IUPAC NOMENCLATURE & STRUCTURAL ISOMERISM

CONTENTS

JEE(Advanced) Syllabus

Concepts :

Hybridisation of carbon; Sigma and pi-bonds; Shapes of molecules; IUPAC nomenclature of simple organic compounds (only hydrocarbons, Monofunctional and bi-functional compounds); Structural isomerism.

Board Syllabus

Some Basic Principles and Techniques

Unit 12-A : General Introduction, Tetra valency of Carbon: Shapes of Organic Compounds, Structural Representations of Organic Compounds, Classification of Organic Compounds, Nomenclature of Organic Compounds, Isomerism.

IUPAC NOMENCLATURE & STRUCTURAL ISOMERISM

1. SECTION (A) : FUNDAMENTAL OF ORGANIC CHEMISTRY

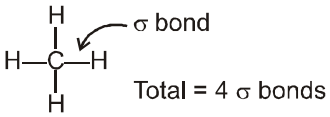
Th1:

1.1 Bonding in organic compounds :

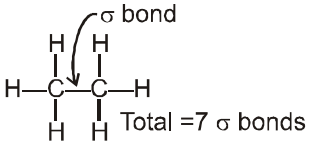
Two types of covalent bond exist in organic compounds.

(a) Sigma bond (σ) : The covalent bond formed between 2 atoms by mutual sharing of 1 pair of e^-. It is denoted by (–).

Ex. In CH_4 molecule



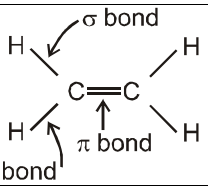
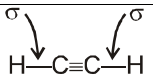
In C_2H_6 molecule



(b) Multiple bond (π) :

Any other bond with σ bond is π bond.

Ex.

(i) In ethane Molecule		(ii) In ethyne molecule	
	Total σ = 5		Total σ = 3
	π = 1		π = 2

Que. Calculate σ and π bond in following compounds.

(a) $HC \equiv CCH=CHCH_3$

(b) $CH_2 = C = CHCH_3$

Sol.

(a) $\sigma_{C-C} : 4$; $\sigma_{C-H} : 6$; $\pi_{C=C} : 1$; $\pi_{C\equiv C} : 2$

(b) $\sigma_{C-C} : 3$; $\sigma_{C-H} : 6$; $\pi_{C=C} : 2$

1.2 Some important definitions :

D1:

(i) **Catenation :** The property of atoms of an element to link with one another forming chains of identical atoms is called catenation.

D2:

(ii) **Homologous series:** Homologous series may be defined as a series of similarly constituted compounds in which the members possess the same functional group, have similar chemical characteristics and have a regular gradation in their physical properties. The two consecutive members differ in their molecular formula by CH_2.

Th2:

1.3 Structural representation of organic compounds :

There are three ways for representation of organic compounds :

(i) Complete structural formula:

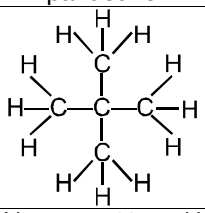
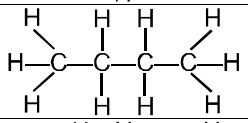
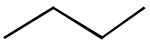
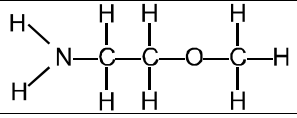
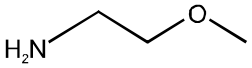
Such a structural formula focuses on the electrons involved in bond formation. A single dash (–) represents a single bond, double dash (=) is used for double bond and a triple dash (≡) represents triple bond. Lone- pairs of electrons on heteroatoms (e.g., oxygen, nitrogen, sulphur, halogens etc.) may or may not be shown.

(ii) Condensed structural formula:

Structural formulas can be further abbreviated by omitting some or all of the dashes representing covalent bonds and by indicating the number of identical groups attached to an atom by a subscript. The resulting expression of the compound is called a condensed structural formula.

(iii) Bond line formula:

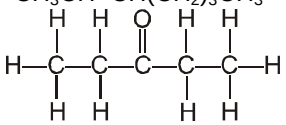
In this formula, carbon and hydrogen atoms are not shown and the lines representing carbon-carbon bonds are drawn in a zig-zag fashion. The only atoms specifically written are oxygen, chlorine, nitrogen etc.

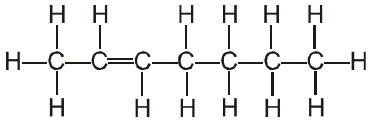
Condensed form	Expanded form	Bond line form
$C(CH_3)_4$		
$CH_3(CH_2)_2CH_3$		
$H_2N(CH_2)_2OCH_3$		

Que. Expand each of the following condensed formulas into their complete structural formulas.

(a) $CH_3CH_2COCH_2CH_3$

(b) $CH_3CH=CH(CH_2)_3CH_3$

Sol. **(a)** 

(b) 

Que. For each of the following compounds,write a condensed formula and also their bond-line formula.

(a) $HOCH_2CH_2CH_2CH(CH_3)CH(CH_3)CH_3$

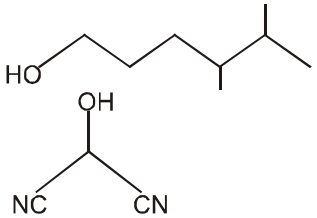
(b) $N{\equiv}C{-}\underset{\displaystyle OH}{\underset{|}{C}}H{-}C{\equiv}N$

Sol. Condensed formula :

(a) $HO(CH_2)_3CH(CH_3)CH(CH_3)_2$

(b) $HOCH(CN)_2$

Bond-line formula :



Th3:

1.4 Degree of Unsaturation (DU) :

The presence of double bonds or rings within a molecule is indicated by a quantity called degree of unsaturation.

Applications: To identify the no. of π bonds or rings and also helpful in determining the structure of the molecule.

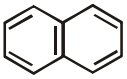
D3: **Definition:** Deficiency of 2H atoms with respect to fully saturated acyclic hydrocarbon is equivalent to One DU. It is also known as Hydrogen Deficiency Index (HDI) or Double Bond Equivalence (DBE)

$H_3C-H_2C-CH_3$ (DU = O) $\xrightarrow{-2H}$ [$CH_3-CH=CH_2$ or  (DU = 1)] $\xrightarrow{-2H}$ $CH_3-C\equiv CH$ or $CH_2=C=CH_2$ or  (DU = 2)

$$\text{Degree of unsaturation (D.U.)} = \frac{(2n+2)-(\text{No. of H atoms}+\text{No. of X atoms}-\text{No. of N atoms})}{2}$$

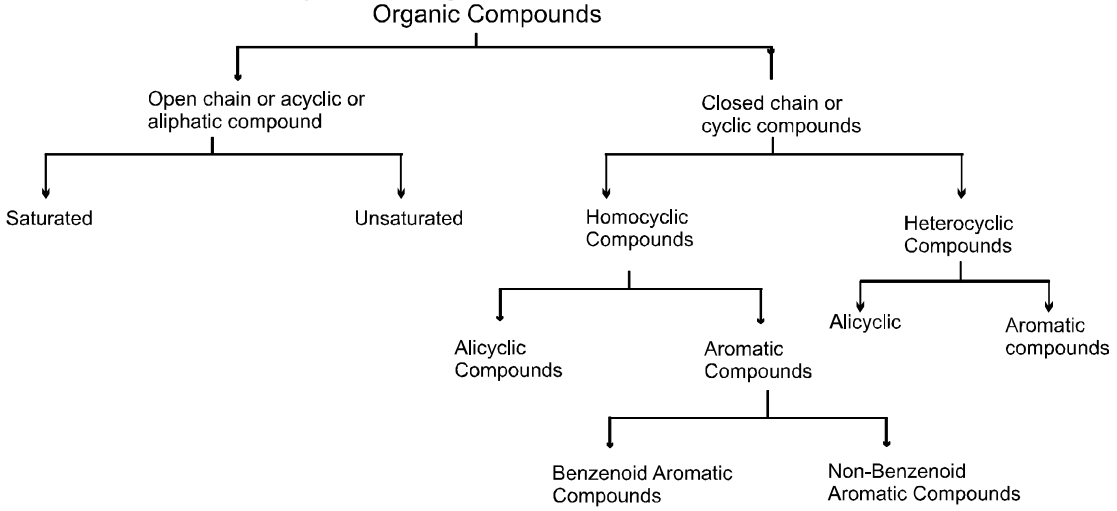
Where n = number of carbon atoms in the molecule

Note : Total no. of cyclic rings + double bonds will gives us degree of unsaturation.
One double bond = one DU
One ring = one DU
One triple bond = two DU

Ex.	**(i)**	$CH_2=CH_2$	DU = $\frac{(2\times2+2)-4}{2}$ = 2/2 = 1	**(ii)**		DU = 2
	(iii)		DU = 4	**(iv)**		DU = 7

Th4:

1.5 Classification of organic compounds



Th5:

1.6 Organic compounds and functional groups

Number of known organic compounds is much more than inorganic compounds but, it has been possible to group them into classes or families based on their structural features. This has given organic chemistry a logical and systematic shape. Examples are as follows :

1.6.1 Alkanes [general formula C_nH_{2n+2} where n = 1, 2, 3, ...]

These are open–chain aliphatic saturated hydrocarbon which have no functional groups. These are also called **paraffins**.

$n = 1 \Rightarrow CH_4$	–	Methane	$n = 2 \Rightarrow C_2H_6$	–	Ethane
$n = 3 \Rightarrow CH_3CH_2CH_3$	–	Propane	$n = 4 \Rightarrow CH_3CH_2CH_2CH_3$	–	Butane
$n = 5 \Rightarrow CH_3CH_2CH_2CH_2CH_3$	–	Pentane	$n = 10 \Rightarrow CH_3(CH_2)_8CH_3$	–	Decane

1.6.2 Alkenes [general formula C_nH_{2n} where n = 2, 3, ...]

Alkenes are open chain unsaturated hydrocarbons and having carbon–carbon double bonds (C=C). These are also called **alkylenes or olefins**. The first three members are generally named by their common names.

Ex. $CH_2=CH_2$ ethylene; $CH_3–CH=CH_2$ propylene; $CH_3–CH_2–CH=CH_2$ butylene; $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}=CH_2$ Isobutylene

1.6.3 Alkynes [general formula C_nH_{2n-2} where n = 2, 3, ...]

Unsaturated aliphatic hydrocarbons containing a carbon–carbon triple bond are called alkynes. The common names of a few simple alkynes are given below.

$CH\equiv CH$	–	Acetylene
$CH_3–C\equiv CH$	–	Methyl acetylene
$CH_3–CH_2–C\equiv CH$	–	Ethylacetylene
$CH_3–C\equiv C–CH(CH_3)_2$	–	Methyl isopropyl acetylene

1.6.4 Some names of hydrocarbon groups

(A) Alkyl, Alkenyl & Alkynyl groups

$\text{Alkane } (C_nH_{2n+2}) \xrightarrow{-H} \text{Alk + yl } (C_nH_{2n+1})$

$\text{Alkene } (C_nH_{2n}) \xrightarrow{-H} \text{Alken + yl } (C_nH_{2n-1})$

$\text{Alkyne } (C_nH_{2n-2}) \xrightarrow{-H} \text{Alkyn + yl } (C_nH_{2n-3})$

Ex. $\text{methane} \xrightarrow[+yl]{-ane} \text{methyl} \quad \left(CH_4 \xrightarrow{-H} -CH_3\right)$

$\text{propane} \xrightarrow[+yl]{-ane} \text{propyl} \quad \left(C_3H_8 \xrightarrow{-H} -C_3H_7\right)$

$CH_2 = CH_2 \xrightarrow{\text{remove H}} -CH=CH_2$ (vinyl group)/ethenyl.

$CH_2 = \overset{1}{CH_2} - \overset{2}{CH} - \overset{3}{CH_3}$

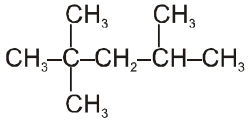
remove H from C_3 → $CH_2 = CH - CH_2 -$ allyl group

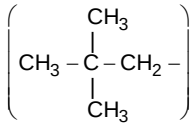
remove H from C_2 → $CH_2 = \underset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}} -$ Isopropenyl group

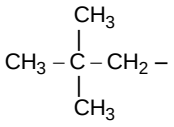
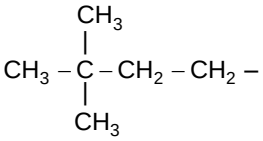
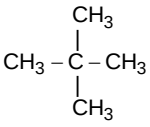
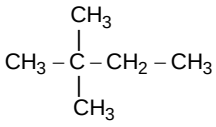
$HC\equiv CH \xrightarrow{-H} HC\equiv C-$ (Ethynyl) ; $H_3C–C\equiv CH \xrightarrow{-H} H_3C–C\equiv C-$ (propynyl)

(B) Iso alkyl group : A compound having $-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{CH}}}}-CH_3$ group is called iso alkyl group.

Ex. $CH_3-\underset{\displaystyle CH_3}{\overset{|}{\underset{|}{CH}}}-$ Iso propyl; $CH_3-\underset{\displaystyle CH_3}{\overset{|}{\underset{|}{CH}}}-CH_2-$ Iso butyl; $CH_3-\underset{\displaystyle CH_3}{\overset{|}{\underset{|}{CH}}}-CH_2-CH_2-$ isopentyl; $CH_3-\underset{\displaystyle CH_3}{\overset{|}{\underset{|}{CH}}}-CH_2-CH_3$ Iso pentane

Exception : Isooctane 

(C) Neo alkyl group : Compound having  group is called neo alkyl group.

Ex.  Neopentyl  Neohexyl  Neopentane  Neohexane

1.6.5 Functional group and residue

The characteristic group of atom which decide the physical and chemical properties of an organic molecule is called functional group.

Functional group is that portion of molecule which is highly reactive and takes part in chemical reactions. Rest of the molecule is called Residue.

Ex. $\underbrace{CH_3CH_2CH_2CH_2}_{\text{Residue}} - \underbrace{COOH}_{\text{Functional Group}}$

2. SECTION (B) : IUPAC-NOMENCLATURE OF ALKANE & CYCLOALKANE

Th6:

2.1 IUPAC system of nomenclature

The IUPAC name of any organic compound consists of maximum five parts in the following sequence.

Secondary prefix + Primary prefix + Word root + Primary suffix + Secondary suffix

2.2 Word root :

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

No. of carbon atoms in parent chain	Word root (Alk)	No. of carbon atoms in parent chain	Word root (Alk)	No. of carbon atoms in parent chain	Word root (Alk)
1	Meth	9	Non	20	Icos
2	Eth	10	Dec	30	Triacont
3	Prop	11	Undec	40	Tetracont
4	But	12	Dodec	50	Pentacont
5	Pent	13	Tridec	60	Hexacont
6	Hex	14	Tetradec	70	Heptacont
7	Hept	15	Pentadec	80	Octacont
8	Oct	16	Hexadeca	100	Cent & Hect

2.3 Primary suffix.

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

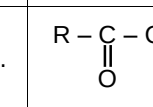
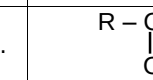
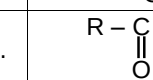
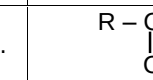
Type of carbon chain	Primary suffix	General name
(a) Saturated	– ane	Alkane
(b) Unsaturated with one double bond	– ene	Alkene
(c) Unsaturated with one triple bond	– yne	Alkyne

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

Type of carbon chain	Primary suffix	General name
(a) Unsaturated with two double bonds	(a) + diene	Alkadiene
(b) Unsaturated with two triple bonds	(a) + diyne	Alkadiyne
(c) Both double and triple bonds	enyne	Alkenyne

2.4 Secondary suffix :

A secondary suffix is then added to the primary suffix to indicate the nature of the functional group present in the organic compounds. Secondary suffix of important functional groups are given below in their decreasing order of seniority.

	Class	Name	Suffix	Prefix
1.	R – COOH	Alkanoic Acid	– oic acid (carboxylic acid)	Carboxy
2.	$R - SO_3H$	Alkane sulphonic Acid	– sulphonic acid	sulpho
3.		Alkanonic Anhydride	– oic anhydride (carboxylic anhydride)	----------
4.	R – COOR	Alkyl alkanoate	– oate (carboxylate)	alkoxy carbonyl or alkanoyl oxy
5.		Alkanoyl halide	–oyl halide (carbonyl halide)	halo carbonyl
6.		Alkanamide	– amide (carboxamide)	carbamoyl
7.	R – C ≡ N	Alkanenitrile	– nitrile (carbonitrile)	cyano
8.		Alkanal	– al (carbaldehyde)	formyl / oxo
9.		Alkanone	– one	oxo
10.	R – OH	Alkanol	– ol	hydroxy
11.	R – SH	Alkanethiol	– thiol	mercapto
12.	$R - NH_2$	Alkanamine	– amine	amino

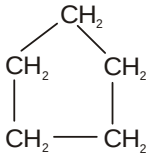
The following examples illustrate the use of word root, primary suffix and secondary suffix in naming of organic compounds.

Organic Compounds	Word root	Primary suffix	Secondary suffix	IUPAC name
CH_3CH_2OH	Eth	an(e)	ol	Ethanol
$CH_3CH_2CH_2NH_2$	Prop	an(e)	amine	Propanamine
$CH_3CH_2CH_2COOH$	But	an(e)	oic acid	Butanoic acid
CH_3CH_2CN	Prop	an(e)	nitrile	Propanenitrile
CH_2=CHCHO	Prop	en(e)	al	Propenal
HC ≡ CCOOH	Prop	yn(e)	oic acid	Propynoic acid

2.5 Primary prefix :

A primary prefix is used simply to distinguish cyclic from acyclic compounds.

For example, in case of carbocyclic compounds, (cyclic compounds containing only carbon atoms in the ring), a primary prefix, **cyclo** is used immediately before the word root. Thus,

Ex. 

Cyclo + pent + ane = Cyclopentane

Primary prefix | Word root | Primary suffix | IUPAC name

If the prefix cyclo is not used, it simply indicates that the compound is acyclic or open chain.

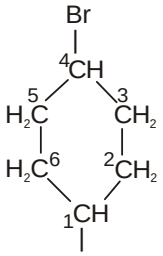
2.6 Secondary prefix :

In IUPAC system of nomenclature, certain groups are not considered as functional groups but are treated as substituents. These are called secondary prefixes and are added immediately before the word root (or the primary prefix in case of carbocyclic compounds) in alphabetical order to denote the side chains or substituent groups. The secondary prefixes for some groups which are always treated as substituent groups (regardless of the fact whether the organic compound is monofunctional or polyfunctional) are given below :

Substituent group	Secondary prefix	Substituent group	Secondary prefix
– F	Fluoro	$-OCH_3$ (–OMe)	Methoxy
– Cl	Chloro	$-OC_2H_5$(–OEt)	Ethoxy
– Br	Bromo	– R	Alkyl
– I	Iodo	$-CH_3$ (–Me)	Methyl
$-NO_2$	Nitro	$-C_2H_5$ (–Et)	Ethyl
– NO	Nitroso	$-CH_2CH_2CH_3$(n-Pr)	n-Propyl
$-\overset{\oplus}{N}\equiv N$	Diazo	$-CH(CH_3)_2$ (–iPr)	Isopropyl
– OR	Alkoxy	$-C(CH_3)_3$ (t-Bu)	t-Butyl

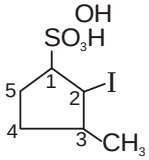
Example :

Organic compounds	Secondary prefix	Word root	Primary suffix	IUPAC name
CH_3CH_2-Br	Bromo	eth	ane	Bromoethane
CH_3-NO_2	Nitro	meth	ane	Nitromethane
$C_2H_5-OC_2H_5$	Ethoxy	eth	ane	Ethoxyethane

Ex. 

