic acid  (B) 2-Chloro propanoic acid 
(C) 2-Chloro ethanoic acid  (D) Chloro succinic acid

Q.2 The IUPAC Name of compound CH\(_3\) - C - CH\(_2\) - OH is:

(A) 2-Methyl-1, 2-propanediol  (B) Isobutylene glycol 
(C) 1,2-Dihydroxy-2-Methyl propane  (D) 2-Hydroxy methyl-2-propanol

Q.3 The IUPAC name of CH\(_3\) - CH - C - CH\(_2\) - CH\(_2\)OH is:

(A) 1-Hydroxy-4-methyl-3-pentanone  (B) 2-Methyl-5-hydroxy-3-pentanone 
(C) 4-Methyl-3-oxo-1-pentanol  (D) Hexanol-1-one-3

Q.4 IUPAC name of CH\(_3\)CH\(_2\)CH\(_2\)CH\(_2\)CH\(_2\)Br

(A) 2-Chloro-3-methyl-7-bromo heptane  (B) 7-Chloro-2-chloro-3-methyl heptane 
(C) 1-Bromo-5-methyl-6-chloro heptane  (D) 1-Bromo-6-chloro-5-methyl heptane

Q.5 IUPAC name of CH\(_2\)=CH - CH\(_2\) - Cl is:

(A) Allyl chloride  (B) 1-Chloro-3-propene 
(C) 3-Chloro-1-propene  (D) Vinyl chloride
Q.6 The correct IUPAC name for \( \text{CH}_3\text{CH}=\text{C(\text{COOH})CH}_2\text{CH}_3 \) is:
(A) 3–Carboxy–2–pentene  
(B) 2–Ethylidene butanoic acid  
(C) 2–Ethyl–2–butenoic acid  
(D) 3–Ethyl–2–buten–4–oic acid

Q.7 The number of carbon atoms in the principal chain of the given compound are:
\[
\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{C}_- \text{COOH}  
\text{OHC}-\text{C}-\text{CH}_2 - \text{CH}_3 
\]
(A) 7  
(B) 5  
(C) 4  
(D) 6

Q.8 The IUPAC name of \( \text{CH}_3-\text{CH}_2-\text{NH}-\text{CH}_3 \) is:
(A) Methyl ethyl amine  
(B) 1–methyl ethan amine  
(C) N–methyl ethan amine  
(D) N–ethyl methanamine

Q.9 The name for the structure [image of a chemical structure]
(A) Cyclo hexanoyl chloride  
(B) Cyclohexane carbonyl chloride  
(C) 1–Chloro cyclohexanal  
(D) Chloro cyclohexyl methanal

Q.10 3–Methyl–2–pentanone is:
\[
\begin{align*}
\text{O} & \\
\text{CH}_3 & \\
\text{CH}_3 & \\
\end{align*}
\]
(A) \( \text{CH}_3 - \text{C} - \text{CH} - \text{CH}_2 - \text{CH}_3 \)  
(B) \( \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{COOH} \)  
(C) \( \text{CH}_3 - \text{CH} - \text{C} - \text{CH}_2 - \text{CH}_3 \)  
(D) \( \text{CH}_3 - \text{CH}_2 - \text{CH}=\text{CH}_2 \)

Q.11 The name of \( \text{ClH}_2\text{C} - \text{C} = \text{C} - \text{CH}_2\text{Cl} \) according to IUPAC nomenclature system is:
\[
\begin{align*}
\text{Br} & \\
\text{Br} & \\
\end{align*}
\]
(A) 2, 3–Dibromo–1,4–dichloro–2–butene  
(B) 1,4–Dichloro–2,3–dibromobutene–2  
(C) Dichloro dibromo butene  
(D) Dichloro dibromo butene

Q.12 The systematic IUPAC name for \( \text{CH}_3 - \text{C} - \text{NH}_2 \) and \( \text{CH}_3 - \text{C} - \text{Cl} \) are:
\[
\begin{align*}
\text{O} & \\
\text{O} & \\
\end{align*}
\]
(A) 1–Amino–1–oxo ethane, 1–chloro ethanal  
(B) 1–Amino ethanal, acetoy chloride  
(C) 1–Oxoothexamine, ethanoyl chloride  
(D) Ethanamide, Ethanoyl chloride

