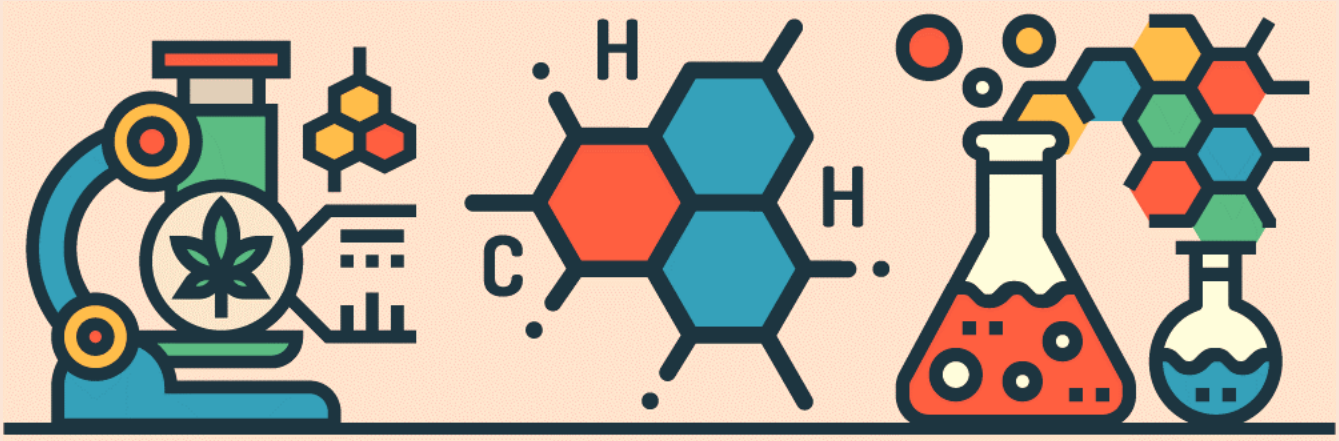
12. ORGANIC CHEMISTRY SOME BASICPRINCIPLES AND TECHNIQUES



Chemistry Smart Booklet

Theory + NCERT MCQs + Topic Wise Practice MCQs + NEET PYQs

Organic Chemistry : Some Basic Principles and Techniques

Classification

Organic Compound

- Acyclic or open chain
- Cyclic or Closed chain
  - Alicyclic Compounds
  - Aromatic Compounds
  - Homocyclic Compounds
    - Benzenoid compounds
    - Non-benzenoid compounds
  - Heterocyclic Compounds

Ring Chain Isomerism

but - 1 - ene and cyclobutane

Purification Methods

- Distillation
- Differential Extraction
- Crystallisation
- Chrmatiography
- Sublimation

Qualitative Analysis

Halogens
Sodium Extract is acidified with conc. HNO_3 and treated with Silver Netrate.

Sulphur
Sodium Extract is acidified with acetic acid and lead acetate is added

Nitrogen
Sodium extract is boiled with iron (II) Sulphate, then acidified with conc. H_2SO_4

Phosphorous
Compound is treated with onidising agent, then boild with HNO_3 and ammonium rnolybdate.

Carbon & Hydrogen
by heating with copper (II) oxide

Quantitative Analysis

Carbon and Hyolrogen

$\%C = \frac{12 \times m_2 \times 100}{44 \times m}$ $\%H = \frac{2 \times m_1 \times 100}{18 \times m}$

m-mass of org. Compound
M_1-mass of CO_2 produced
M_1-mass of H_2 produced

Nitrogen

Carius method $\%N = \frac{28 \times V \times 100}{22400 \times m}$ Kjelalahes method $\%N = \frac{1.4 \times N \times V}{m}$

m-mass of org. Compound
N-Normality of acid
V-volume of acid

Hologen

Carius method

$\%halogen = \frac{at.mass\ of \times M_1 \times 100}{molar\ mass\ of\ Ag \times m}$

m-mass of org. Compound
M_1-mass of AgX formed

Sulphur

Carius method $\%S = \frac{32 \times m_1 \times 100}{233 \times m}$

m-mass of org. Compound
M_1-mass of $BaSO_4$ formed

Phosphorus

$\%P = \frac{62 \times m_1 \times 100}{222 \times m}$

m-mass of org. Compound
M_1-mass of $Mg_2P_2O_7$ formed

Structural Isomerism

Compounds that true same chemical formula but different chemical bond arrangement are called structural isomers.