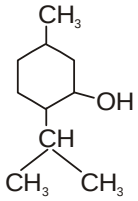
4-Bromo + cyclo + hex + an (e) + 1-ol

Secondary prefix | Primary prefix | Word root | Primary suffix | Secondary suffix



2-Iodo-3-methyl + cyclo + pent + ane + 1-sulphonic acid

Secondary prefix | Primary prefix | Word root | Primary suffix | Secondary suffix



2-Isopropyl-5-methylcyclohexanol

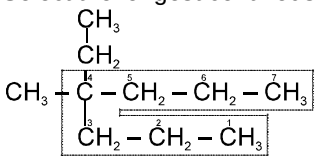
Here Secondary prefix = 2-Isopropyl-5-methyl
Primary prefix = cyclo
Word root = hex
Primary suffix = an(e)
Secondary suffix = ol

Th7:

3. IUPAC NOMENCLATURE OF BRANCHED / COMPLEX ALKANES

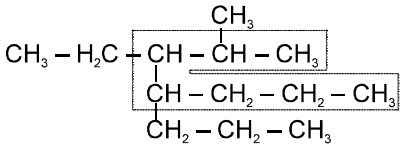
3.1 Parent carbon chain selection :

(a) Select the longest continous carbon chain in the molecule.



longest chain has 7 carbons so word root is "Hept"

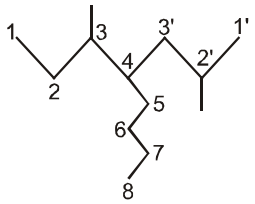
(b) When chains of equal lengths are competing for selection then that chain is selected which has more number of substituents/branches.



longest chain has 7 carbon & 3 substituents

(c) When the number of substituents are same then the substitutents at the nearest positions from the either end is prefer for parent chain selection.

Ex. Here, 2 choices for longest chain

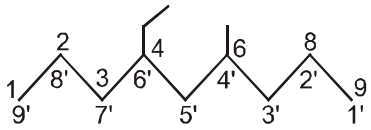


Chain- (A) 1–2–3–4–5–6–7–8 Chain- (B) 1'–2'–3'–4–5–6–7–8

Chain- (A) & Chain- (B) both have 2 substituents but in chain-B substituent is nearer (at 2nd position) than in chain-A (at 3rd position). So, chain-B will be preferred.

(d) If the two substituents are found in equivalent positions the lower number is given to the one coming first in the alphabetical order.

Ex. Here, 2 choices for longest chain



Chain- (A) 1–2–3–4–5–6–7–8–9 Chain- (B) 1'–2'–3'–4'–5'–6'–7'–8'–9'

In both chain-A & chain-B, substituents are at same position (4th). In chain-A substituent is ethyl & in chain-B, it is methyl. Alphabetically ethyl will be preferred. So, chain-A is selected.

3.2 Numbering of the parent carbon chain :

The numbering is done in such a way that the branched carbon atoms get the lowest possible number :

Note :

(1) Write the substituents in place of secondary prefix with their appropriate locations in alphabetical order.

(2) If the same substituent occurs more than once in the molecule, the prefix di (for two), tri (for three), etc. are used to indicate how many times it appears.

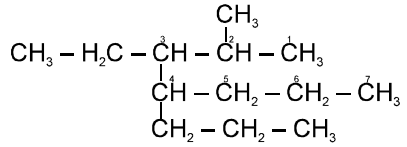
(3) Prefixes di, tri, tetra etc. are not considered in deciding alphabetical order for simple substituents but considered for complex substituents.

(4) Iso & Neo is considered for alphabetical seniority order.

(5) Numbers are separated from each other by commas(,).

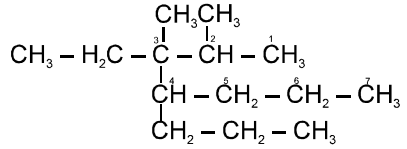
(6) Numbers are separated from words by hyphens and there is no break between name of substituents and word root.

Ex. **(i)**



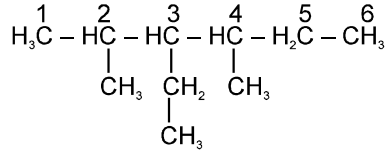
3-Ethyl-2-methyl-4-propylheptane

(ii)



3-Ethyl-2,3-dimethyl-4-propylheptane

(iii)



3-Ethyl-2,4-dimethylhexane

4. SECTION (C) : IUPAC-NOMENCLATURE OF ALKENE, CYCLOALKENE, POLYENES & ALKYNE

Th8:

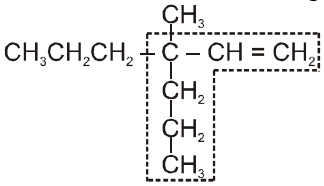
4.1 IUPAC nomenclature of Alkenes/Alkynes/Alkenyne

4.1.1 Alkenes :

Functional group :

(1) Select the longest carbon chain containing carbon–carbon double bond. This need not be the longest chain in the compound as a whole. Parent name will be alkene corresponding to number of carbon atoms in the longest chain.

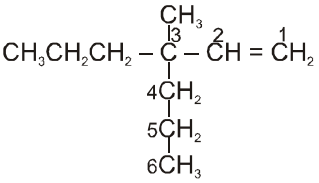
Ex.



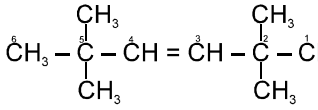
Longest chain has 6 atoms $\Rightarrow$ parent name = hexane

(2) Carbon atoms in the longest chain is numbered from that end in such a way that doubly bonded carbon atom gets the lowest number. The position of double bond is indicated by the smaller of the numbers assigned to two carbon atoms of double bond.

$\therefore$ The above example can be numbered as,

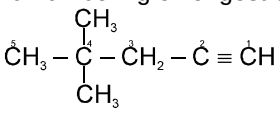


Position of double bond will be indicated as no. 1, Hence name will be 3-Methyl-3-propylhex-1-ene

Ex.  2,2,5,5-Tetramethylhex-3-ene

4.1.2 Alkynes

Parent chain selection and numbering of longest chain is exactly same as that for alkenes.

Ex. $CH_3C{\equiv}C{-}CH_3$ But-2-yne  4,4-Dimethylpent-1-yne

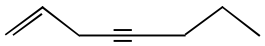
4.1.3 Alkenyne (containing both double and triple bonds)

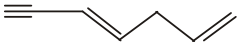
Numbering is done in a manner that double and triple bonds get the lowest possible number. If double bond and triple bond both have same number then double bond is prefer over triple bond.

$HC \equiv C - CH_2 - CH = CH_2$

1	**2**	**3**	**4**	**5** (numbering is done from alkyne) **(wrong)**
5	**4**	**3**	**2**	**1** (numbering is done from alkene) **(Correct)**

Ex.

(a)  Oct-1-en-4-yne

(b)  Hepta-3,6-dien-1-yne

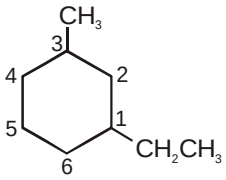
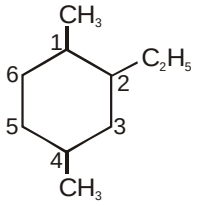
Th9:

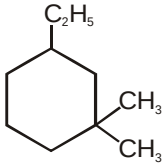
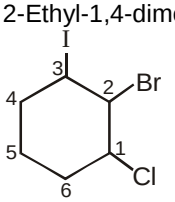
5. IUPAC NOMENCLATURE OF ALICYCLIC COMPOUNDS

(1) The names of alicyclic compounds are obtained by adding the prefix "**cyclo**"

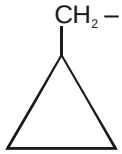
Ex.  Cyclobutane  Cyclopentene

(2) The numbering of the carbon atoms in the ring is done in such a way that the substituent which comes first in the alphabetical order is given the lowest possible number and it does not violate the lowest set of locants rule.

Ex.  1-Ethyl-3-methyl cyclohexane  2-Ethyl-1,4-dimethyl cyclohexane

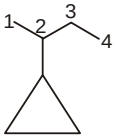
 3-Ethyl-1,1-dimethyl cyclohexane  2-Bromo-1-chloro-3-iodocyclohexane

(3) When the ring contains more or equal number of carbon atoms than the alkyl group attached to it, then it is named as a derivative of cycloalkane and the alkyl group is treated as substituent

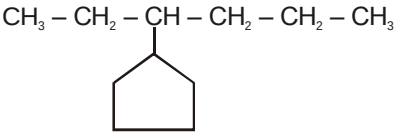
Ex.  Propylcyclopropane

(4) The alkane chain contains greater number of carbon atoms than present in the ring, then the compound is considered as the derivative of alkane and the ring is designated as substituent.

Ex.



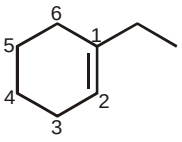
2-Cyclopropylbutane



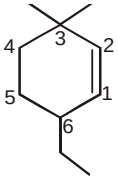
3-Cyclopentylhexane

(5) If ring has unsaturation and side chain is saturated then ring is selected as parent chain.
If side chain has unsaturation and ring is saturated then side chain is selected as parent chain.
If both have unsaturation the chain with maximum unsaturation has selected as parent chain.
If equal unsaturation then longest chain is selected as parent chain.
If unsaturation and number of carbon atoms both are equal then ring is selected as parent chain.

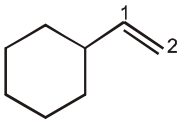
Ex.



1-Ethylcyclohex-1-ene



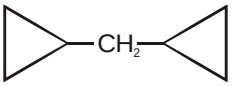
6-Ethyl-3,3-dimethylcyclohex-1-ene



Cyclohexyl ethene

(6) If more than one alicyclic ring is attached to a single chain then the compound is named as a derivative of alkane and the ring are treated as a substituent group.

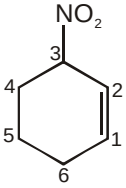
Ex.



Dicyclopropylmethane

(7) If a multiple bond and some other substitutents are present in the ring, the numbering is done in such a way that the multiple bond gets the lowest number

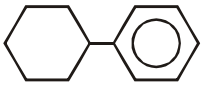
Ex.



3-Nitrocyclohex-1-ene

(8) If a compound contains an alicyclic ring directly linked to the benzene ring. It is named as a derivative of benzene.

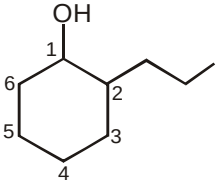
Ex.



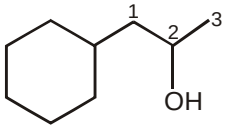
Cyclohexylbenzene

(9) If functional group is present in cyclic compounds then the main chain is taken in which principal functional lie's, if the principal functional group is present in ring also then main chain will be taken for the maximum no. of carbon atoms.

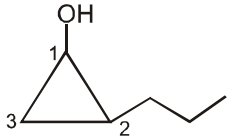
Ex.



2-Propylcyclohexan-1-ol



1-Cyclohexylpropan-2-ol

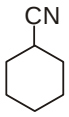


2-Propyl cyclopropan-1-ol

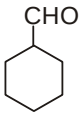
(10) When chain terminating functional group is directly attached with ring then ring is taken as parent chain & special suffix is used for this functional group.

Functional Group	Suffix
CHO	Carbaldehyde
COOH	Carboxylic Acid
COX	Carbonyl halide
COOR	Alkyl Carboxylate
$CONH_2$	Carboxamide
CN	Carbonitrile

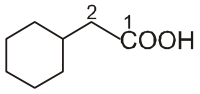
Ex.



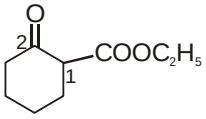
Cyclohexanecarbonitrile



Cyclohexanecarbaldehyde



2-Cyclohexyl ethanoic acid



Ethyl 2-oxocyclohexane-1-carboxylate

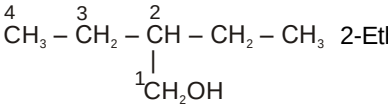
6. SECTION (D) : IUPAC NOMENCLATURE OF NON-CHAIN TERMINATING FUNCTIONAL GROUPS

Th10:

6.1 IUPAC nomenclature of compounds containing functional groups

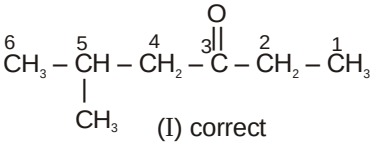
6.1.1 Rules for non chain terminating functional groups

(1) **Parent chain :** Select the longest possible chain with maximum functional group and maximum unsaturation without caring whether it also denotes the longest possible chain or not.

Ex.  2-Ethyl butan-1-ol (Parent chain contains four rather than five carbon atoms)

(2) **Lowest number for the functional group :** Numbering is done from that side of the chain which gives lowest locant to the principle functional group followed by double and triple bonds.

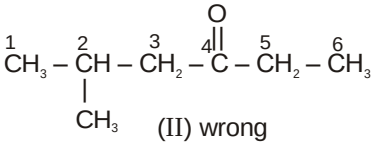
Ex.



(I) correct

5-Methyl hexan-3-one

(>C = O group gets lowest number 3)

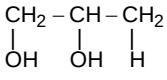


(II) wrong

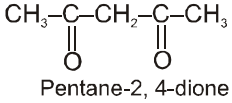
(>C = O group gets number 4 which is not lowest)

(3) If a compound contains two or more like groups, the numerical prefixes di, tri, tetra etc. are used

Ex.



Propane – 1,2,3 – triol

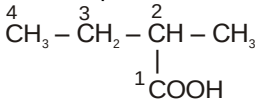


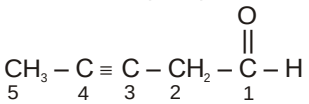
Pentane-2, 4-dione

7. SECTION (E) : IUPAC NOMENCLATURE OF CHAIN TERMINATING FUNCTIONAL GROUPS

7.1 Rules for chain terminating functional groups

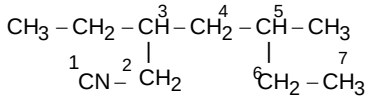
(1) When a chain terminating functional group such as – CHO, – COOH, – COOR, – $CONH_2$, – COCl, – C ≡ N etc. is present, it is always given number 1 (one.)





Ex. 2-Methylbutan-1-oic acid Pent-3-yn-1-al

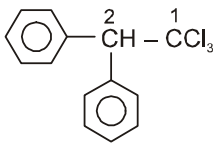
Que. Write the IUPAC name of

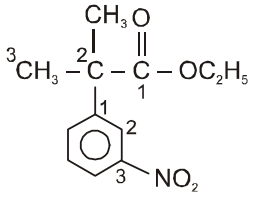


Sol.

1. The longest chain containing functional group is of **7** carbon atoms. Therefore, the word root is hept & the chain is numbered as shown.
2. There is no multiple bond in it. Hence, the primary suffix is **ane**.
3. The functional groups is –CN. Hence, secondary suffix is **nitrile**
4. Moreover, there is a methyl group on carbon 5 and ethyl group on carbon 3.
5. The IUPAC name is, therefore, **3-Ethyl-5-methylheptanenitrile**

(2) The name for benzene as substituent is phenyl. In case the phenyl ring is further substitued, the carbon atoms of the ring directly attached to the parent chain in such a ways that the substituent on the ring gets the least possible number. For example

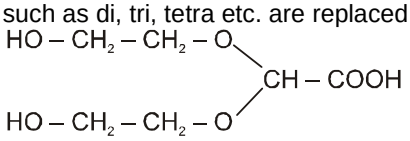




1,1,1-Trichloro-2,2-diphenylethane Ethyl- 2-methyl-2-(3-nitrophenyl) propanoate

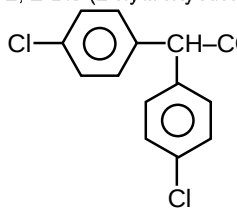
(3) If the organic molecule contains more than one similar complex substitutents, then the numeral prefixes such as di, tri, tetra etc. are replaced by bis, tris, tetrakis etc. respectively.

Ex.



2, 2-Bis (2-hydroxyethoxy) ethanoic acid

Ex.

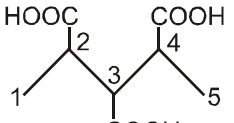


IUPAC Name : 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane

Common name is D.D.T. (Dichloro diphenyl trichloro ethane) & is used as insecticide.

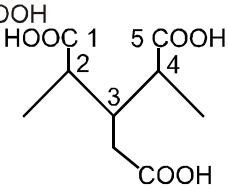
(4) When 3 or more principle functional groups are directly attached with an open chain, then special suffix is used.

Ex.



Pentane- 2,3,4–tricarboxylic acid.

Not true for



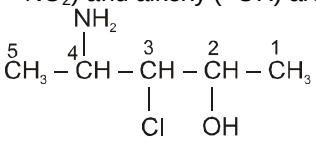
3-Carboxymethyl-2,4- dimethylpentanedioic acid

7.2 Rules for IUPAC nomenclature of polyfunctional compounds :

(1) When an organic compound contains two or more different functional groups then senior functional group is selected as the principal functional group while other functional groups are treated as substituents.

(2) Some functional group such as all halo groups (fluoro, bromo, chloro, iodo), nitroso (NO) nitro ($-NO_2$) and alkoxy (–OR) are always treated as substituent groups.

Ex.



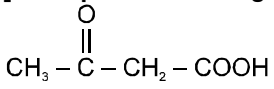
4-Amino-3-chloropentan-2-ol

($-NH_2$ & – Cl group treated as substituent)

Numbering the principal chain order is

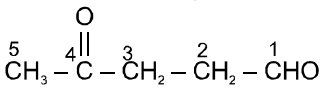
[Principal functional group > double bond > triple bond > substituents]

Ex.



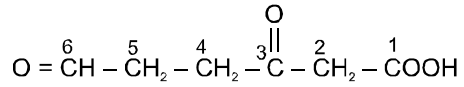
3-Oxobutan-1-oic acid

[– COOH > – CO]



4-Oxopentan-1-al

[– CHO > C=O]



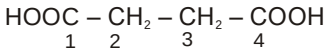
3, 6-Dioxohexanoic acid or 5-Formyl-3-oxopentanoic acid

[COOH > C & CHO]

(3) If more than one same chain terminating group are present then the principal chain is selected including the functional groups and numbring is done from that side which gives lowest locant to unsaturation and substituents.

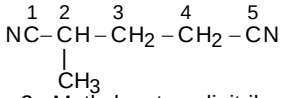
Ex.

(a)



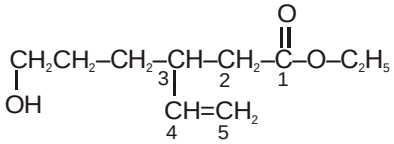
Butane-1, 4-dioic acid

(b)



2 – Methylpentanedinitrile

(c)



Ethyl-3-(3-hydoxy propyl) pent-4-enoate

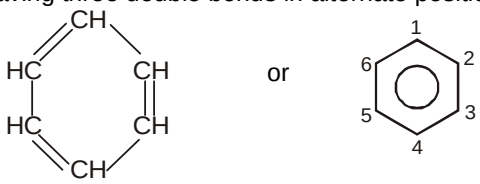
Parent chain contains five rather than six carbon atoms.

8. SECTION (F) : IUPAC-NOMENCLATURE OF AROMATIC COMPOUNDS

Th11:

8.1 Nomenclature of aromatic compounds

The aromatic compounds are cyclic compounds which contain one or more benzene type rings. Benzene is the simplest hydrocarbon of aromatic series which has planar cyclic ring of six carbon atoms having three double bonds in alternate positions as shown below.

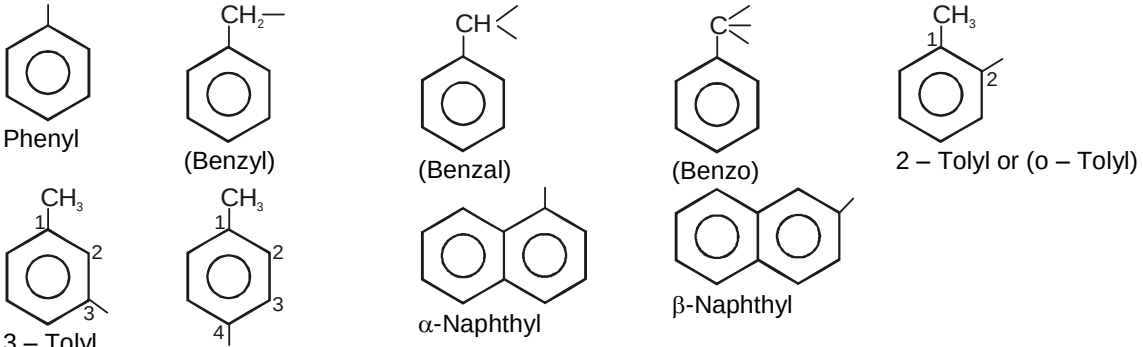


(i) Nuclear substituted: The functional group is directly attached to the benzene ring, in the IUPAC system they are named as derivatives of benzene. The position of the substituents in disubstituted benzenes are indicated either by prefixes such as o-(ortho) for 1,2,m-(meta) for 1, 3 and p-(para) for 1, 4 position. However, many of their common names have also been adopted by the IUPAC system.