Q.13 The IUPAC name of the compound \( \text{CH}_2 - \text{C} = \text{CH} - \text{C} - \text{NH}_2 \) is:
\[
\begin{align*}
\text{NH}_2 & \\
\text{OCH}_3 & \\
\end{align*}
\]
(A) 4–Amido–2–methoxy–1–amino–2–butene  
(B) 4–Amino–3–methoxy–2–butenamide  
(C) 2–Methoxy–1,4–diamino–2–butenal  
(D) 1–Amino–2–methoxy–3–amido propene
Q.14 The correct name for \[
\begin{array}{c}
H \\
\text{OH}
\end{array}
\text{C} = \text{O}
\] is:
(A) 2-Hydroxy cyclopentanal
(B) 2-Formyl-1-hydroxy cyclopentane
(C) 2-Hydroxy cyclopentane carbaldheyde
(D) Cyclopentane-2-ol-1-al

Q.15 The IUPAC name of \[
\begin{array}{c}
\text{O} \\
\text{Cl}
\end{array}
\text{C} - \text{OC}_{2} \text{H}_{5}
\] is:
(A) Ethoxy formyl chloride
(B) Ethoxy methanol chloride
(C) Ethyl chloro methanoate
(D) Ethoxy carbonyl chloride

Q.16 IUPAC name of \[
\begin{array}{c}
\text{CH}_{3} \\
\text{CH} - \text{CH} - \text{CH} - \text{CH} - \text{CH}_{3}
\end{array}
\] is:
(A) 2-cyano-3-methylhexane
(B) 3-methyl-5-ctabigexace
(C) 2-4-Dimethyl pentanenitrile
(D) 2-cyano-3-methylhexane

Q.17 \[
\begin{array}{c}
\text{HO} \\
\text{C} - \text{C} - \text{C}
\end{array}
\] has the IUPAC name:
(A) 3,4-Dimethyl-1-penten-3-ol
(B) Isopropyl-3-methyl vinyl carbinol
(C) 2,3-Dimethyl-4-penten-3-ol
(D) None of the above

Q.18 Which of the following compound has wrong IUPAC name?
(A) \[
\begin{array}{c}
\text{CH}_{3} \\
\text{CH}_{2} \text{COO} - \text{CH}_{2} \text{CH}_{3}
\end{array}
\text{(Ethyl butanoate)}
\] (B) \[
\begin{array}{c}
\text{CH}_{3} \\
\text{CH} - \text{CH} - \text{CH} - \text{CHO}
\end{array}
\text{(3-Methylbutanal)}
\]
(C) \[
\begin{array}{c}
\text{OH} \\
\text{CH}_{3}
\end{array}
\text{(2-Methyl-3-butanol)}
\] (D) \[
\begin{array}{c}
\text{CH}_{3} \\
\text{CH} - \text{C} - \text{CH}_{2} - \text{CH}_{3}
\end{array}
\]

Q.19 The IUPAC name of the compound \[
\begin{array}{c}
\text{HO} \\
\text{Cl}
\end{array}
\text{C}
\] is:
(A) 1, 1-dimethyl-3-cyclohexanol
(B) 1, 1-dimethyl-3-hydroxy cyclohexane
(C) 3, 3-dimethyl-1-cyclohexanol
(D) 3, 3-dimethyl-1-hydroxy cyclohexane

Q.20 The IUPAC name of the compound is
(A) 6-bromo-2-chlorocyclohexene
(B) 3-bromo-1-chlorocyclohexene
(C) 1-bromo-3-chlorocyclohexene
(D) 2-bromo-6-chlorocyclohex-1-ene

**ANSWERS**
Q.1 (A) Q.2 (A) Q.3 (A) Q.4 (D) Q.5 (C) Q.6 (C) Q.7 (B) Q.8 (C) Q.9 (B) Q.10 (A) Q.11 (A) Q.12 (D) Q.13 (B) Q.14 (C) Q.15 (C) Q.16 (C) Q.17 (A) Q.18 (C) Q.19 (C) Q.20 (B)
NOMENCLATURE OF ALICYCIC COMPOUNDS

(A) Unsubstituted cyclic compounds:  Prefix + word root + suffix  
Cyclo + no. of C + ane / ene

Example:

- Cyclopropane
- Cyclobutane
- Cyclohexene

(B) Substituted cyclic compound (closed + open chain saturated)

Rule:

(i) If number of carbons in closed chain ≥ no. of carbons in open saturated chain, then closed chain will be selected as parent chain.