Position Isomerism

Propane - 1 - ol — Propan - 2 - ol

Tautomerism

$CH_3 - C(=O) - H \rightleftharpoons CH_2 = C(OH) - H$

Keto form — enol form

Metamerism

methoxy propane — ethyoxyethane

Functional Isomersim

propanone — propanal

Chain Isomerism

Pentane — 2 - methylbutane — 2,2 - Dimethyl propane

Parts of IUPAC Name

- Prefix
- Root word
- Primary Suffix
- Secondary Suffix

Rules for IUPAC Naming

Rule 1 : Select the longest possible carbon chain.

Rule 2 : Numbering of parent chain is done from that side where functional group, multiple bond and substituent get the lowest number

Rule 3 : Lowest sun rule — If first substituent gets same number from all side then chain selected should have lowest sum of all substituend numbering.

Rule 4 : Alphabet rule — Naming should be done in alphabitical order if the numbering of all substituent is same.

Rule 5 : If the molecule have more than one functional group, the functional group with highest prriority reievers the lowest number.

Organic Reaction

Types

- Addition reaction
- Substitution reaction
- Elimination reaction

Bond Fission

- Homolytic free radicals are fomed
- Heterolytic Casbocation and carbanion is formed

Electromeric displacement Effect

Hyperconfugation Effect

delocalisation of σ electrons of C-H bond of an allcye group directly attached to an atom with unshared p-oroital.

Inductive Effect

Partial displacement of Sigma electrons towards more electronegative atom/Group. It is a permanent effect

+I effect: CH_3, C_2H_5, etc — -I effect: $-CN$, $-COOH$, etc

Electromeric Effect

In the presence of neagent, the doubuor triple bond get broken. It is a temperory effect.

Resonance Effect

When a molecule can be represented by two or more structures which have same arrangement of atoms but differ in distribution of electrons is called resonance.

+R Effect: halogen, -OH, OR — -R effect: -COOH, -CHO, -CN

Electrophile

Electron deficient Species. Leur's acid

Example- Cl^+, Br^+, NO_2, CH_3, $AlCl_3$, etc.

Nucleophile

Electron rich Species leur's acid

Example- H_2O, NH_3, OH, Cl, F, CH_3.

Attacking Reagent

Organic molecule → Intermedite → Product(s)

Corbocation

- Carbon atom having a positive charge with only Six electron is its valence shell.
- Carbocation carbon is sp^2 hybridised.

$-\overset{\oplus}{C}H_2 > -\overset{\oplus}{C}H - CH_3 > -CH_2 - \overset{\oplus}{C}H_2 > \overset{\oplus}{C}H_3$

Carbonion

- Carbon atom having a negative charge on it.
- Carbonion carbon is sp^3 hybridised.

$\overset{\ominus}{C}H_3 > -CH_2 - \overset{\ominus}{C}H_2 > -\overset{\ominus}{C}H - CH_3$

Free Radical

- Carbon atom having 7 electron in the valance shell is called carbon free radical.
- Carbon of free radical is sp^2 hybridised.

$-\dot{C}H_2 > -\dot{C}H - CH_3 > -\dot{C}H_2 > \dot{C}H_3$

ISOMERISM

Stereo Isomerism

Compounds that havesame chemical formula and sequence of covalent bonds but differ in spatial arrangement are called stereo isMers

- Geometrical Isomerism
- Optical Isomerism

ORGANIC CHEMISTRY SOME BASICPRINCIPLES AND TECHNIQUES

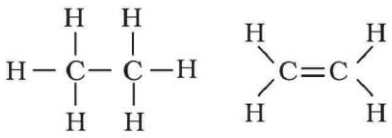
Introduction

In this chapter, we shall discuss some basic principles and techniques of analysis needed for understanding the formation and properties of organic compounds. Organic compounds are essential for existence and maintenance of life on earth. These include complex molecules like (DNA) which carry genetic information and proteins which is building blocks of life. Organic compounds also play an important role in material used in daily life such as cloths, fuel, dyes, and medicines etc.

Structural Representations of Organic Compounds

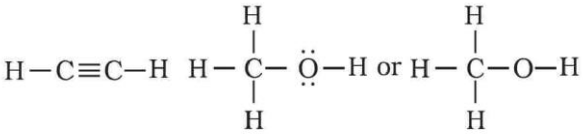
Structural Formulas

The Lewis structures can be simplified by representing the two electron covalent bonds by a dash (–). In this representation, a single bond is represented by a single dash (–), a double bond by a double dash (=) and a triple bond by a triple dash (≡). The lone pair on an atom may or may not be shown. This representation is called structural formula.