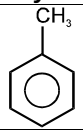
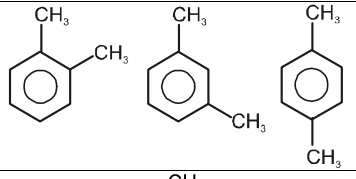
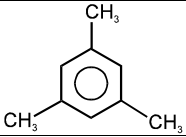
(ii) Side chain substituted: If functional group is present in the side chain of the benzene ring in the IUPAC system, these are usually named as phenyl derivatives of the corresponding aliphatic compounds.

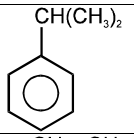
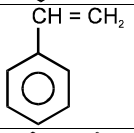
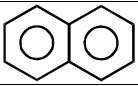
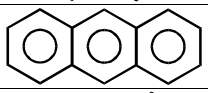
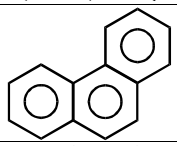
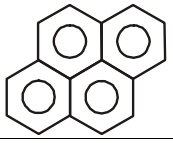
The IUPAC and common names of a few important members of each family are given below.

1. Aryl groups :

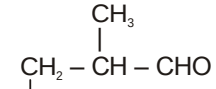


8.2 Other aromatic examples

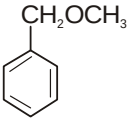
S.No.	Compounds	Common Name	IUPAC Name
	Aromatic Hydrocarbons		
1		Toluene	Methylbenzene or Toluene
2		Xylene (o,m,p)	(o,m,p) Dimethylbenzene
3		Mesitylene	1,3,5-Trimethylbenzene

4		Cumene	Isopropylbenzene
5		Styrene	Phenyl ethane or Ethenylbenzene
6		Naphthalene	Naphthalene
7		Anthracene	Anthracene
8		Phenanthrene	Phenanthrene
9		Pyrene	Pyrene

Que. Write IUPAC name of following aromatic compounds



(a)



(b)

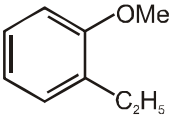
Ans.

(a) 2-Methyl-3-phenylpropanal
(b) Methoxyphenylmethane (Benzyl methyl ether)

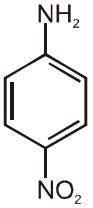
Que. Write the structural formula of :
(a) o-Ethylanisole,
(b) p-Nitroaniline,
(c) 2,3-Dibromo-1-phenylpentane
(d) 4-Ethyl-1-fluoro-2-nitrobenzene.

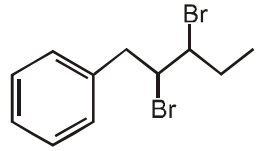
Ans.

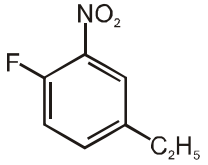
(a)



(b)



(c) 

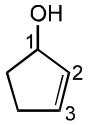
(d) 

Th12:

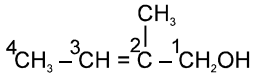
9. SOME IMPORTANT 1993 RECOMMENDATIONS FOR IUPAC NOMENCLATURE OF ORGANIC COMPOUNDS :

1. Locants (numerals and / or letters) are placed immediately before the part of the name to which they relate. For example :

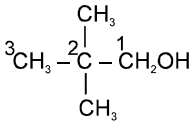
$CH_3CH_2CH = CH_2$ should be named as but-1-ene ; $CH_3CH_2CH_2OH$ should be named as propan-1-ol similarly, a few more examples are given as following :



Cyclopent-2-en-1-ol



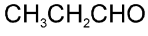
2-Methylbut-2-en-1-ol



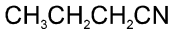
2,2-Dimethylpropan-1-ol

2. The locant 1 is often omitted when there is no ambiguity. For example.

Butanoic acid

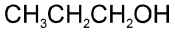


Propanal

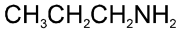


Butanenitrile

In all the above examples locant 1 for the functional group is omitted because the position of the functional group is unambiguous. However, in the following cases the position of the functional group must be mentioned.



Propan-1-ol

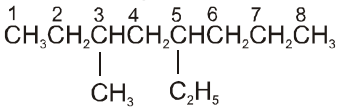


Propan-1-amine

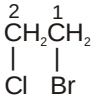
Here, we cannot write simply propanol (or propanamine) because there are two propanols ; propan-1-ol and propan-2-ol.

3. Arrangement of Prefixes

(i) Simple prefixes such as methyl, ethyl, chloro, nitro, hydroxy, etc. are arranged alphabetically. The prefixes di, tri, etc. are however not considered for comparison.

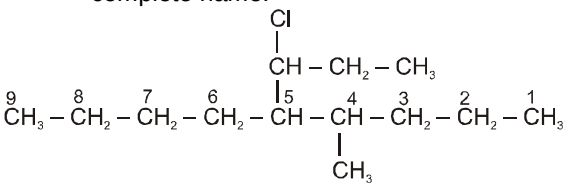
Ex. 

5-Ethyl-3-methyl octane



1-Bromo-2-chloroethane

(ii) The name of a prefix for a substituted substituent is considered to begin with the first letter of its complete name.

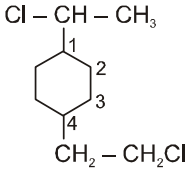
Ex. 

5-(1-Chloropropyl)-4-methyloctane

for the substituted 1-chloropropyl, 'C' is taken as the first letter.

(iii) When two or more prefixes consist of identical roman letters priority for citation is given to the group which contains the lowest locant at the first point of difference.

For example,



1-(1-Chloroethyl)-4-(2-chloroethyl)cyclohexane

Here, 1-chloroethyl gets priority over 2-chloroethyl.

Structural Isomerism

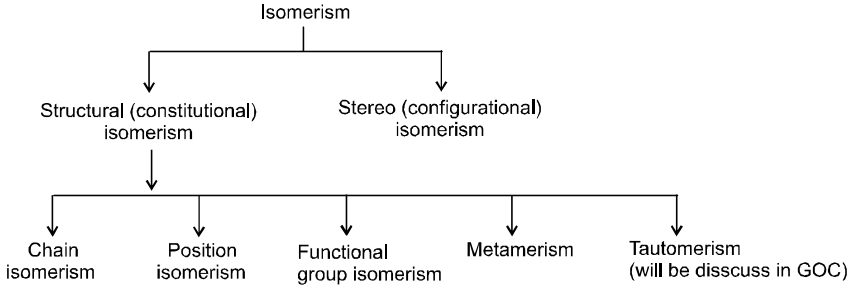
10. SECTION (G) : STRUCTURAL ISOMERISM

D4: Isomerism :

The phenomenon of existence of 2 or more compounds possessing the same molecular formula but different properties is known as isomerism. Such compounds are known as isomers.

Th13:

10.1 Classification of isomerism



10.2 Structural isomerism :

When two or more organic compounds have same molecular formula but different structural formula, (i.e., they differ in connectivity of atoms) then they are called **structural isomers** and the phenomenon is called structural isomerism

Structural isomers have always different IUPAC name

Ex. $CH_3-CH=CH-CH_3$ (But – 2 – ene), $CH_3CH_2CH=CH_2$ (But – 1 – ene) structural Isomers

Ex. $CH_3-CH(CH_3)-CH_2-CH_3$ (2 – Methyl butane), $CH_3-CH(CH_3)-CH_2CH_3$ (2 – Methylbutane) Identical compounds (not isomers)

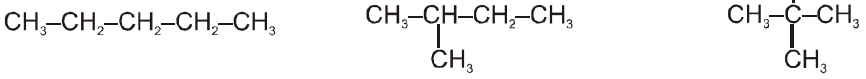
10.3 Various types of structural isomers are :

D5:

(a) **Chain isomerism:** Compounds having same molecular formula but different carbon skeletons (either difference in main chain or side chain) are known as chain isomers & phenomenon is known as chain isomerism.

Condition : They have same nature of locants.

Ex.

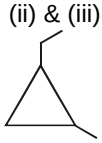


(i) Pentane (Main chain of 5C)

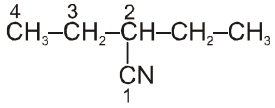
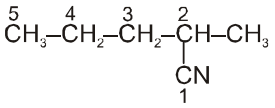
(ii) Isopentane (Main chain of 4 C)

(iii) Neopentane (Main chain of 3C)

(i), (ii) & (iii) are chain isomers :

Ex. (i)  (ii) 

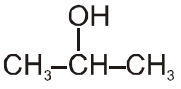
Size of main chain = 3 Size of main chain = 3
Size of longest Side chain = 2 Size of longest side chain = 1
Both are chain isomers due to difference in number of carbon atoms in side chain.

Ex.  & 

2-Ethylbutanenitrile 2-Methylpentanenitrile

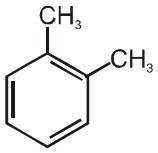
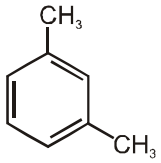
D6:

(b) **Position isomerism :** Compounds have same size of main chain & side chain along with same nature of locants but having different position of locants are known as position isomers & phenomenon is position isomerism.

Ex. $CH_3CH_2CH_2OH$ & 

Propan-1-ol Propan-2-ol

Difference only in position of –OH group

Ex.  &  & 

o-Xylene m-Xylene p-Xylene

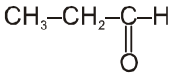
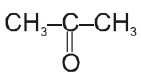
Difference only in position of $–CH_3$ group

D7:

(c) **Functional isomerism :** Compounds having same molecular formula but different functional group are known as functional isomers & phenomenon is functional isomerism.

Ex. $CH_3–O–CH_3$ & $CH_3–CH_2–OH$

Methoxymethane Ethanol

Ex.  & 

Propanal Propanone

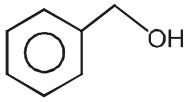
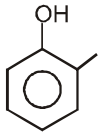
Ex. $CH_3–CH=CH–CH_3$ & 

But-2-ene Cyclobutane

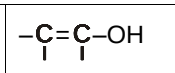
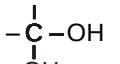
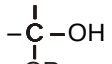
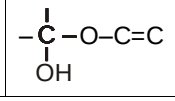
It is also known as **ring chain isomerism** [as 1 isomer has ring & another has aliphatic chain]

Note :

(1) 1º, 2º, 3º amines are functional isomers.
(2) 1º, 2º, 3º amides are functional isomers.
(3) Alcohol attached to sp^2 C is chemically different from alcohol attached to sp^3 C.

 &  are functional isomers.

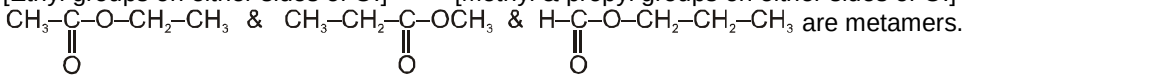
(4) Following compounds don't exist at room temperature therefore not considered as a structural isomer.

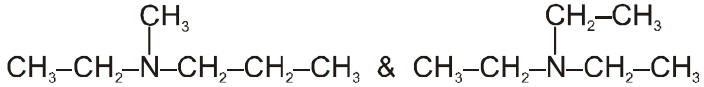
(i)		(ii)	–C≡C–OH	(iii)		(iv)	
(v)		(vi)	Any peroxy compound	(vii)			

D8:

(d) **Metamerism :** Compounds having same nature of functional groups but different nature of alkyl groups along that polyvalent functional group are known as metamers & phenomenon is metamerism.

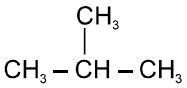
Ex. $CH_3–CH_2–O–CH_2–CH_2$ & $CH_3–O–CH_2–CH_2–CH_3$
Ethoxy ethane — Methoxy propane
[Ethyl groups on either sides of O.] — [Methyl & propyl groups on either sides of O.]

Ex.  are metamers.

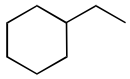
Ex.  are metamers.

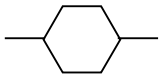
Ex. Identify relationship between the given compounds :

(a) (i) $CH_3–CH_2CH_2–CH_3$
Butane
Size of main chain = 4
Size of side chain = 0

(ii) 
2-Methylpropane
Size of main chain = 3
Size of side chain = 1

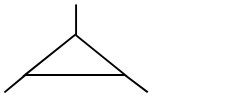
Structure (i) & (ii) are chain isomers.

(b) (i) 
1–Ethylcyclohexane
Size of main chain = 6
Size of side chain = 2

(ii) 
1,4-Dimethylcyclohexane
Size of main chain = 6
Size of side chain 1 = 1
Size of side chain 2 = 1

Structure (i) & (ii) are chain isomers.

(c) (i) 
Cyclohexane
Size of main chain = 6
Size of side chain = 0

(ii) 
1,2,3–Trimethylcyclopropane
Size of main chain = 3
Size of side chain 1 = 1
Size of side chain 2 = 1
Size of side chain 3 = 1

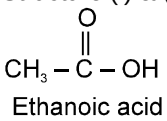
Structure (i) & (ii) are chain isomers.

(d) $\left.\begin{array}{ll} H_3C-CH_2-CH=CH_2 & (but-1-ene) \\ H_3C-CH=CH-CH_3 & (but-2-ene) \end{array}\right]$ position isomers

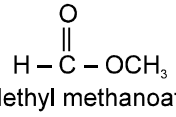
(e) $\left.\begin{array}{ll} HC\equiv C-CH_2-CH_2-CH_3 & (pent-1-yne) \\ H_3C-C\equiv C-CH_2-CH_3 & (pent-2-yne) \end{array}\right]$ position isomers

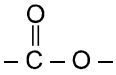
(f) (i) $CH_3–CH_2OH$ (Ethanol)
Functional groups –OH
Structure (i) & (ii) are functional isomers.

(ii) $CH_3–O–CH_3$ (Methoxymethane)
Function groups –O–

(iii) 
Ethanoic acid

Functional groups –COOH
Structure (iii) & (iv) are functional isomers.

(iv) 
Methyl methanoate

Functional groups 

(g) (i) $C_2H_5–O–C_2H_5$ (Diethyl ether)
Hydrocarbon groups $–C_2H_5$, $–C_2H_5$
Structure (i) & (ii) are metamers.

(ii) $C_3H_7–O–CH_3$ (Methyl propyl ether)
Hydrocarbon groups $–C_3H_7$, $–CH_3$

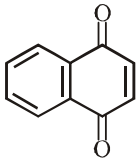
Exercise-1

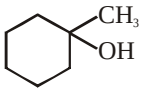
Marked questions are recommended for Revision.

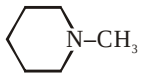
PART - I : SUBJECTIVE QUESTIONS

Section (A) : Fundamental of Organic Chemistry

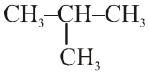
A-1. Write the number of σ and π bonds in the following molecules ?

(a) 

(b) 

(c) 

A-2. Find the number of 1°, 2° & 3° hydrogen atoms in the following compounds

(a)  (b) $CH_3–CH_2–CH_3$ (c) $CH_3–CH_2–CH_2–CH_3$

A-3. Find the hybridization state of each carbon atoms in following compound ?

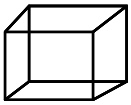
$CH_2=C=CH–CH_2–C\equiv C–CH_2–NH_2$

A-4. Expand each the following condensed formulae into their complete structural and bond line formulae :

(1) $HOCH_2CH_2NH_2$ (2) $CH_3(CH_2)_3OH$

(3) $CH_3CH_2COCH_2CH_3$ (4) $CH_3CH=CH(CH_2)_3CH_3$

A-5. Find DU of following compound :

(a) C_5H_{10} (b) 

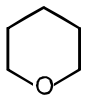
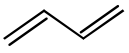
A-6. Find DU of following compound :

(a) C_6H_6O (b) C_6H_5I (c) C_5H_9N

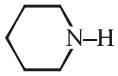
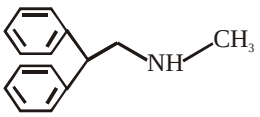
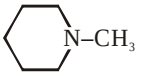
A-7. Draw formulae for the first four members of each homologous series begining with the following.

(a) H–COOH (b) H–CH=CH_2 (c)

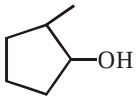
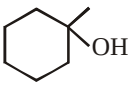
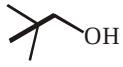
A-8. Classify the following compounds as homocyclic, heterocyclic, alicyclic, aromatic, saturated and unsaturated.

(a)  (b)  (c)  (d) 

A-9. Indicate the following as 1°, 2° and 3° amines.

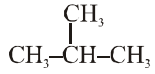
(a)  (b)  (c)  (d) 

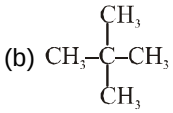
A-10. Indicate the following as 1°, 2° and 3° alcohol.

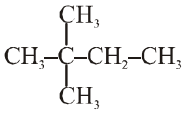
(a)  (b)  (c) 

Section (B) : IUPAC-Nomenclature of Alkane & Cycloalkane

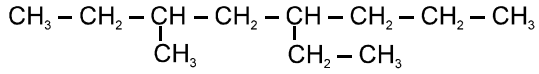
B-1. Write IUPAC name of the following compounds :

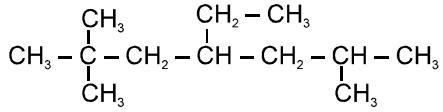
(a) 

(b) 

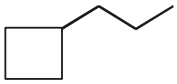
(c) 

B-2. Write IUPAC name of the following compounds:-

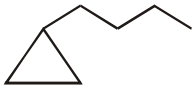
(a) 

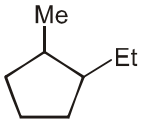
(b) 

B-3. Write correct IUPAC name of the following

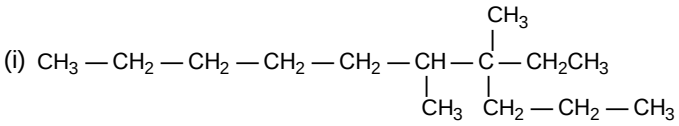
(i) 

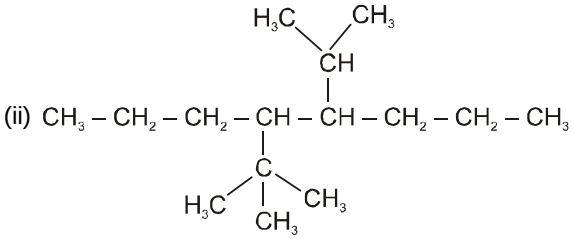
(ii) 

(iii) 

(iv) 

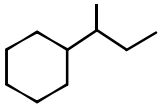
B-4. Write the correct IUPAC name of the following compounds.

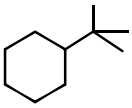
(i) 

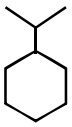
(ii) 

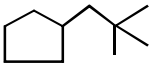
B-5. Write structures of the following IUPAC name.
(i) 1, 3-Dicyclopentyl propane
(ii) 1-Methyl-4-propylcyclohexane
(iii) 2-Ethyl-1,1-dimethylcyclopentane

B-6. Write IUPAC names of the following hydrocarbon (use common naming for hydrocarbon groups.)

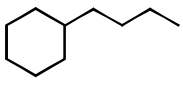
(a) 

(b) 

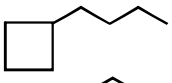
(c) 

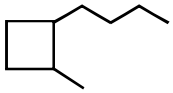
(d) 

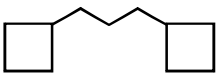
B-7. Identify the parent chain in the following compounds as ring or side chain.

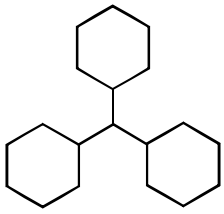
(a) 

(b) 

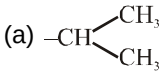
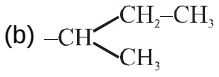
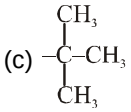
(c) 

(d) 

(e) 

(f) 

B-8. Write the common name of the following alkyl groups.

(a)  (b)  (c) 

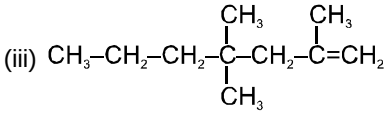
(d) $-CH_2-CH_3$ (e) $CH_3-CH_2-CH_2-$

Section (C) : IUPAC-Nomenclature of Alkene, Cycloalkene, Polyenes & Alkyne

C-1. Write the general formula of alkenes. Give IUPAC names of first three members.

C-2. Write IUPAC name of the following :

(i) $(CH_3)_3C-CH=CH_2$ (ii) $CH_2=CH-CH=CH_2$

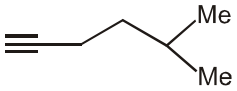
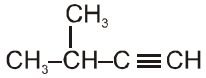
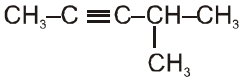
(iii)  (iv) 

C-3. Draw the bond line structures of the following compounds.