Example:

- 1-methyl cyclopropane
- Propyl cyclo pentane

- 1-(2-methyl propyl) cyclohexane
- 1-(1-methyl butyl)-2-methyl cyclohexane

(ii) If number of carbons in open chain > closed chain ⇒ Open chain is parent chain

Example:

- 1-cyclobutyl pentane
- 2-cyclopentyl-4-methyl hexane

- 1-ethyl-2-methyl cyclobutane
- 3-ethyl-1,1-dimethyl cyclopentane

Rule:

Cyclic compounds with functional group is considered as parent chain:

- COO
  - Cyclopropane carboxylic acid
- COOH
  - Cyclohexane-1,2-dicarboxylic acid
Cyclohexyl ethanoic acid

If FG (\(-\text{COOH}\)) present on both cyclic and non-cyclic then number of carbon atoms is considered.

3-carboxymethyl cyclohexane carboxylic acid
cyclopentyl cyclohexane

If unsaturation (Multiple bond) present

Rule:
Chain containing multiple bond is selected as parent chain

3-butyl cyclopropene 1-cyclopentyl ethene 3-cyclopentyl but-1-ene

If ring and non-cyclic side chain both containing double bond then check the number of C atoms and given parent chain.

3-(prop-2-enyl) cyclo pent-1-ene

Number of double bond is considered while selecting parent chain

1-(cyclopent-2-enyl) buta-1,3-diene

In case of more than one multiple bond use suffix ‘a’ after word root.

5-propyl cyclohexa-1, 3-diene
Cyclobutyl cyclohexane carboxylate

Cyclohexyl ethane carboxylate

- C-NH₂ \rightarrow \text{Carboxamide}

eg. \quad \text{Cyclohexane carboxamide}

g. \quad \text{N-Cyclohexyl ethanamide}

\rightarrow 3\text{-Cyclohexyl cyclopentanol}

\rightarrow \text{Methylene cyclohexane}

**NOMENCLATURE OF BICYCLO COMPOUNDS**

Bicyclo compounds: If two rings are fused at two common carbon atoms then compound are known as bicyclic compound.

(l) Unsubstituted bicyclo compounds

Prefix + Numbering of carbon atoms in each bridge in decreasing order + Suffix
Bicyclo (4.4.0) decane
(Bridge head C not considered)


eg. Bicyclo [3,2,0] Heptane

(ii) Substituted bicyclo (Bicyclo with substitution or functional group)
In substituted bicyclic compounds numbering starts from a bridge head carbon atom and proceeds towards longest bridge then smaller bridge & then smallest bridge.

2-Chloro bicyclo [2.2.1] heptane

bicyclo [2.2.1] heptane-7-carboxylic acid

Bicyclo [2.1.1] hexane

Bicyclo [2.1.1] hexane-5-carboxylic acid

F.G. is preferred over double bond,
bicyclo [3.2.2] dec-9-en-carboxylic acid

Bicyclo [3.2.2] non-8-ene-6-carboxylic acid

NOMENCLATURE OF SPIRO COMPOUNDS

Spiro comp. - Two cyclic rings are fused at one common carbon (only one bridge head)
Name: Prefix + no. of carbon in bridges in increasing order + suffix
Spiro [2.4] heptane

Rule for numbering: In spiro compounds numbering starts from carbon of smaller ring which is next to spiro carbon proceeds towards other carbon atoms of smaller ring then towards larger ring via spiro carbon atom.
Rule: If more than one functional group is present at cyclic chain, then principal function group (PFG) is selected.

- 2-formyl cyclobutane carboxylic acid
- 3-oxo cyclohexane carbaldehyde
PROBLEMS

Write the IUPAC Nomenclature of following compounds:

ANSWER

(1) bicyclo [4.2.0] octane
(2) bicyclo [4.3.0] nonane–7-ene
(3) bicyclo [4.3.0] nonane–2-carboxylic acid
(4) bicyclo [4.2.0] octane–7-one
(5) bicyclo [2.2.2] octane–2-carbnitrile
(6) bicyclo [2.2.1] heptane-7-carboxylic acid
(7) spiro [2.2.0] penta-1, 4-diene
(8) spiro [4.5] decan-1-one
(9) spiro [2.3] hexane
(10) 5-formyl spiro [3.3] heptane-1-carboxylic acid
(11) 8-oxo bicyclo [4.2.0] octane-2-carboxylic acid
(12) 8-methyl spiro [4.5] decan-1-amine
(13) 1-chloro spiro [5.5] undecane
(14) 4-chloro spiro [4.4] nonan-1-ol
(15) 1-hydroxy spiro [2.5] octane-4-carboxylic acid
(16) spiro [2.5] octan-1-one
(17) bicyclo [3.2.0] hept-6-ene-2-carboxamide
(18) 7-oxo spiro [4.4] nonane-1-carbaldehyde
(19) spiro [2.5] octane-1-carbaldehyde
(20) bicyclo [2.2.0] hexan-2-one