(a) 2-Methylhept-3-ene

(b) 2,6-Dimethylhepta-1, 5-diene

C-4. Write IUPAC name of the following

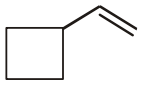
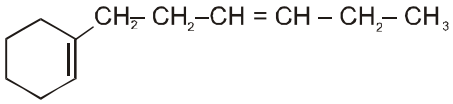
(i)  (ii)  (iii) 

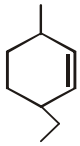
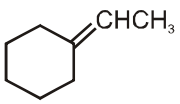
C-5. Draw structure of following IUPAC names.

(i) Hexa-2,4-diyne (ii) Pent-3-en-1-yne

(iii) Pent-1-en-4-yne (iv) Pent-1-en-3-yne

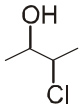
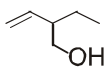
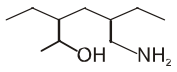
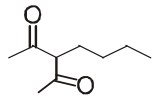
C-6. Write the IUPAC name of the following

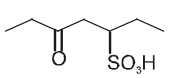
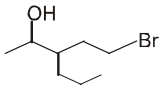
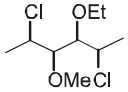
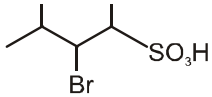
(i)  (ii) 

(iii)  (iv) 

Section (D) : IUPAC Nomenclature of non-chain terminating functional groups

D-1. Write the IUPAC names of the following compounds.

(a)  (b)  (c)  (d) 

(e)  (f)  (g)  (h) 

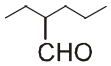
D-2. Draw the structures of each of the followings.

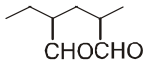
(a) Butan-1-ol (b) Butane-2-thiol (c) Pentan-2-amine

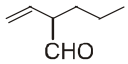
(d) Pentan-2-one (e) 3-Chloropentan-1-ol (f) Hexan-2,4-dione

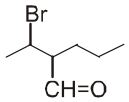
Section (E) : IUPAC Nomenclature of chain terminating functional groups

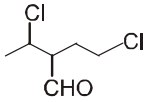
E-1. Select the longest continous carbon chain in each of the following molecules.

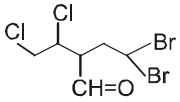
(a) 

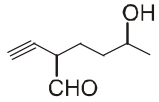
(b) 

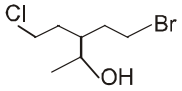
(c) 

(d) 

(e) 

(f) 

(g) 

(h) 

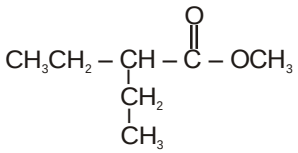
E-2. Write the structure of the following compounds :

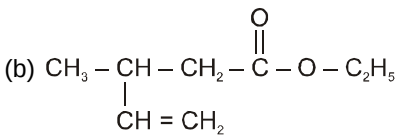
(a) 3-Hydroxypentane-2-sulphonic acid.
(b) 3-Chloromethylpentanoic acid
(c) 3-Bromobutanoyl chloride
(d) Cyclohexyl ethanoate
(e) Phenyl ethanoate
(f) 2-Chloroethyl propanoate
(g) Diethyl pentanedioate

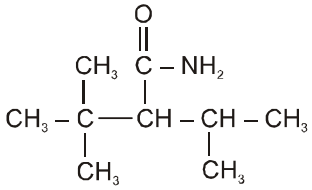
E-3. Write the structure of the following compounds :

(a) Butanamide
(b) N-methylethanamide
(c) Cyclopropanecarboxylic anhydride
(d) Cyclopropylbutanoate

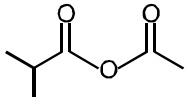
E-4. Write IUPAC Name :

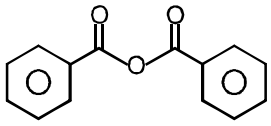
(a) 

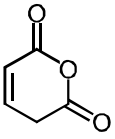
(b) 

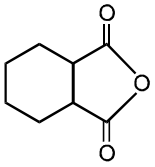
(c) 

E-5. Write IUPAC names of following compounds.

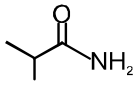
(a) 

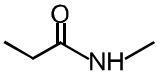
(b) 

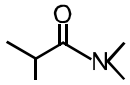
(c) 

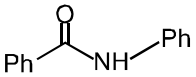
(d) 

E-6. Write IUPAC names of following compounds.

(a) 

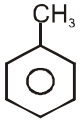
(b) 

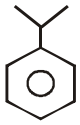
(c) 

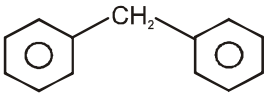
(d) 

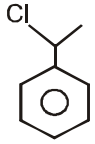
Section (F) : IUPAC-Nomenclature of Aromatic compounds

F-1. Write IUPAC name of the following :

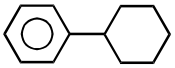
(a) 

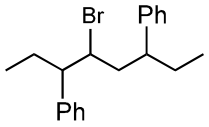
(b) 

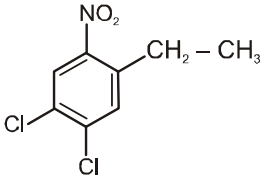
(c) 

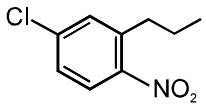
(d) 

F-2. Write the correct IUPAC name of the following :

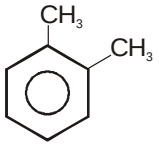
(a) 

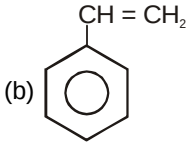
(b) 

(c) 

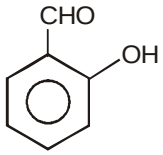
(d) 

F-3. Write common & IUPAC name of following structure:

(a) 

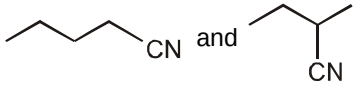
(b) 

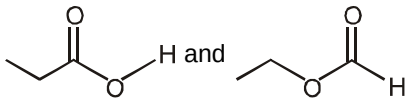
(c) 

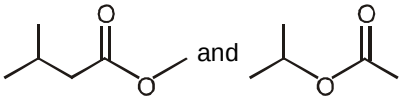
(d) 

Section (G) : Structural Isomerism

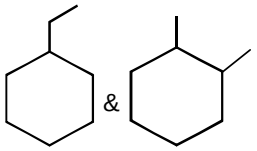
G-1. Identify the relationship between the given compounds.

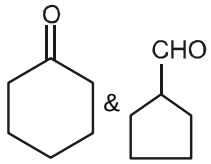
(a) 

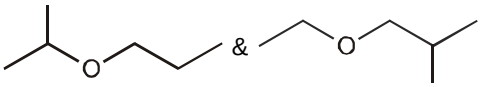
(b) 

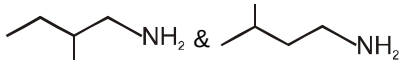
(c) 

G-2. Identify the relationship between the given compounds.

(a) 

(b) 

(c) 

(d) 

Section (H) : Number of Structural Isomers

H-1. Draw all structurally isomeric alkenes with molecular formula C_4H_8.

H-2. Draw all structurally isomeric 2º chlorides with molecular formula $C_5H_{11}Cl$.

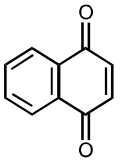
H-3. Draw all structurally isomeric benzene containing isomers with molecular formula C_7H_8O.

H-4. Draw all structurally isomeric cyclic bromides with molecular formula C_4H_7Br.

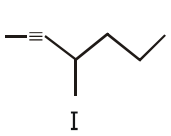
H-5. The ring chain functional isomer of compound But-2-ene are.

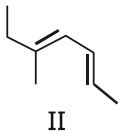
PART - II : ONLY ONE OPTION CORRECT TYPE

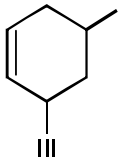
Section (A) : Fundamental of Organic Chemistry

A-1. Molecular formula of naphthaquinone  is

(A) $C_{12}H_8O_2$ (B) $C_{11}H_6O_2$ (C) $C_{10}H_6O_2$ (D) $C_{10}H_8O_2$

A-2. 
I


II

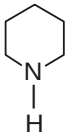

III

Incorrect statement for the above structure :

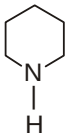
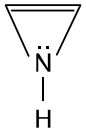
(A) I, II & III have C_nH_{2n-2} general formula. (B) I, II & III have same empirical formula.

(C) I, II are identical and homologue of compound III. (D) I, II & III have same molecular formula.

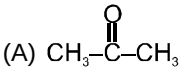
A-3. Which of the following is not an alicyclic compound ?

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

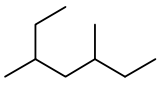
A-4. The saturated heterocyclic compound is :

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

A-5. Which of the following compound is unsaturated hydrocarbon ?

(A)  (B) $CH_3–C\equiv N$ (C)  (D) 

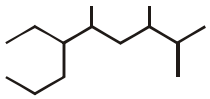
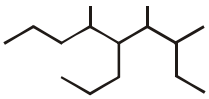
Section (B) : IUPAC-Nomenclature of Alkane & Cyclo alkane

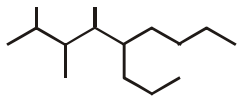
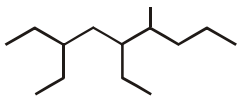
B-1. The correct IUPAC name of the alkane  is :

(A) 2-Ethyl-4-methylhexane (B) 5-Ethyl-3-methylhexane

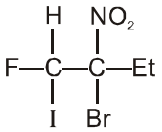
(C) 3,5-Dimethylheptane (D) 3,5-Dimethylhexane

B-2. The correct structure of 6-Ethyl-2,3,5-trimethylnonane is :

(A)  (B) 

(C)  (D) 

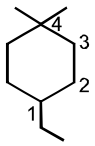
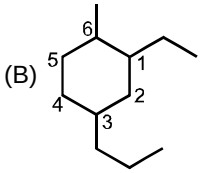
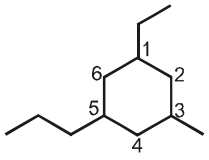
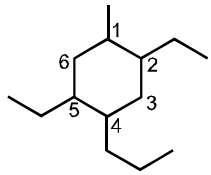
B-3. The correct IUPAC name of the following compound is :



(A) 1-Bromo-1-ethyl-2-fluoro-2-iodo-1-nitroethane.
(B) 3-Bromo-4-fluoro-4-iodo-3-nitrobutane.
(C) 2-Bromo-1-fluoro-1-iodo-2-nitrobutane.
(D) 1-Fluoro-1-iodo-2-bromo-2-ethyl-2-nitroethane.

B-4. A student named a certain compound as 2, 3-diethylbutane. Its correct IUPAC names is
(A) 2, 3-Dimethylhexane (B) 3, 4-Dimethylhexane
(C) 2-Ethyl-3-methylpentane (D) 2-Ethylbutane

B-5. In which of the following compound IUPAC numbering is correct ?

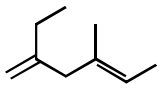
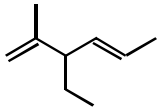
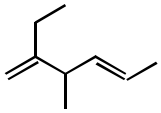
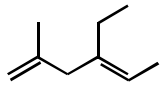
(A) 
(B) 
(C) 
(D) 

Section (C) : IUPAC-Nomenclature of Alkene, Alkyne, Cyclo alkene & polyenes

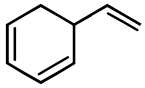
C-1. Select the structure with correct numbering in the chain :
(A) $\overset{5}{C}H_2 = \overset{4}{C}H - \overset{3}{C}H_2 - \overset{2}{C} \equiv \overset{1}{C}H$
(B) $\overset{1}{C}H_3 - \overset{2}{C}H = \overset{3}{C}H - \overset{4}{C}H_2 - \overset{5}{C} \equiv \overset{6}{C}H$
(C) $\overset{7}{C}H_2 = \overset{6}{C}H - \overset{5}{C}H = \overset{4}{C}H - \overset{3}{C}H_2 - \overset{2}{C}H = \overset{1}{C}H_2$
(D) $\overset{1}{C}H_2 = \overset{2}{C}H - \overset{3}{C}H = \overset{4}{C}H - \overset{5}{C}H_2 - \overset{6}{C} \equiv \overset{7}{C}H$

C-2. The correct IUPAC name of the compound $CH_2=CH-CH_2-\underset{\displaystyle C_2H_5}{\underset{|}{CH}}-CH_3$
(A) 4-Ethylpent-1-ene (B) 2-Ethylpent-4-ene (C) 4-Methylhex-1-ene (D) 3-Methylhex-1-ene

C-3. The correct structure of 2-Ethyl-3-methylhexa-1,4-diene :

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

C-4. The correct IUPAC name of the compound



(A) 1-Ethenylcyclohexa-2, 4-diene (B) 5-Ethenylcyclohexa-1, 3-diene
(C) 6-Ethenylcyclohexa-1, 3-diene (D) Cyclohexa-2, 4-dienylethene

Section (D) : IUPAC Nomenclature of non-chain terminating functional groups

D-1. Which of the following is a correct priority order of functional groups?

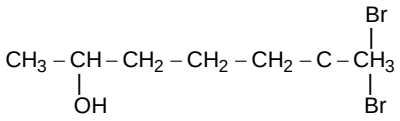
(A) $-COOH \rangle -SO_3H \rangle -NH_2 \rangle -\overset{\displaystyle O}{\overset{\|}{C}}-NH_2$

(B) $-\overset{\displaystyle O}{\overset{\|}{C}}-H \rangle -\overset{\displaystyle O}{\overset{\|}{C}}-R \rangle -OH \rangle -NH_2$

(C) $-SO_3H \rangle -\overset{\displaystyle O}{\overset{\|}{C}}-R \rangle -CHO \rangle -OH$

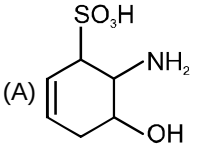
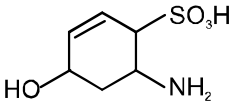
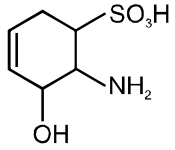
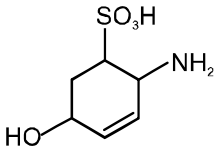
(D) $-\overset{\displaystyle O}{\overset{\|}{C}}-OR \rangle -\overset{\displaystyle O}{\overset{\|}{C}}-X \rangle -\overset{\displaystyle O}{\overset{\|}{C}}-O-\overset{\displaystyle O}{\overset{\|}{C}}- \rangle -CHO$

D-2. The IUPAC name of is :

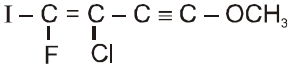


(A) 6, 6-Dibromoheptan-2-ol
(B) 2, 2-Dibromoheptan-6-ol
(C) 6, 6-Dibromoheptan-2-al
(D) None of these

D-3. The correct structure of 6-Amino-4-hydroxycylohex-2-ene-1-sulphonic acid.

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

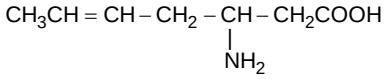
D-4. The correct IUPAC name of the given compound is



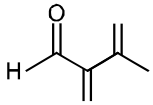
(A) 3-Chloro-1-fluoro-1-iodo-4-methoxybut-1-en-3-yne
(B) 4-Methoxy-2-chloro-1-fluoro-1-iodobutenyne
(C) 3-Chloro-4-fluoro-4-iodo-1-methoxybutenyne
(D) 2-Chloro-1-fluoro-1-iodo-4-methoxybutenyne

Section (E) : IUPAC-Nomenclature of chain terminating Functional groups

E-1. The IUPAC name of the following is :

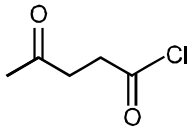


(A) 3-Aminohept-5-enoic acid
(B) 5-Aminohex-2-enecarboxylic acid
(C) 3-Aminohept-4-enoic acid
(D) 5-Aminohept-2-enoic acid

E-2.  is named as **:**

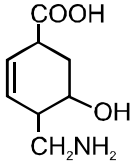
(A) 2, 3-Dimethylenebutanal
(B) 3-Methyl-2-methylenebut-3-enone
(C) 3-Methyl-2-methylenebut-3-enal
(D) 2, 3-Dimethylenebutanone

E-3. The correct IUPAC name of compound is :



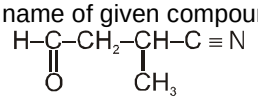
(A) 1-Chloropentane-1, 4-dione
(B) 4-Chlorocarbonylbutan-2-one
(C) 4-Oxopentanoyl chloride
(D) 3-Oxobutanecarbonyl chloride

E-4. The correct IUPAC name of following compound is



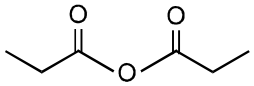
(A) 4-Aminomethyl-3-hydroxycyclohex-5-ene-1-carboxylic acid
(B) 2-Aminomethyl-5-carboxycyclohex-3-en-1-ol
(C) 4-Aminomethyl-5-hydroxycyclohex-2-ene-1-carboxylic acid
(D) 3-Hydroxy-4-aminomethylcyclohex-5-en-1-oic acid

E-5. IUPAC name of given compound is :



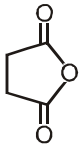
(A) 3- Carbonitrile-3-methyl butanal
(B) 3-Formyl-2-methyl propne nitrile
(C) 3-Cyanobutanal
(D) 2-Methyl-4-oxobutane nitrile

E-6.



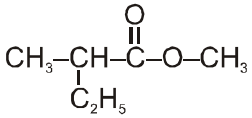
The IUPAC name of the compound is :
(A) Propanoic anhydride
(B) Dipropanoic anhydride
(C) Ethoxy propanoic acid
(D) 1-Oxopropyl propanoate

E-7. The IUPAC name of the compound is :



(A) Cyclobutanedioic anhydride
(B) Butanedicarboxylic anhydride
(C) Cyclobutanedicarboxylic anhydride
(D) Butanedioic anhydride

E-8. The correct IUPAC name of following compound is :



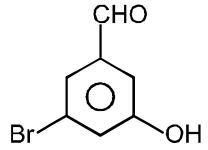
(A) Methyl -2-ethylpropanoate
(B) Methyl butane-2-carboxylate
(C) Methyl- 2-methylbutanoate
(D) Methoxypentanone

E-9. IUPAC name of the compound $BrCH_2-CH(CONH_2)-CO-CH_2-CH_2CH_3$ is

(A) 2-Bromomethyl-3-oxohexanamide
(B) 1-Bromo-2-amido-3-oxohexane
(C) 1-Bromo-2-amido-n-propylketone
(D) 3-Bromo-2-proponyl-propanamide

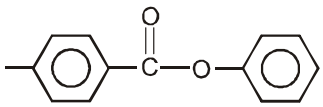
Section (F) : IUPAC-Nomenclature of Aromatic compounds

F-1. The IUPAC name of the following compound is :



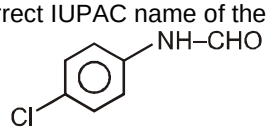
(A) 5-Bromo-3-hydroxybenzenecarbaldehyde
(B) 3-Bromo-5-formylphenol
(C) 3-Bromo-5-hydroxybenzenecarbaldehyde
(D) 1-Bromo-3-formyl-5-hydroxybenzene

F-2. IUPAC name of

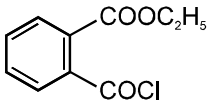


(A) 4-Chlorophenyl benzoate.
(B) Phenyl-4-chlorobenzenecarboxylate.
(C) Benzyl-4-chlorobenzenecarboxylate.
(D) 4-Chloro diphenylcarboxylate.

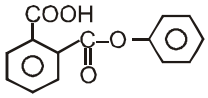
F-3. The correct IUPAC name of the compound.



(A) N-Formyl-4-chlorobenzenamine
(B) N-Formyl-4-chloroaniline
(C) N-(4-chlorophenyl)methanamide
(D) N-(Parachlorophenyl)-N-formylaniline

F-4. IUPAC name of the compound  is

(A) 2-Chlorocarbonyl ethylbenzenecarboxylate (B) 2-Carboxyethylbenzoyl chloride
(C) Ethyl 2-(chlorocarbonyl)benzenecarboxylate (D) Ethyl 1-(chlorocarbonyl)benzenecarboxylate

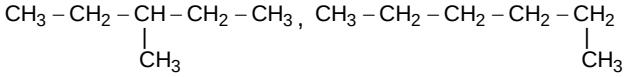
F-5. The correct IUPAC name of the compound


(A) 2-Phenoxycarbonylbenzenecarboxylic acid (B) Phenyl-2-carboxybenzenecarboxylate
(C) 2-Benzoyloxybenzenecarboxylic acid (D) 2-Benzyloxycarbonylbenzenecarboxylic acid

Section (G) : Structural Isomerism

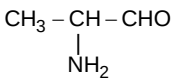
G-1. Isomers have essentially identical.
(A) Structural formula (B) Chemical properties
(C) Molecular formula (D) Physical properties

G-2. Compound with same molecular formula but different structural formula are called.
(A) Isomers (B) Isotopes (C) Isobars (D) Isoelectric

G-3. What is the correct relationship between the following compounds ?


(A) Chain isomers (B) Position isomers (C) Functional isomers (D) Identical

G-4. What is the relation between 3-Ethylpentane and 3-Methylhexane ?
(A) Chain isomers (B) Position isomers (C) Functional isomers (D) Relation

G-5. $CH_3–CH_2–NH–CHO$; 

I II

Which type of isomerism is observed between I and II.
(A) Chain isomers (B) Position isomers (C) Functional isomers (D) Metamers

G-6. Molecular formula $C_4H_{10}O$ represent
(A) Two primary alcohol (B) One secondary alcohol
(C) One tertiary alcohol (D) All of these

Section (H) : Number of Structural Isomers

H-1. How many positional isomers are possible for dimethylcyclohexane ?
(A) 3 (B) 4 (C) 5 (D) 6

H-2. How many aromatic isomers are possible for trichlorobenzene ($C_6H_3Cl_3$) ?
(A) 2 (B) 3 (C) 4 (D) 5

H-3. The number of ether isomers represented by formula $C_4H_{10}O$ is (only structural)
(A) 4 (B) 3 (C) 2 (D) 1

H-4. Total number of 2° amine isomers of $C_4H_{11}N$ would be (only structural)
(A) 4 (B) 3 (C) 5 (D) 2

H-5. How many structural isomers of all the tertiary alcohols with molecular formula $C_6H_{14}O$.
(A) 2 (B) 3 (C) 4 (D) 5

H-6. The number of structural isomers for C_5H_{10} are :
(A) 8 (B) 6 (C) 9 (D) 10

H-7. The number of acyclic isomers of C_3H_5Cl are :
(A) 1 (B) 2 (C) 3 (D) 4

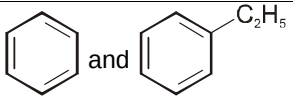
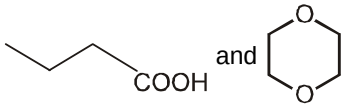
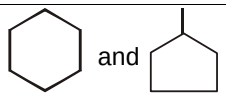
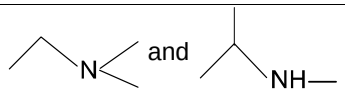
H-8. The number of cyclic ketones of molecular formula C_3H_4O are :
(A) 2 (B) 1 (C) 3 (D) 4

H-9. The number of cyclic isomers of molecular formula $C_3H_4Cl_2$ are :
(A) 1 (B) 2 (C) 3 (D) 4

H-10. The number of structural isomers of for C_4H_9Cl are :
(A) 1 (B) 2 (C) 3 (D) 4

PART - III : MATCH THE COLUMN

1. Match the following :

	Column-I		Column-II
(A)		(p)	Homologs
(B)		(q)	Functional isomers.
(C)		(r)	Chain isomers.
(D)		(s)	Have same general formula
		(t)	Have same empirical formula.

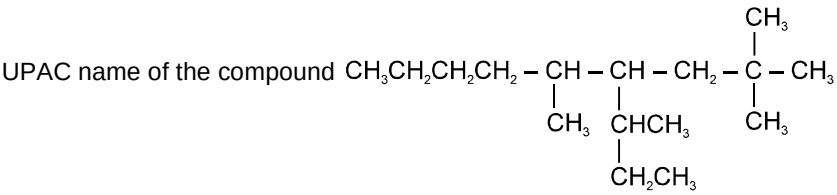
2. Match the following :

	Column-I (Benzene derivative molecular formula)		Column-II (No. of aromatic structural Isomers)
	(Here ⇒ X, Y, Z monovalent substituents)		
(A)	$C_6H_4X_2$	(p)	6
(B)	C_6H_4XY	(q)	3
(C)	$C_6H_3X_3$	(r)	4
(D)	$C_6H_3X_2Y$	(s)	5
(E)	C_6H_3XYZ	(t)	10

Exercise-2

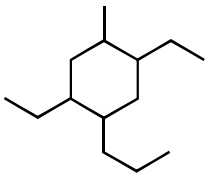
Marked questions are recommended for Revision.

PART - I : ONLY ONE OPTION CORRECT TYPE

1. IUPAC name of the compound  is :

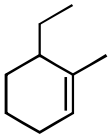
(A) 2,2,5-Trimethyl-4-(1-methylpropyl) nonane
(B) 4,8,8-Trimethyl-6-(1-methylpropyl) nonane
(C) 3,6-Dimethyl-4-(1-methylene tertiary butyl) nonane
(D) 6,6-Dimethyl-2-propyl-4-(1-methylpropyl) heptane

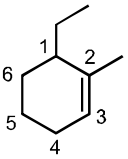
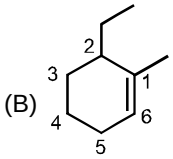
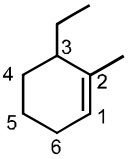
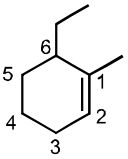
2. In the structure of 4-Isopropyl-2,4,5-trimethylheptane, number of 1°, 2° & 3° H's are respectively.
(A) 18, 5, 4 (B) 21, 4, 3 (C) 18, 4, 3 (D) 21, 5, 4

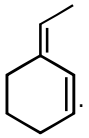
3. The correct IUPAC name of  is :

(A) 1, 4-Diethyl-2-methyl-5-propylcyclohexane (B) 1, 4-Diethyl-5-methyl-2-propylcyclohexane
(C) 2, 5-Diethyl-1-methyl-4-propylcyclohexane (D) 2, 5-Diethyl-4-methyl-1-propylcyclohexane

4. IUPAC nomenclature of the given organic compound will be : $(CH_3)_2C(CH_2CH_3)CH_2CH(Cl)CH_3$:
(A) 5-Chloro 3, 3-dimethyl hexane (B) 4-Chloro-2-ethyl-2-methyl pentane
(C) 2-Chloro-4-ethyl-4-methyl pentane (D) 2-Chloro-4, 4-dimethyl hexane

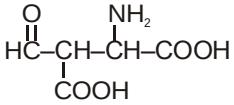
5. The correct IUPAC numbering in the compound  is :

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

6. The correct IUPAC name of  .

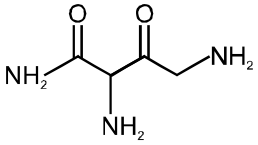
(A) 1-Ethylidenecyclohex-2-ene (B) 3-Ethylidenecyclohex-1-ene
(C) 2-Ethylidenecyclohex-1-ene (D) 3-Ethenylcyclohex-1-ene

7. Correct IUPAC name of the following compound is



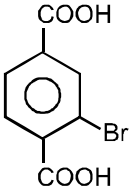
(A) 2-Amino-3-Formyl butane-1,4-dioic acid (B) 2-formyl-3-amino butane-1,4-dioic acid
(C) 3-Amino-2-formyl butane-1,4-dioic acid (D) 2-Amino-3-carboxy-4-oxo butanoic acid

8. The correct IUPAC name of the compound is :



(A) 1, 2, 3-Triaminobutane-1, 3-dione (B) 2, 4-Diamino-3-oxobutanamide
(C) 1, 3-Dioxobutane-1, 2, 4-triamine (D) 1, 3, 4-Triaminobutane-2, 4-dione

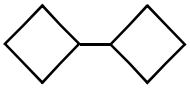
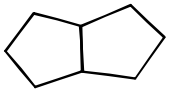
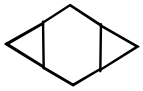
9. IUPAC name of the following molecule is



(A) 2-Bromobenzene-1,4-dioic acid (B) 3-Bromobenzene-1,4-dicarboxylic acid
(C) 2-Bromobenzene-1,4-dicarboxylic acid (D) 3-Bromobenzene-1,6-dicarboxylic acid

10. IUPAC name of picric acid is
(A) 2,4,6-Trinitrobenzene carboxylic acid (B) 2,4-Dinitrobenzene carboxylic acid
(C) 2,4,6-Trinitrophenol (D) 2,4-Dinitrophenol

11. Which one of the compound is not isomer of others ?

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

12. What is the number of all (structurally isomeric) alkynes with molecular formula C_6H_{10}.

(A) 6 (B) 7 (C) 8 (D) 9

13. Number of structurally isomeric ethers with molecular formula $C_5H_{12}O$.

(A) 4 (B) 5 (C) 6 (D) 7

14. How many structural isomers are possible when one of the hydrogen is replaced by a chlorine atom in anthracene ?

(A) 3 (B) 7 (C) 4 (D) 6

15. The number of structurally isomerc tribromo derivatives possible for benzene are :

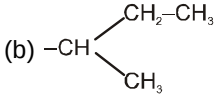
(A) 2 (B) 3 (C) 4 (D) 5

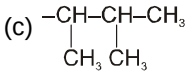
PART - II : NUMERICAL VALUE QUESTIONS

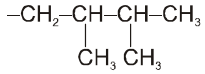
1. A hydrocarbon (R) has six membered ring in which there is no unsaturation. Two alkyl groups are attached to the ring adjacent to each other. One group has 3 carbon atoms with branching at 1st carbon atom of chain and another has 4 carbon atoms. The larger alkyl group has main chain of three carbon atoms of which second carbon is substituted. Number of 2° carbons in R are :

2. Number of correct names in the given substituents are :

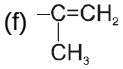
(a)  Ethylmethyl

(b)  1-Methylpropyl

(c)  2,3-Dimethylpropyl

(d)  2,3-Dimethylbutyl

(e) = CH–CH_3 Ethylidene

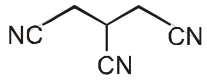
(f)  2-Methylethenyl

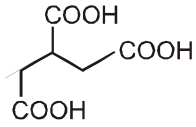
(g) –C ≡ CH Ethynyl

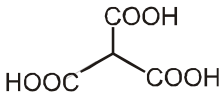
(h) $–CH_2–CH=CH_2$ 2-Propenyl

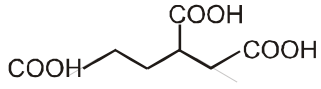
(i) $–CH_2–C \equiv CH$ Prop-1-ynyl

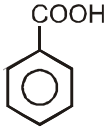
3. The number of compound(s) in which carbon atom of functional group can be counted in main chain is/are :

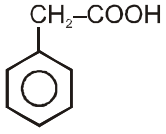
(a) 

(b) 

(c) 

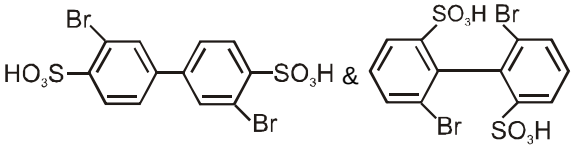
(d) 

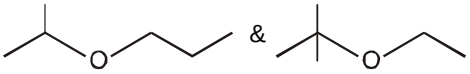
(e) 

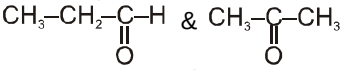
(f) 

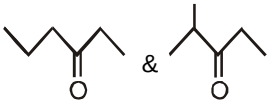
4. What is the degree of unsaturation in a compound with molecular formula $C_9H_6N_4$?

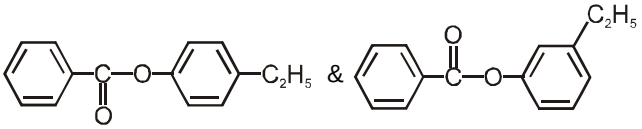
5. The no. of isomeric pairs with correct relationship specified are :

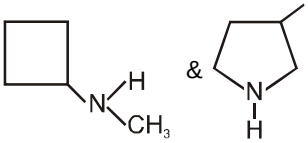
(a)  Position isomers

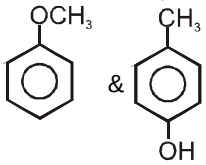
(b)  Metamers

(c)  Functional isomere

(d)  Position isomers

(e)  Position isomers

(f)  Functional isomers

(g)  Functional isomers

6. How many structurally isomeric dibromo butanes are possible.

7. How many number of all structurally isomeric dienes with molecular formula C_5H_8 are possible.

8. How many structural alkenes of formula $C_2FClBrI$ are possible.

9. How many aromatic benzene ring containing isomers of formula C_8H_{10} are possible.

10. How many tetramethyl benzene are possible.

11. How many structurally isomeric cyclic isomers of molecular formula C_3H_7N are possible.

12. The number of structurally isomeric ketones with molecular formula $C_6H_{12}O$ are :

13. The number of structurally isomeric esters with molecular formula $C_5H_{10}O_2$ are.

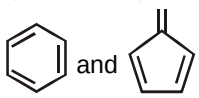
PART - III : ONE OR MORE THAN ONE OPTION CORRECT TYPE

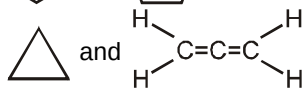
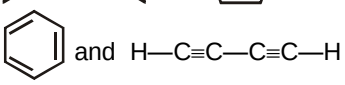
1. All the members of a homologus series have same

(A) Functional group (B) Empirical formula

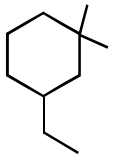
(C) General formula (D) All of these

2. The pair of compounds having the same general formula.

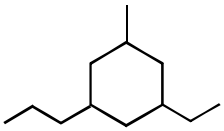
(A)  (B) 

(C)  (D) 

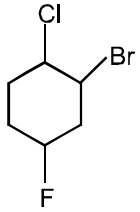
3. Which of the following IUPAC names are correct.

(A) 

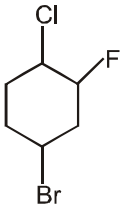
3-Ethyl-1,1-dimethylcyclohexane

(B) 

1-Ethyl-3-methyl-5-propylcyclohexane

(C) 

2-Bromo-1-chloro-4-fluorocyclohexane

(D) 

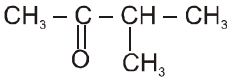
1-Bromo-4-chloro-3-fluorocyclohexane

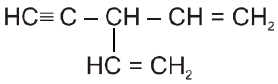
4. The compound with only primary hydrogen atoms is/are :

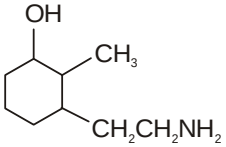
(A) Hexamethylcyclopropane (B) Neohexane

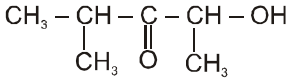
(C) Tetramethylbutane (D) Hexamethylbenzene

5. Which of the following is/ are incorrect IUPAC name/ (s) :

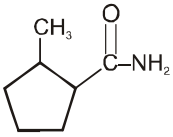
(A)  2-Methylbutan -3-one

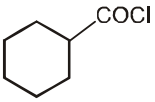
(B)  3-Ethenylpent-1-en-4-yne

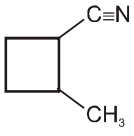
(C)  3- (2-Aminoethyl)-2-methylcyclohexan-1-ol

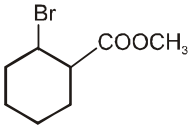
(D)  4-Methyl-3-oxopentan-2-ol

6. Which of the following IUPAC names are correct.

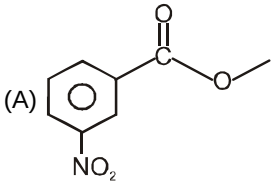
(A)  2-Methylcyclopentanecarboxamide.

(B)  Cyclohexanoyl chloride.

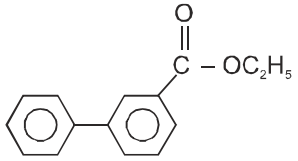
(C)  2-Methylcyclobutanecarbonitrile

(D)  Methyl-2-bromocyclohexanecarboxylate

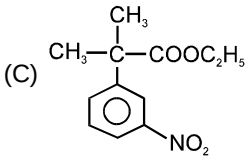
7. Which of the following IUPAC names are incorrect.

(A) 

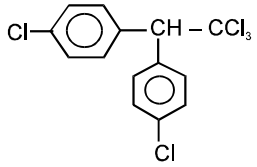
Methyl-3-nitrobenzenecarboxylate

(B) 

Ethyl-3-phenylbenzene-1-carboxylate

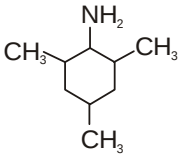
(C) 

Ethyl-2-methyl-2-(3-nitrophenyl)ethanoate

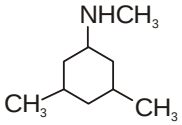
(D) 

1,1,1-Trichloro-2,2-bis(4-chlorophenyl) ethane

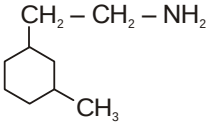
8. Which of the following is the correct relationship ?



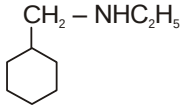
I



II



III



IV

(A) I & II are functional isomers.

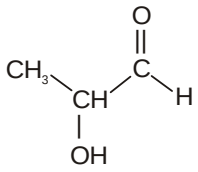
(B) II & IV are metamers.

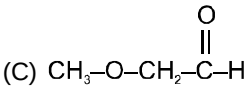
(C) I & IV are position isomers.

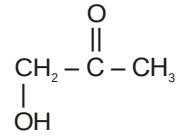
(D) I & III are chain isomers.

9. Which of the following are functional isomers of methyl ethanoate ?

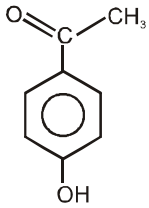
(A) $CH_3–CH_2–COOH$

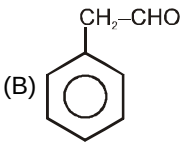
(B) 

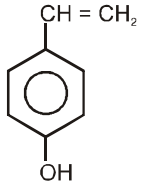
(C) 

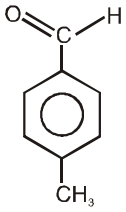
(D) 

10. Which of the following can be the isomer(s) of C_8H_8O :

(A) 

(B) 

(C) 

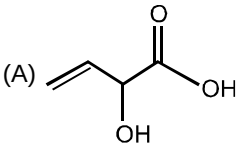
(D) 

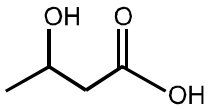
PART - IV : COMPREHENSION

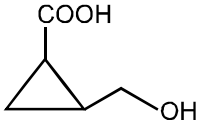
Comprehension # 1 (Questions 1 to 2)

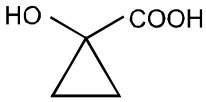
There are three isomeric compounds P, Q, R with molecular formula $C_4H_6O_3$. Compound P is a saturated hydroxy carboxylic acid. Compound Q is a symmetrical anhydride while R is an aldehydic ester.

1. Which of the following is P ?

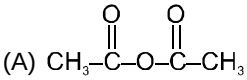
(A) 

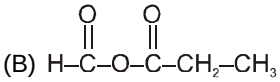
(B) 

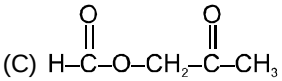
(C) 

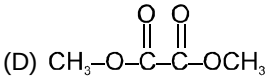
(D) 

2. Which of the following is the metamer of Q ?

(A) 

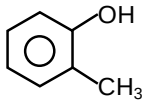
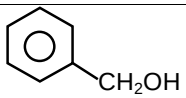
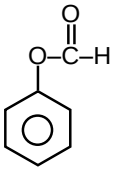
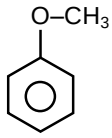
(B) 

(C) 

(D) 

Comprehension # 2 (Questions 3 to 5)

Q.3, Q.4 and Q.5 by appropriately matching the information given in the three columns of the following table.

Compounds	IUPAC Name	Common name
(I) 	(i) Methoxy benzene	(P) Benzylalcohol
(II) 	(ii) Phenyl methanoate	(Q) o-cresol
(III) 	(iii) Phenylmethanol	(R) Phenyl formate
(IV) 	(iv) 2-Methylphenol	(S) Anisole

3. Which is not the correct combination for the names of the given compounds ?
(A) (I) (iv) (Q) (B) (II) (iii) (P) (C) (III) (i) (R) (D) (IV) (i) (S)

4. The only correct combination in which benzoic acid is the functional isomer of the given compound?
(A) (I) (iv) (Q) (B) (III) (i) (R) (C) (II) (iii) (P) (D) (III) (ii) (R)

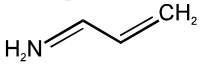
5. Which combination is the homologue of phenyl ethanol?
(A) (I) (iv) (Q) (B) (II) (iii) (P) (C) (III) (ii) (R) (D) (IV) (i) (S)

Exercise-3

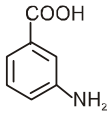
*** Marked Questions are more than one correct options.**

PART - I : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

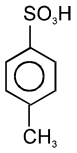
1. Which of the following represent the given mode of hybridisation $sp^2–sp^2–sp–sp$ from left to right. **[IIT-JEE 2003(S)]**

(A) $H_2C=CH–C\equiv N$ (B) $HC\equiv C–C\equiv CH$ (C) $H_2C=C=C=CH_2$ (D) 

2. Write IUPAC name of the following **[IIT-JEE 2004]**



3. Write IUPAC name of the following **[IIT-JEE 2005]**



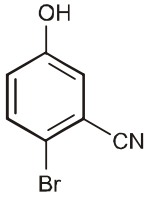
4. The IUPAC name of C_6H_5COCl is : **[IIT-JEE 2006]**

(A) Benzoyl chloride (B) Benzene chloro ketone
(C) Benzene carbonyl chloride (D) Chloro phenyl ketone

5. The number of structural isomers for C_6H_{14} is : **[IIT-JEE 2007]**

(A) 3 (B) 4 (C) 5 (D) 6

6. The IUPAC name of the following compound is : **[IIT-JEE 2009]**



(A) 4-Bromo-3-cyanophenol (B) 2-Bromo-5-hydroxybenzonitrile
(C) 2-Cyano-4-hydroxybromobenzene (D) 6-Bromo-3-hydroxybenzonitrile

7. The total number of cyclic isomers possible for a hydrocarbon with the molecular formula C_4H_6 is / are : **[IIT-JEE 2010]**

8. In allene (C_3H_4), the type(s) of hybridisation of the carbon atoms is (are) : **[IIT-JEE 2012]**

(A) sp and sp^3 (B) sp and sp^2 (C) only sp^3 (D) sp^2 and sp^3

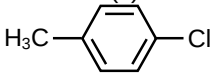
9. The carboxyl functional group (–COOH) is present in : **[IIT-JEE 2012, 3/162]**

(A) picric acid (B) barbituric acid (C) ascorbic acid (D) aspirin

10. The correct combination of names for isomeric alcohols with molecular formula $C_4H_{10}O$ is/are **[IIT-JEE 2014]**

(A) *tert*-butanol and 2-methylpropan-2-ol (B) *tert*-butanol and 1, 1-dimethylethan-1-ol
(C) *n*-butanol and butan-1-ol (D) isobutyl alcohol and 2-methylpropan-1-ol

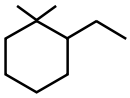
11. The IUPAC name(s) of the following compound is (are) **[JEE-Advanced 2017, 3/160]**



(A) 4-methylchlorobenzene (B) 4-chlorotoluene
(C) 1-chloro-4-methylbenzene (D) 1-methyl-4-chlorobenzene

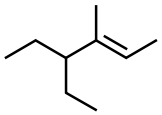
PART - II : JEE (MAIN) ONLINE PROBLEMS (PREVIOUS YEARS)

1. The IUPAC name of the following compound is : **[JEE(Main) 2017 (08-04-17), 4/120]**



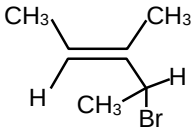
(1) 1, 1-Dimethyl-2-ethylcyclohexane
(2) 2-Ethyl-1,1-dimethylcyclohexane
(3) 2, 2-Dimethyl-1-ethylcyclohexane
(4) 1-Ethyl-2,2-dimethylcyclohexane

2. The IUPAC name of the following compound is : **[JEE(Main) 2018 (15-04-18), 4/120]**



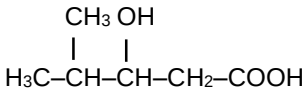
(1) 3-ethyl-4-methylhex-4-ene
(2) 4,4-diethyl-3-methylbut-2-ene
(3) 4-methyl-3-ethylhex-4-ene
(4) 4-ethyl-3-methylhex-2-ene

3. What is the IUPAC name of the following compound? **[JEE(Main) 2019 (10-01-19), 4/120]**



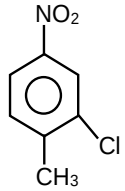
(1) 2-Bromo-3- methylpent-3-ene
(2) 3-Bromo-1, 2-dimethylbut-1-ene
(3) 4-Bromo-3- methylpent-2-ene
(4) 3-bromo-3-methyl-1, 2-dimethyprop-1-ene

4. The IUPAC name of the following compound is **[JEE(Main) 2019 (08-04-19)S1, 4/120]**



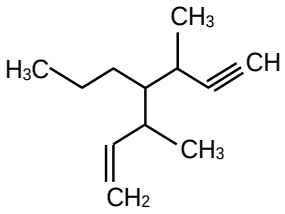
(1) 3-Hydroxy-4-methylpentanoic acid
(2) 2-Methyl-3-hydroxypentan-5-oic acid
(3) 4,4-Dimethyl-3-hydroxybutanoic acid
(4) 4-Methyl-3-hydroxypentanoic acid

5. The correct IUPAC name of the following compound is : **[JEE(Main) 2019 (09-04-19)S1, 4/120]**



(1) 3–chloro–4–methyl–1–nitrobenzene
(2) 5–chloro–4–methyl–1–nitrobenzene
(3) 2–methyl–5–nitro–1–chlorobenzene
(4) 2–chloro–1–methyl–4–nitrobenzene

6. The IUPAC name for the following compound is : **[JEE(Main) 2019 (12-04-19)S2, 4/120]**



(1) 3-methyl-4-(3-methylprop-1-enyl)-1-heptyne
(2) 3,5-dimethyl-4-propylhept-1-en-6-yne
(3) 3,5-dimethyl-4-propylhept-6-en-1-yne
(4) 3-methyl-4-(1-methylprop-2-ynyl)-1-heptene

Answers

EXERCISE - 1

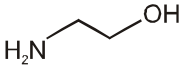
PART - I

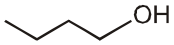
A-1. (a) 19 σ bonds, 6π bonds (b) 22 σ bonds (c) 20 σ bonds

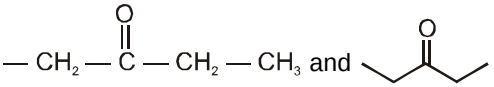
A-2. (a) 1° H → 9, 3° H → 1 (b) 1°H → 6, 2°H → 2 (c) 1°H → 6, 2°H → 4

A-3. $CH_2 = C = CH - CH_2 - C \equiv C - CH_2 - NH_2$

sp^2 sp sp^2 sp^3 sp sp sp^3

A-4. (1) $H_2N–CH_2–CH_2–OH$ and 

(2) $CH_3–CH_2–CH_2–CH_2–OH$ and 

(3)  and

(4) $CH_3–CH=CH–CH_2–CH_2–CH_2–CH_3$ and 

A-5. (a) = 1, (b) = 5

A-6. (a) 4, (b) 4, (c) 2

A-7. (a) H–COOH, $CH_3–COOH$, $CH_3–CH_2–COOH$, $CH_3–CH_2–CH_2–COOH$

(b) $CH_2=CH_2$, $CH_3–CH=CH_2$, $CH_3–CH_2–CH=CH_2$, $CH_3–CH_2–CH_2–CH = CH_2$

(c) $CH_3–CO–CH_3$, $CH_3–CO–C_2H_5$, $C_2H_5–CO–C_2H_5$, $C_3H_7–CO–C_2H_5$

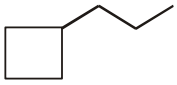
A-8. (a) Homocyclic, alicyclic, saturated (b) Homocyclic, aromatic, unsaturated
(c) Heterocyclic, alicyclic, saturated (d) unsaturated.

A-9. (a) 2° (b) 2° (c) 3° (d) 3°

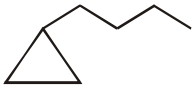
A-10. (a) 2° (b) 3° (c) 1°

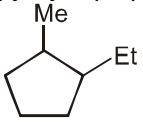
B-1. (a) 2-Methyl propane (b) 2, 2-Dimethyl propane (c) 2, 2-Dimethyl butane

B-2. (a) 5-Ethyl-3-methyloctane (b) 4-Ethyl-2,2,6-trimethylheptane

B-3. (i) 
Propyl cyclobutane

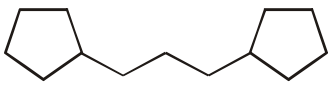
(ii) 
Propyl cyclopropane

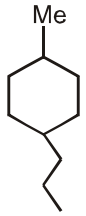
(iii) 
1-Cyclopropyl butane

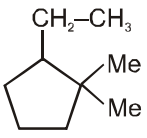
(iv) 

1-Ethyl-2-methyl cyclopentane

B-4. (i) 4-Ethyl-4,5-dimethyldecane (ii) 4-(1,1-Dimethylethyl)-5-(1-methylethyl) octane

B-5. (i) 

(ii) 

(iii) 

B-6. (a) s-Butylcyclohexane (b) t-Butylcyclohexane
(c) Isopropylcyclohexane (d) Neopentylcyclopentane

B-7. (a) ring (b) side chain (c) ring
(d) ring (e) side chain (f) side chain

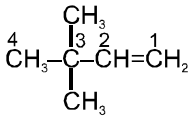
B-8. (a) Isopropyl group (b) Secondary–butyl group (c) Tertiary-butyl group
(d) Ethyl group (e) n-propyl group

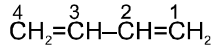
C-1. General formula → C_nH_{2n}

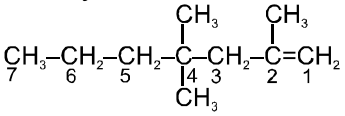
$H_2C = CH_2$ Ethene

$CH_3–CH=CH_2$ Propene

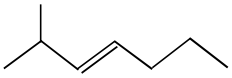
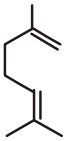
$CH_3–CH_2–CH=CH_2$ 1-Butene

C-2. (i) 
3,3-Dimethylbutene

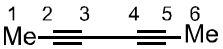
(ii) 
Buta-1,3-diene

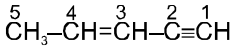
(iii) 
2,4,4-Trimethylheptene

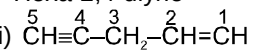
(iv) 
But-2-ene

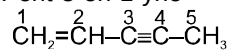
C-3. (a)  (b) 

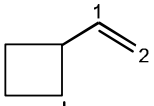
C-4. (i) 5-Methylhexyne (ii) 3-Methylbutyne (iii) 4-Methylpent-2-yne

C-5. (i) 
Hexa-2,4-diyne

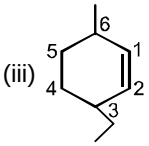
(ii) 
Pent-3-en-1-yne

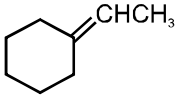
(iii) 
Pent-1-en-4-yne

(iv) 
Pent-1-en-3-yne

C-6. (i)  1-cyclobutylethene

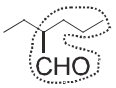
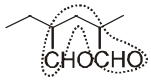
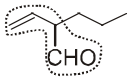
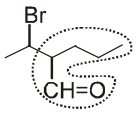
(ii) 1-(Hex-3-enyl)cyclohex-1-ene

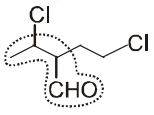
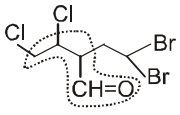
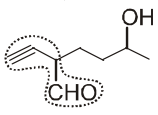
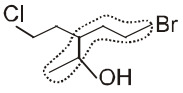
(iii)  3-Ethyl-6-methyl cyclohexene

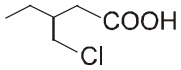
(iv)  Ethylidene cyclohexane

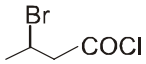
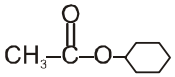
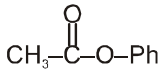
D-1. (a) 3-Chlorobutan-2-ol (b) 2-Ethylbut-3-en-1-ol
(c) 5-Aminomethyl-3-ethylheptan-2-ol (d) 3-Butylpentane-2,4-dione
(e) 5-Oxoheptane-3-sulphonic acid. (f) 3-(2-Bromoethyl)hexan-2-ol
(g) 2,5-Dichloro-3-ethoxy-4-methoxyhexane (h) 3-Bromo-4-methylpentane-2-sulphonic acid

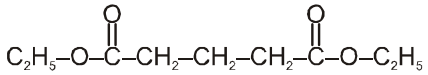
D-2. (a) $CH_3–CH_2–CH_2–CH_2–OH$ (b) $CH_3–CH(SH)–CH_2–CH_3$
(c) $CH_3–CH(NH_2)–CH_2–CH_2–CH_3$ (d) $CH_3–CO–CH_2–CH_2–CH_3$
(e) $HO–CH_2–CH_2–CH(Cl)–CH_2–CH_3$ (f) $CH_3–CO–CH_2–CO–CH_2–CH_3$

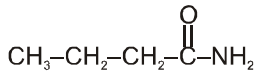
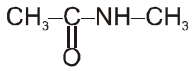
E-1. (a)  (b)  (c)  (d) 

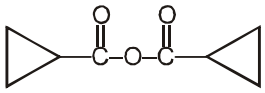
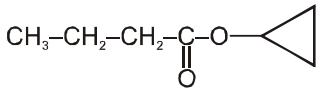
(e)  (f)  (g)  (h) 

E-2. (a) $CH_3–CH(SO_3H)–CH(OH)–CH_2–CH_3$ (b) 

(c)  (d)  (e) 

(f) $CH_3–CH_2–COOCH_2–CH_2–Cl$ (g) 

E-3. (a)  (b) 

(c)  (d) 

E-4. (a) Methyl-2-ethylbutanoate (b) Ethyl-3-methylpent-4-en-1-oate
(c) (c) 3,3 Dimethyl-2-(1-methylethyl)butanamide

E-5. (a) Ethanoic 2-methylpropanoic anhydride (b) Benzenecarboxylic anhydride
(c) Pent-2-enedioic anhydride (d) Cyclohexane-1, 2-dicarboxylic anhydride

E-6. (a) 2-Methylpropanamide (b) N-Methylpropanamide
(c) N, N-Dimethyl-2-methylpropanamide (d) N-Phenylbenzenecarboxamide

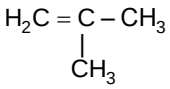
F-1. (a) Methylbenzene (b) Isopropylbenzene or Methylethyl benzene
(c) Diphenylmethane (d) 1-Chloro-1-phenylethane.

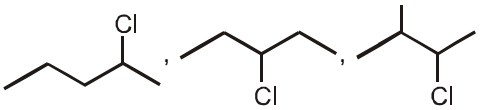
F-2. (a) Cyclohexylbenzene (b) 4-Bromo-3, 6-diphenyloctane
(c) 1, 2-Dichloro-4-ethyl-5-nitrobenzene (d) 4-Chloro-1-nitro-2-propylbenzene

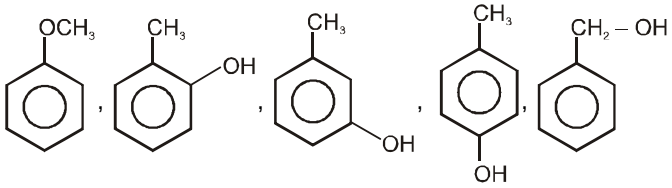
F-3. (a) 1,2-Dimethyl benzene (o–Xylene) (b) Phenylethene (Styrene)
(c) 4-Methyl phenol (p–cresol) (d) 2-Hydroxybenzenecarbaldehyde (Salicylaldehyde)

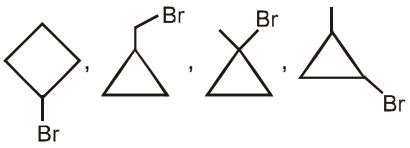
G-1. (a) Chain Isomers (b) Functional isomers (c) Homologs.

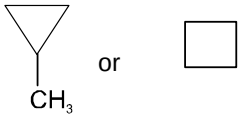
G-2. (a) Chain Isomers (b) Functional isomers (c) Metamers. (d) Position isomers

H-1. $H_2C=CH–CH_2–CH_3$, $H_3C–CH=CH–CH_3$, 

H-2. 

H-3. 

H-4. 

H-5. 

PART - II

A-1.	(C)	**A-2.**	(C)	**A-3.**	(D)	**A-4.**	(C)	**A-5.**	(D)
B-1.	(C)	**B-2.**	(A)	**B-3.**	(C)	**B-4.**	(B)	**B-5.**	(C)
C-1.	(D)	**C-2.**	(C)	**C-3.**	(C)	**C-4.**	(B)	**D-1.**	(B)
D-2.	(A)	**D-3.**	(B)	**D-4.**	(D)	**E-1.**	(A)	**E-2.**	(C)
E-3.	(C)	**E-4.**	(C)	**E-5.**	(D)	**E-6.**	(A)	**E-7.**	(D)
E-8.	(C)	**E-9.**	(A)	**F-1.**	(C)	**F-2.**	(B)	**F-3.**	(C)
F-4.	(C)	**F-5.**	(A)	**G-1.**	(C)	**G-2.**	(A)	**G-3.**	(A)
G-4.	(A)	**G-5.**	(C)	**G-6.**	(D)	**H-1.**	(B)	**H-2.**	(B)
H-3.	(B)	**H-4.**	(B)	**H-5.**	(B)	**H-6.**	(D)	**H-7.**	(C)
H-8.	(B)	**H-9.**	(B)	**H-10.**	(D)				

PART - III

1. (A $\rightarrow$ p,s); (B $\rightarrow$ q,s,t); (C $\rightarrow$ r,s,t); (D $\rightarrow$ q,s,t) **2.** (A $\rightarrow$ q); (B $\rightarrow$ q); (C $\rightarrow$ q); (D $\rightarrow$ p); (E $\rightarrow$ t)

EXERCISE - 2

PART - I

1.	(A)	**2.**	(B)	**3.**	(A)	**4.**	(D)	**5.**	(D)
6.	(B)	**7.**	(A)	**8.**	(B)	**9.**	(C)	**10.**	(C)
11.	(D)	**12.**	(B)	**13.**	(C)	**14.**	(A)	**15.**	(B)

PART - II

1.	5	**2.**	5	**3.**	1	**4.**	9	**5.**	4
6.	6	**7.**	6	**8.**	3	**9.**	4	**10.**	3
11.	4	**12.**	6	**13.**	9				

PART - III

1.	(A,C)	**2.**	(A,B,D)	**3.**	(A,B,C)	**4.**	(A,C,D)	**5.**	(A,B,D)
6.	(A,C,D)	**7.**	(C)	**8.**	(A,B,D)	**9.**	(A,B,C,D)	**10.**	(B,C,D)

PART - IV

1.	(D)	**2.**	(B)	**3.**	(C)	**4.**	(D)	**5.**	(B)

EXERCISE - 3

PART - I

1.	(A)	**2.**	3-Aminobenzoic acid			**3.**	4-Methylbenzenesulphonic acid		
4.	(C)	**5.**	(C)	**6.**	(B)	**7.**	5	**8.**	(B)
9.	(D)	**10.**	(ACD)	**11.**	(BC)				

PART - II

1.	(2)	**2.**	(4)	**3.**	(3)	**4.**	(1)	**5.**	(4)
6.	(2)								

Additional Problems for Self Practice (APSP)

Marked questions are recommended for Revision.

This Section is not meant for classroom discussion. It is being given to promote self-study and self-testing amongst the Resonance students.

PART - I : PRACTICE TEST-1 (IIT-JEE (MAIN Pattern))

Max. Marks: 100 **Max. Time : 1 Hour**

Important Instructions:

A. General :

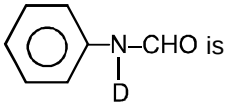
1. The test paper is of **1** hour duration.
2. The Test Paper consists of **25** questions and each questions carries **4** Marks. Test Paper consists of **Two** Sections.

B. Test Paper Format and its Marking Scheme:

1. Section-1 contains **20** multiple choice questions. Each question has four choices (1), (2), (3) and (4) out of which **ONE** is correct. For each question in Section-1, you will be awarded 4 marks if you give the corresponding to the correct answer and zero mark if no given answers. In all other cases, minus one **(–1)** mark will be awarded.
2. Section-2 contains **5** questions. The answer to each of the question is a **Numerical Value**. For each question in Section-2, you will be awarded 4 marks if you give the corresponding to the correct answer and zero mark if no given answers. No negative marks will be answered for incorrect answer in this section. In this section answer to each question is **NUMERICAL VALUE** with two digit integer and decimal upto two digit. If the numerical value has more than two decimal places **truncate/round-off** the value to **TWO** decimal placed.

SECTION-1

This section contains **20** multiple choice questions. Each questions has four choices (1), (2), (3) and (4) out of which Only **ONE** option is correct.

1. IUPAC name of  is

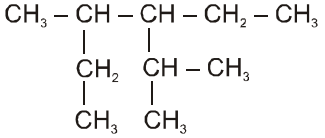
(1) N-Deutero-N-formylbenzenamine (2) N-Phenylamino-N-deuteromethanal

(3) N-Deutero-N-phenylmethanamide (4) N-Deuterobenzene carboxamide

2. In the organic compound $\overset{1}{C}H_2=\overset{2}{C}H-\overset{3}{C}H_2-\overset{4}{C}H_2-\overset{5}{C}\equiv\overset{6}{C}H$, the pair of hybridised orbitals involved in the formation of : C_2–C_3 bond is :

(1) sp–sp^2 (2) sp–sp^3 (3) sp^2–sp^3 (4) sp^3–sp^3

3. The correct IUPAC name of the following compound is



(1) 4-Ethyl-3,5-dimethylhexane (2) 2,4-Dimethyl-3-ethylhexane

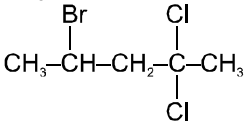
(3) 3-Ethyl-2,4-dimethylhexane (4) 3-Isopropyl-4-methylhexane

4. Which IUPAC name is incorrect among the following compounds ?

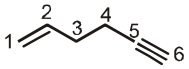
(1) CH_3–CH=CH–CH_2–Cl 1-Chlorobut-2-ene

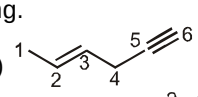
(2) $HC\equiv C$–CH_2–CH_2–Br 1-Bromobut-3-yne

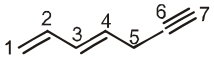
(3) CH_3–CH=CH–CH=CH_2 Penta-1,3-diene

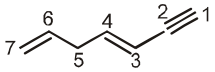
(4)  4-Bromo-2,2-dichloropentane

5. Which of the following represent incorrect numbering.

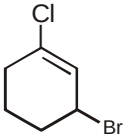
(1) 

(2) 

(3) 

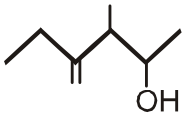
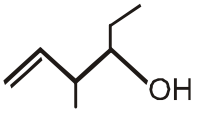
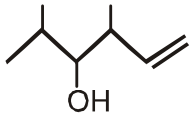
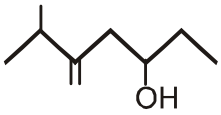
(4) 

6. The IUPAC name of the compound shown below is

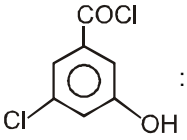


(1) 2-Bromo-6-chlorocyclohex-1-ene
(2) 6-Bromo-2-chlorocyclohexene
(3) 3-Bromo-1-chlorocyclohex-1-ene
(4) 1-Bromo-3-chlorocyclohexene

7. What is the structure of 4-Methylhex-5-en-3-ol.

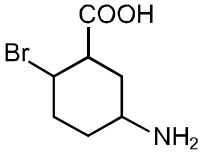
(1) 
(2) 
(3) 
(4) 

8. A compound having straight chain of five carbon atoms has one ketone group and two methyl groups on different-different carbon atoms. The IUPAC name of the compound is :
(1) 2,4-Dimethyl-3-oxopentane
(2) 2,4-Dimethylpentan-3-one
(3) 3,4-Dimethyl-2-oxopentane
(4) 3,3-Dimethylpentan-2-one

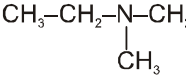
9. What is the IUPAC name of  :

(1) 5-Chloro-3-hydroxybenzenecarbonyl chloride.
(2) 3-Hydroxy-5-chlorobenzenecarbonyl chloride.
(3) 3-Chloro-5-hydroxybenzenecarbonyl chloride.
(4) 1-Chlorocarbonyl-3-chlorobenzen-1-ol

10. The correct IUPAC name of compound is :

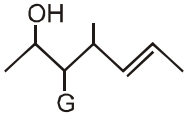


(1) 3-Amino-6-bromocyclohexane-1-carboxylic acid
(2) 2-Bromo-5-aminocyclohexane-1-carboxylic acid
(3) 5-Amino-2-bromocyclohexane-1-carboxylic acid
(4) 4-Bromo-5-carboxycyclohexanamine

11. The IUPAC name of  is :

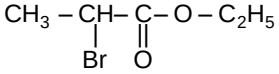
(1) N-Methyl-N-ethyl ethanamine
(2) Diethyl methanamine
(3) N-Ethyl-N-methyl ethanamine
(4) Methyl diethyl ethanamine

12. In the given formula G is an unknown group.



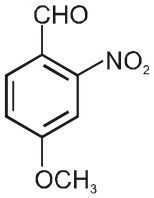
What will be the group G, which can change the word root (parent carbon chain length) of above structure?
(1) $-CH=CH_2$ (2) $-Cl$ (3) $-CH_2-CH_2-CH_3$ (4) $-COOH$

13. Correct IUPAC name of given ester is :



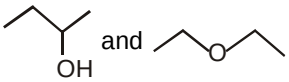
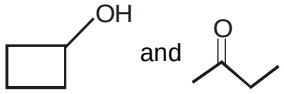
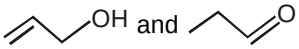
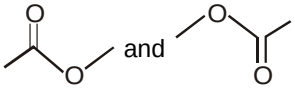
(1) Ethyl 2-bromopropanoate (2) 2-Bromoethylpropanoate
(3) Ethyl 1-bromoethanoate (4) 2-Bromo ethoxyethanecarboxylate

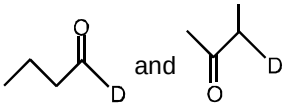
14. Relation between Ethyl benzenecarboxylate and phenyl propanoate is :
(1) Metamers (2) Functional isomers
(3) Chain isomers (4) Homologues

15. The correct IUPAC name of the compound  is :

(1) 4-Methoxy-2-nitrobenzaldehyde (2) 4-Formyl-3-nitro anisole
(3) 4-Methoxy-6-nitrobenzaldehyde (4) 2-Formyl-5-methoxy nitrobenzene

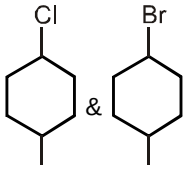
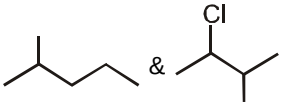
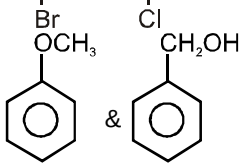
16. Which of the following pair of compounds is not functional isomers ?

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

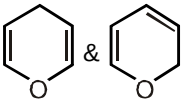
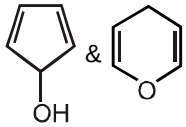
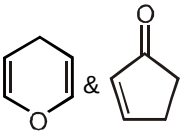
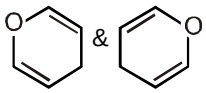
17.  are related as :

(1) Functional Isomers (2) Position Isomers (3) Chain Isomers (4) Metamers

18. Which of the following is correctly matched.

(1)  chain somer
(2)  Identical
(3)  Positional isomer
(4)  Metamer

19. Which of the following pairs of structures do not represent isomers ?

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

20. Hybridisation of carbon atoms present in the smallest ester are :
(1) All sp^3 (2) All sp^2 (3) sp^2 and sp^3 (4) sp^2 and sp

SECTION-2

This section contains **5** questions. Each question, when worked out will result in **Numerical Value**.

21. Total number of structural isomers possible from molecular formula C_8H_{18} that contain 7 carbons in the parent chain are :

22. Total number of position isomers of trimethyl cyclohexane are :

23. How many 1° amines are possible with molecular formula $C_4H_{11}N$ (only structural isomers)

24. The number of metamers of the compound with molecular formula $C_5H_{12}O$ is/are :

25. How many tertiary alcohols is/are possible with molecular formula $C_5H_{12}O$?

Practice Test-1 (IIT-JEE (Main Pattern))

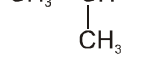
OBJECTIVE RESPONSE SHEET (ORS)

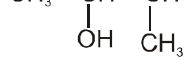
Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25					
Ans.										

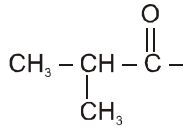
PART - II : JEE (MAIN) / AIEEE OFFLINE PROBLEMS (PREVIOUS YEARS)

1. Which of the following compounds has wrong IUPAC name: **[AIEEE- 2002, 3/225]**

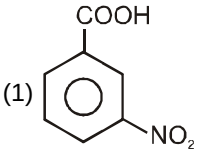
(1) $CH_3–CH_2–CH_2–COO–CH_2CH_3$ → Ethyl butanoate

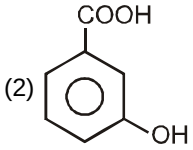
(2)  → 3-Methylbutanal

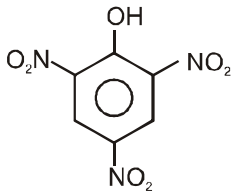
(3)  → 2-Methyl-3-butanol

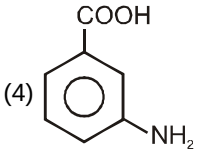
(4)  → 2-Methyl-3-pentanone

2. Pricric acid is : **[AIEEE- 2002, 3/225]**

(1) 

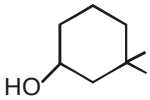
(2) 

(3) 

(4) 

3. The general formula $C_nH_{2n}O_2$ could be for open chain **[AIEEE- 2003, 3/225]**

(1) diketones (2) carboxylic acids (3) diols (4) dialdehydes.

4. The IUPAC name of the compound  is **[AIEEE- 2004, 3/225]**

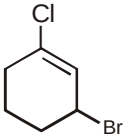
(1) 3, 3-dimethyl-1-hydroxycyclohexane (2) 1, 1-dimethyl-3-hydroxycyclohexane

(3) 3, 3-dimethyl-1-cyclohexanol (4) 1, 1-dimethyl-3-cyclohexanol

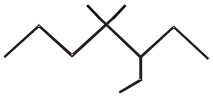
5. Which one of the following does not have sp^2 hybridized carbon? **[AIEEE- 2004, 3/225]**

(1) acetone (2) acetic acid (3) acetonitrile (4) acetamide

6. The IUPAC name of the compound shown below is **[AIEEE- 2006, 3/165]**



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

7. The IUPAC name of  is : **[AIEEE-2007, 3/120]**

(1) 5,5-Diethyl-4,4-dimethylpentane (2) 3-Ethyl-4,4-dimethylheptane
(3) 1,1-Diethyl-2,2-dimethylpentane (4) 4,4-Dimethyl-5, 5-diethylpentane

8. The correct decreasing order of priority for the functional groups of organic compounds in the IUPAC system of nomenclature is **[AIEEE-2008, 3/105]**

(1) $-SO_3H$, $-COOH$, $-CONH_2$, $-CHO$ (2) $-CHO$, $-COOH$, $-SO_3H$, $-CONH_2$
(3) $-CONH_2$, $-CHO$, $-SO_3H$, $-COOH$ (4) $-COOH$, $-SO_3H$, $-CONH_2$, $-CHO$

9. The IUPAC name of neopentane is : **[AIEEE-2009, 4/144]**

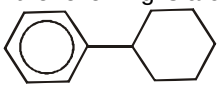
(1) 2, 2-dimethylpropane (2) 2-methylpropane
(3) 2, 2-dimethylbutane (4) 2-methylbutane

10. Aspirin is known as : **[AIEEE 2012, 4/120]**

(1) Acetyl salicylic acid (2) Phenyl salicylate (3) Acetyl salicylate (4) Methyl salicylic acid

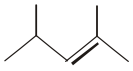
PART-III : NATIONAL STANDARD EXAMINATION IN CHEMISTRY (NSEC) STAGE-I

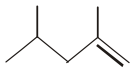
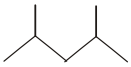
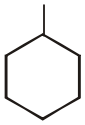
1. Which of the following is a correct name for the following compound ? **[NSEC-2000]**



(A) cyclohexylbenzene (B) biphenyl (C) hexylbenzene (D) phenylbenzene

2. Which is the constitutional isomer of the compound : **[NSEC-2000]**



(A)  (B)  (C)  (D) both (A) and (C)

3. A compound with no tertiary hydrogen is : **[NSEC-2001]**

(A) $(CH_3)_3CCH(CH_3)_2$ (B) $(CH_3)_3CCH_2CH_3$
(C) $(CH_3)_2CHCH_2CH_2CH_3$ (D) None of these

4. How many structural isomers can be obtained by the replacement of one hydrogen atom of propene with chlorine ? **[NSEC-2001]**

(A) 4 (B) 3 (C) 2 (D) 5

5. The shape of 2-butene is : **[NSEC-2001]**

(A) planar (B) tetrahedral (C) linear (D) pyramidal

6. The IUPAC name of $CH_2=CHCN$ is : **[NSEC-2001]**

(A) Cyanoethene (B) Vinyl cyanide. (C) Ethenenitrile (D) 2-Propenitrile

7. The number of isomers of C_6H_{14} is : **[NSEC-2001]**

(A) 6 (B) 5 (C) 4 (D) 7

8. The compound which represents an unsaturated hydrocarbon is : **[NSEC-2002]**

(A) $CH_3-C\equiv N$ (B) $CH_3-CH=CH_2$ (C) $CH_3-CH=O$ (D) all of these

9. The number of possible primary alcohols with the molecular formula $C_4H_{10}O$ is : **[NSEC-2002]**

(A) 1 (B) 2 (C) 3 (D) 4

10. The number of possible mononitro isomers on nitration of 2,3-dichloronaphthalene is **[NSEC-2003]**
(A) 3 (B) 6 (C) 4 (D) 5.

11. In the conversion, $CH_3CH_2C{\equiv}N \rightarrow CH_3CH_2{-}CH_2{-}NHCOCH_3$, the nitrogen atom changes its state of hybridisation from **[NSEC-2003]**
(A) sp^2 to sp^3 (B) sp to sp^3 (C) sp to sp^2 (D) sp^2 to sp.

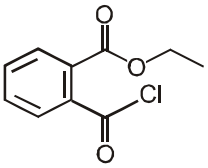
12. The IUPAC name of $HOCH_2CH{=}C(CH_3)_2$ **[NSEC-2003]**
(A) 2-Methyl-2-buten 4-ol (B) 3-Methyl-2-buten-1-ol
(C) 2-Methyl-2-butenol (D) 3-Methyl-2-butenol.

13. The number of possible isomers for di-nitronaphthalene is **[NSEC-2004]**
(A) 12 (B) 10 (C) 8 (D) 14.

14. The compound 2-Chloro-3-methyl-1-butanol has the following formula **[NSEC-2006]**
(A) $CH_3CH(CH_3)CHClCH_2OH$ (B) $CH_3CHOHCH(CH_3)CH_2Cl$
(C) $CH_2ClC(CH_3)_2CH_2OH$ (D) $CH_3CHClCH(CH_3)CH_2OH$.

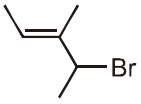
15. How many different alcohols (not including optical isomers) are possible with the molecular formula : $C_4H_{10}O$? **[NSEC-2006]**
(A) 3 (B) 4 (C) 5 (D) 6

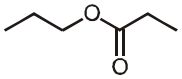
16. The C–C–H bond angle in ethylene is : **[NSEC-2007]**
(A) 180º (B) 109º28º (C) 120º (D) 90º

17. The IUPAC name of  is : **[NSEC-2007]**
(A) 2-Chlorocarbonylethyl benzoate (B) 2-Carboxyethylbenzoylchloride
(C) Ethyl-2-(chlorocarbonyl) benzoate (D) Ethyl-1-(chlorocarbonyl) benzoate

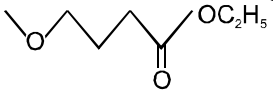
18. How many sigma bonds and pi bonds are present in $CH_2{=}C{=}CH_2$? **[NSEC-2007]**
(A) 6 sigma and 1pi (B) 8 sigma and 0 pi (C) 4 sigma and 4 pi (D) 6 sigma and 2 pi

19. The number of ether metamers represented by the molecular formula $C_4H_{10}O$ is : **[NSEC-2009]**
(A) 1 (B) 2 (C) 3 (D) 4

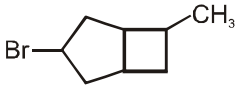
20. The IUPAC name of  is : **[NSEC-2009]**
(A) 2-Bromo-3-methylbut-3-ene (B) 4-Bromo-3-methylpent-2-ene
(C) 2-Bromo-3-methylpent-3-ene (D) 4-Bromo-2,3-dimethylbut-2-ene

21. The IUPAC name of the following compound is : **[NSEC-2010]**

(A) n-Propyl ethanoate (B) Ethyl propanoate
(C) Pentanoic anhydride (D) n-Propyl propanoate

22. The number of isomers of dibromobiphenyl (Biphenyl $C_6H_5{-}C_6H_5$) is **[NSEC-2011]**
(A) 8 (B) 10 (C) 12 (D) 14

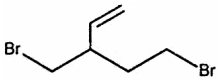
23. The IUPAC name of the following compound is : **[NSEC-2011]**

(A) 3-Methoxy ethylpropanoate (B) Ethyl 4-methoxybutanoate
(C) 1,4-Diethoxybutane (D) Ethoxy 3-methoxybutyrate

24. The correct IUPAC name of the following compound is : **[NSEC-2012]**



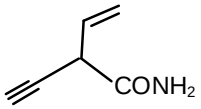
(A) 2-Bromo-5-methylbicyclo[5:4:0]heptanes (B) 3-Bromo-7-methylbicyclo[3.2.0]heptanes
(C) 3-Bromo-6-methylbicyclo[3.2.0]heptanes (D) 2-Methyl-6-bromobicyclo[2.3.0]heptane

25. The IUPAC name of the following compounds is **[NSEC-2014]**



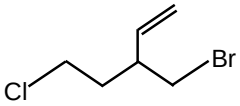
(A) 5-Bromo-3-(bromomethyl)pent-1-ene (B) 3-(1-Bromomethyl)-4-bromobut-1-ene
(C) 1,4-Dibromo-3-ethenylbutane (D) 1-Bromo-3-(bromomethyl) but-4-ene

26. The IUPAC name of the following compound is **[NSEC-2016]**



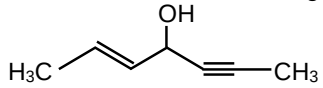
(A) 3-Aminocarbonylpent-1-en-4-yne (B) 2-Ethenylbut-3-yn-1-amide
(C) 2-Ethynylbut-3-en-1-amide (D) 3-Aminocarbonylpent-4-en-1-yne

27. The IUPAC name of the following compound is **[NSEC-2018]**



(A) 1-Bromo-4-chloro-3-ethenylbutane (B) 4-Bromo-1-chloro-3-ethenylbutane
(C) 3-(Bromomethyl)-5-chloropent-1-ene (D) 3-(Bromomethyl)-1-chloropent-4-ene

28. IUPAC name of the following molecule is **[NSEC-2019]**



(A) 4-hydroxyhept-2-en-5-yne (B) hept-2-en-5-yn-4-ol
(C) hept-5-en-2-yn-4-ol (D) 4-hydroxyhept-5-en-2-yne

29. All four types of carbon (1°, 2°, 3° and 4°) are present in **[NSEC-2019]**

I II III IV

(A) I, II and III (B) II, III and IV (C) I, II and IV (D) II and IV

PART - IV : PRACTICE TEST-2 (IIT-JEE (ADVANCED Pattern))

Max. Time : 1 Hr. **Max. Marks : 69**

Important Instructions

A. General :

1. The test is of 1 hour duration.
2. The Test Booklet consists of 23 questions. The maximum marks are 69.

B. Question Paper Format

3. Each part consists of five sections.
4. Section-1 contains 8 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE is correct.
5. Section-2 contains 6 multiple choice questions. Each question has four choices (A), (B), (C) and (D) out of which ONE OR MORE THAN ONE are correct.
6. Section-3 contains 6 questions. The answer to each of the questions is a numerical value, ranging from 0 to 9 (both inclusive).

7. Section-4 contains 1 paragraphs each describing theory, experiment and data etc. 2 questions relate to paragraph. Each question pertaining to a particular passage should have only one correct answer among the four given choices (A), (B), (C) and (D).
8. Section-5 contains 1 multiple choice questions. Question has two lists (list-1 : P, Q, R and S; List-2 : 1, 2, 3 and 4). The options for the correct match are provided as (A), (B), (C) and (D) out of which ONLY ONE is correct.

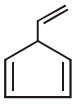
C. Marking Scheme :

9. For each question in Section 1, 4 and 5 you will be awarded 3 marks if you darken the bubble corresponding to the correct answer and zero mark if no bubble is darkened. In all other cases, minus one (–1) mark will be awarded.
10. For each question in Section 2, you will be awarded 3 marks. If you darken all the bubble(s) corresponding to the correct answer(s) and zero mark. If no bubbles are darkened. No negative marks will be answered for incorrect answer in this section.
11. For each question in Section 3, you will be awarded 3 marks if you darken only the bubble corresponding to the correct answer and zero mark if no bubble is darkened. No negative marks will be awarded for incorrect answer in this section.

SECTION-1 : (Only One option correct Type)

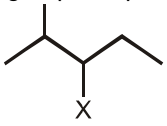
This section contains 8 multiple choice questions. Each questions has four choices (A), (B), (C) and (D) out of which Only ONE option is correct.

1. How many position isomers are possible for chlorophenol ?
(A) 2 (B) 3 (C) 4 (D) 5

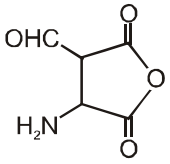
2. IUPAC name of  is :
(A) 5-ethenylcyclopenta-1,3-diene (B) 3-ethenylcyclopenta-1,4-diene
(C) 1-ethenylcyclopenta-2,4-diene (D) 2-ethenylcyclopenta-1,3-diene

3. How many carboxylic acid structure isomers are possible with $C_5H_{10}O_2$?
(A) 3 (B) 4 (C) 5 (D) 8

4. Which of the following is correct IUPAC name
(A) 2-Bromo cyclohex-5-ene carbaldehyde (B) Ethyl-2-vinyl pentanoate
(C) 5-Bromo-3-chlorohept-3-ene (D) 2-Ethenylhexa-1,5-diene

5. When X group is replaced by –C≡N, then the IUPAC name of the compound is :


(A) 2-Methylpentane-3-nitrile (B) 3-Cyano-2-methylpentane
(C) 2-Ethyl-3-methylbutanenitrile (D) 2-Methylpentane-3-carbonitrile

6. Correct IUPAC name of following compound is


(A) 2-Amino-3-formyl butane-1,4-dioic anhydride (B) 3-Amino-2-formyl butane-1,4-dioic anhydride
(C) 3-Amino-2-oxobutane-1,4-dioic anhydride (D) 2-Formyl-3-amino butane-1,4-dioic anhydride

7. $Me-O-\overset{\overset{O}{\|}}{C}-Me$ and Et–O–CH=O are :
(A) Functional isomers (B) Metamers
(C) Positional isomers (D) Chain isomers

8. How many structurally isomeric carbonyl compounds are possible with molecular formula $C_5H_{10}O$.
(A) 5 (B) 6 (C) 7 (D) 8

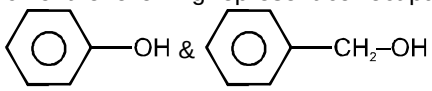
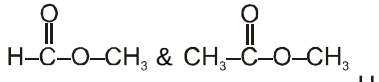
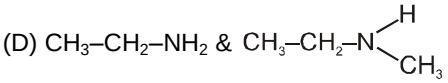
Section-2 : (One or More than one options correct Type)

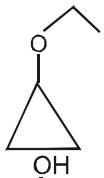
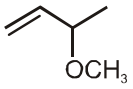
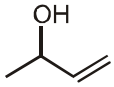
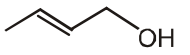
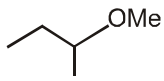
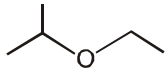
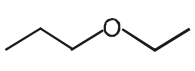
This section contains 6 multiple choice questions. Each questions has four choices (A), (B), (C) and (D) out of which ONE or MORE THAN ONE are correct.

9. Which of the following statements are incorrect for aniline.
(A) Compound is heterocyclic hydrocarbon.
(B) Number of σ bonds are 8.
(C) Degree of unsaturation of the compound is 3
(D) It contains functional group amine

10. Select correct IUPAC name.
(A) Methane-1,1,1,1-tetracarboxylic acid
(B) 5-Carbonyl-heptane-1,7-dioic acid
(C) 2-Chloro ethanoyl chloride
(D) 1-Bromo-3-fluoro-4-methyl cyclohexane

11. Which of the following IUPAC name(s) is/are incorrect :
(A) 4-Chloro-3-methyl cyclopentanol
(B) 1-Amino-3-bromohexan-1-one
(C) 4-chloro-3-methylcyclohexane carboxylic acid
(D) 3-Bromo-1-methylhexan-1-ol

12. Which of the following represent correct pair of homologous ?
(A)  &
(B) Me–OH & $MeCH_2CH_2OH$
(C) 
(D) 

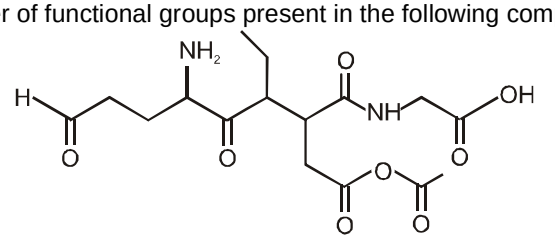
13. Which of the following is/are correct statement(s) :
(A)  &  are functional isomers of each other
(B)  &  are position isomers of each other
(C)  &  are chain isomers of each other
(D)  &  are metamers of each other.

14. Which of the following is/are correct statement(s) :
(A) The number of structural isomers for molecular formula C_3H_8 are 2
(B) The number of structural isomers for molecular formula C_5H_{12} are 3
(C) The number of structural isomers for molecular formula C_6H_{14} are 5
(D) The number of benzene ring containing structural isomers for molecular formula C_6H_4BrCl are 4

Section-3 : (Numerical Value Questions)

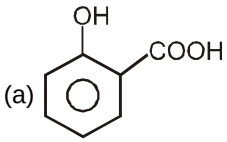
This section contains 6 questions. Each question, when worked out will result in numerical value from 0 to 9 (both inclusive).

15. Number of functional groups present in the following compound is :

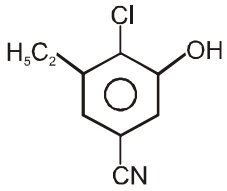


16. How many total stable acyclic structure isomers are possible with molecular formula C_4H_8O ?

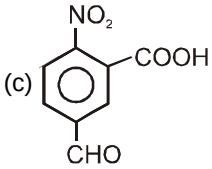
17. The no. of compound with correct IUPAC name is/are :

(a) 

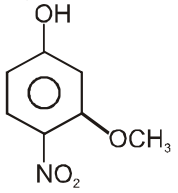
2-Carboxyphenol

(b) 

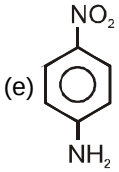
3-Ethyl-4-chloro-5-hydroxybenzenecarbonitrile

(c) 

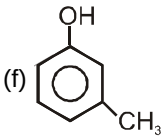
3-Formyl-5-nitrobenzenecarboxylic acid

(d) 

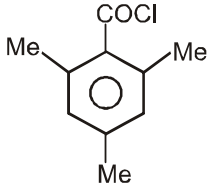
1-Hydroxy-3-methoxy-4-nitrobenzene

(e) 

4-Amino-1-nitrobenzene

(f) 

3-Methylphenol

(g) 

2,4,6-Trimethylbenzenecarbonlychloride

18. How many alkynes isomers are formed with molecular formula C_4H_6 ?

19. The number of structure isomeric compound(s) possible with molecular formula C_8H_{18} containing 5 carbon atoms in main chain having only methyl group(s) as side chain is:

20. The number of possible alkynes (strucutral only) having molecular formula $C_3FClBrI$ is :

SECTION-4 : Comprehension Type (Only One options correct)

This section contains 1 paragraphs, each describing theory, experiments, data etc. 2 questions relate to the paragraph. Each question has only one correct answer among the four given options (A), (B), (C) and (D).

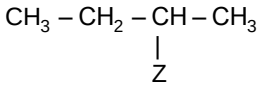
Paragraph for Questions 21 to 22

Compounds having same molecular formula but different connectivity of atoms or groups are called structure isomers. Structrue isomers are further classify according to their dissimilarities.

21. Which is not the isomer of butanoic acid?

(A) 3-Hydroxybutanal (B) Ethyl ethanoate
(C) 2-Methylpropanoic acid (D) Butane-2,3-diol

22. In the following skelton Z can be, if the molecular formula is $C_5H_{10}O_2$:

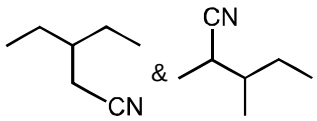
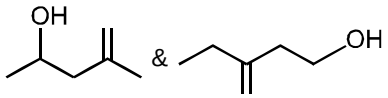
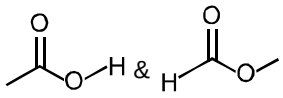


(i) A carboxylic acid group (ii) An ester group
(iii) Hydroxyaldehyde group (iv) Diol
(A) i & ii (B) iii & iv (C) i & iv (D) ii & iii

SECTION-5 : Matching List Type (Only One options correct)

This section contains 1 questions, each having two matching lists. Choices for the correct combination of elements from List-I and List-II are given as options (A), (B), (C) and (D) out of which one is correct.

23. Match the following :

	List-I		**List-II**
(P)	$Ph–CH_2–O–CH=O$ & $Ph–O–CH_2–CH=O$	(1)	Chain isomers
(Q)		(2)	Position isomers
(R)		(3)	Functional isomers
(S)		(4)	Metamers

Code :

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

Practice Test-2 ((IIT-JEE (ADVANCED Pattern))

OBJECTIVE RESPONSE SHEET (ORS)

Que.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Ans.										
Que.	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Ans.										
Que.	**21**	**22**	**23**							
Ans.										

APSP Answers

PART - I

1.	(3)	**2.**	(3)	**3.**	(3)	**4.**	(2)	**5.**	(2)
6.	(3)	**7.**	(2)	**8.**	(2)	**9.**	(3)	**10.**	(3)
11.	(3)	**12.**	(4)	**13.**	(1)	**14.**	(1)	**15.**	(1)
16.	(4)	**17.**	(1)	**18.**	(2)	**19.**	(4)	**20.**	(3)
21.	3	**22.**	6	**23.**	4	**24.**	6	**25.**	1

PART – II

1.	(3)	**2.**	(3)	**3.**	(2)	**4.**	(3)	**5.**	(3)
6.	(3)	**7.**	(2)	**8.**	(4)	**9.**	(1)	**10.**	(1)

PART - III

1.	(A)	**2.**	(D)	**3.**	(B)	**4.**	(B)	**5.**	(A)
6.	(D)	**7.**	(B)	**8.**	(B)	**9.**	(B)	**10.**	(A)
11.	(C)	**12.**	(B)	**13.**	(B)	**14.**	(A)	**15.**	(B)
16.	(C)	**17.**	(C)	**18.**	(D)	**19.**	(C)	**20.**	(B)
21.	(D)	**22.**	(C)	**23.**	(B)	**24.**	(C)	**25.**	(A)
26.	(C)	**27.**	(C)	**28.**	(B)	**29.**	(D)		

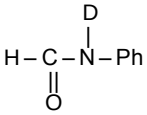
PART - IV

1.	(B)	**2.**	(A)	**3.**	(B)	**4.**	(C)	**5.**	(C)
6.	(A)	**7.**	(B)	**8.**	(C)	**9.**	(ABC)	**10.**	(AC)
11.	(ABD)	**12.**	(BC)	**13.**	(ABD)	**14.**	(BC)	**15.**	6
16.	11	**17.**	2	**18.**	2	**19.**	4	**20.**	4
21.	(D)	**22.**	(A)	**23.**	(D)				

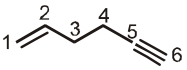
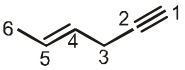
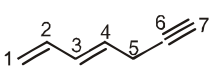
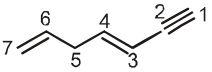
APSP Solutions

PART - I

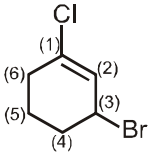
1.



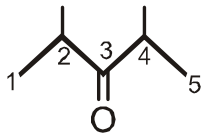
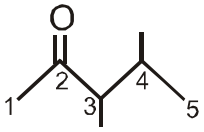
N-Deutero-N-phenylmethanamide.

5. (1)  (2)  (3)  (4) 

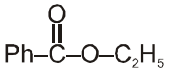
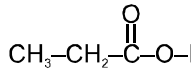
6.

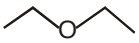


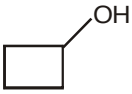
3-Bromo-1-chlorocyclohex-1-ene

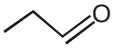
8.  OR 

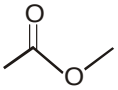
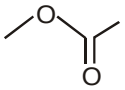
2,4-Dimethylpentan-3-one 3,4-Dimethylpentan-2-one

14.  and  are metamers

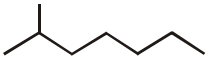
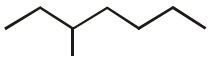
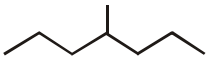
16. (1)  and  are functional isomer.

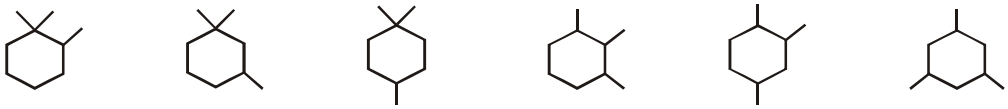
(2)  and  are functional isomers.

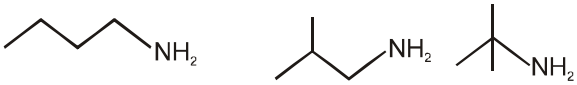
(3)  and  are functional isomers.

(4)  and  are identical.

19. In (4), both are identical.

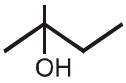
21. (1)  (2)  (3) 

22. 

23. 

24. $CH_3–O–CH_2–CH_2–CH_2–CH_3$; $CH_3–O–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_2–CH_3$; $CH_3–O–CH_2–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_3$;

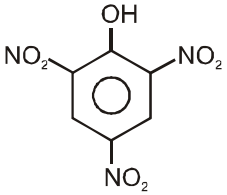
$CH_3–O–\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}–CH_3$; $CH_3–CH_2–O–CH_2–CH_2–CH_3$; $CH_3–CH_2–O–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_3$

25.  (Only one tertiary alcohol with $C_5H_{12}O$)

PART - II

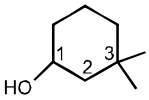
1. $\overset{1}{CH_3}–\overset{2}{\underset{\displaystyle OH}{\underset{|}{CH}}}–\overset{3}{\underset{\displaystyle CH_3}{\underset{|}{CH}}}–\overset{4}{CH_3}$ 3-Methyl-2-butanol

2. Pricric acid is 2,4,6-trinitro phenol



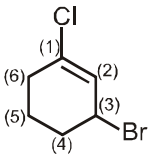
strongly acidic

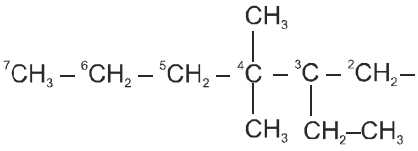
3. Diketones : $C_nH_{2n-2}O_2$, Carboxylic acid : $C_nH_{2n}O_2$, Diols : $C_nH_{2n+2}O_2$, Dialdehydes : $C_nH_{2n-2}O_2$

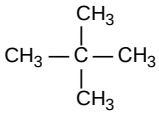
4.  3.3 dimethy1-1-cyclohexanol

5. $\overset{sp^3}{CH_3}-\overset{sp^2}{CO}-CH_3$; $\overset{sp^3}{CH_3}-\overset{sp^2}{COOH}$; $\overset{sp^3}{CH_3}-\overset{sp}{C}\equiv N$; $\overset{sp^3}{CH_3}-\overset{sp^2}{CONH_2}$

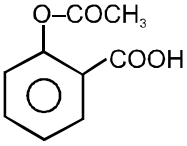
Acetone ; Acetic Acid ; Acetonitrile ; Acetamide

6.  3- Bromo-1-chlorocyclohex-1-ene

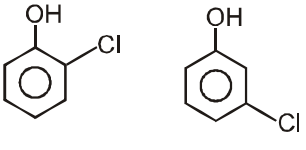
7.  (3-Ethyl-4,4-dimethylheptane)

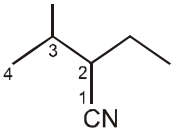
9. 

2, 2-dimethylpropane

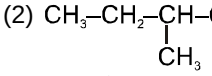
10.  Aspirin (Acetyl salicylic acid)

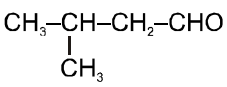
PART – IV

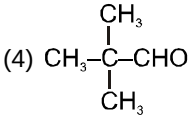
1.  Total = 3

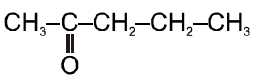
5. 

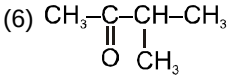
8. (1) $CH_3-CH_2-CH_2-CH_2-CHO$

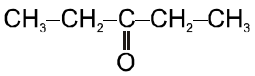
(2) 

(3) 

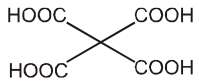
(4) 

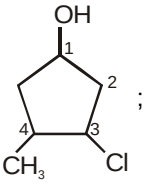
(5) 

(6) 

(7) 

9. The number of σ bonds are 14 and DU = 4.

10. A is :  ; C is : 

11. A is :  ;

(B) should have amide as the functional group.

(D) has incorrect main chain.

12. A, D have different functional groups. So, cannot be homologous.

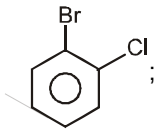
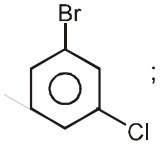
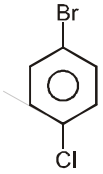
13. (C) These are metamers.

14. (A) $CH_3–CH_2–CH_3$

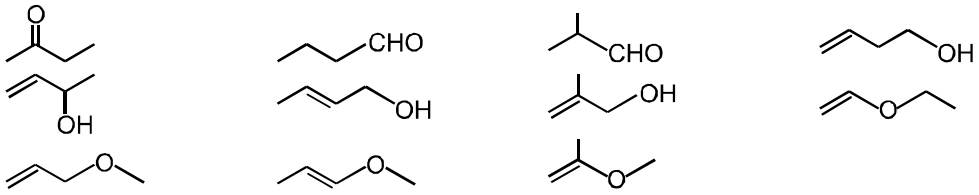
(B) $CH_3–CH_2–CH_2–CH_2–CH_3$; $CH_3–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_2–CH_3$; $CH_3–\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}–CH_3$

(C) $CH_3–CH_2–CH_2–CH_2–CH_2–CH_3$; $CH_3–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_3–CH_2–CH_3$;

$CH_3–CH_2–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_2–CH_3$; $CH_3–\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}–CH_2–CH_3$; $CH_3–\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{CH}}}}–CH–CH_3$

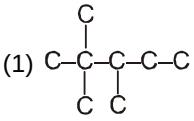
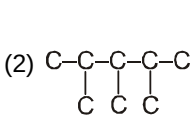
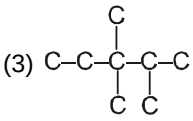
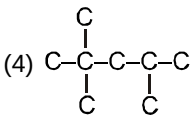
(D)  ;  ; 

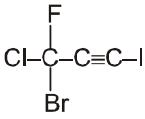
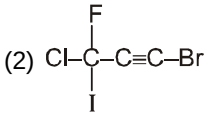
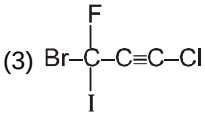
15. –CHO, $–\underset{\displaystyle O}{\overset{\displaystyle \|}{C}}–$, $–NH_2$, $–\underset{\displaystyle O}{\overset{\displaystyle \|}{C}}–\overset{\displaystyle H}{\overset{|}{N}}$, –COOH , $–\underset{\displaystyle O}{\overset{\displaystyle \|}{C}}–O–\underset{\displaystyle O}{\overset{\displaystyle \|}{C}}–$ functional groups are present.

16. 

17. f and g are correct.

19. DU = 0

∴ (1)  (2)  (3)  (4) 

20. (1)  (2)  (3)  (4)