Ethane

Ethene



Ethyne

Methanol

Condensed Formulas

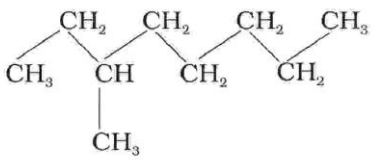
In this formula, the arrangement of atoms are shown but the bonds between may be omitted and the number of identical groups attached to an atom are indicated by a subscript.

Condensed Formulas

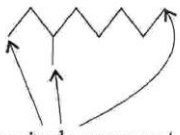
In this representation, the carbon and hydrogen atoms are not shown and the lines between carbon-carbon bonds are shown in a zig-zag manner.

(a) $CH_3CH_2CH(CH_3)CH_2CH_2CH_2CH_3$

(b)

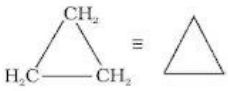


(c)

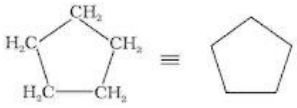


Terminals represent methyl group

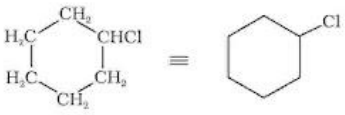
In cyclic compounds, the bond-line formulas may be given as follows:



Cyclopropane



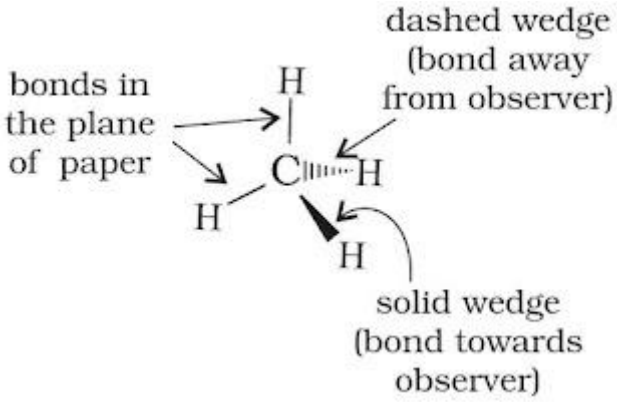
Cyclopentane



chlorocyclohexane

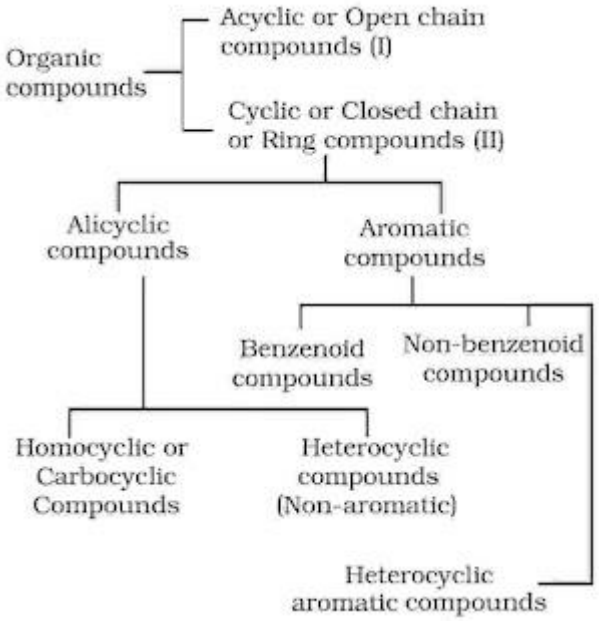
Three-dimensional representation of organic molecules

The three-dimensional (3-D) structure of organic molecules can be represented on paper by using certain conventions. In these formulae, the thick solid (or heavy) line or the solid wedge indicates a bond lying above the plane of the paper and projecting towards the observer while a dashed wedge is used to represent a bond lying below the plane of the paper and projecting away from the observer.



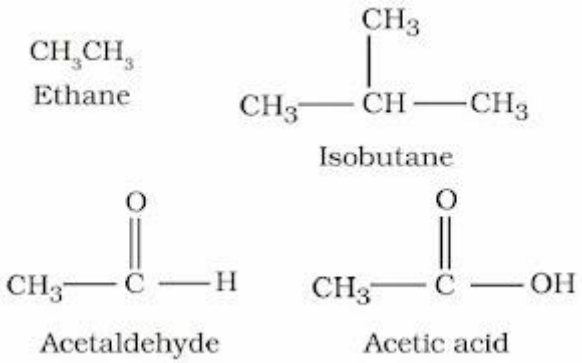
Classification of Organic Compounds

On the basis of their structures, organic compounds are broadly classified as follows:



Open Chain Compounds

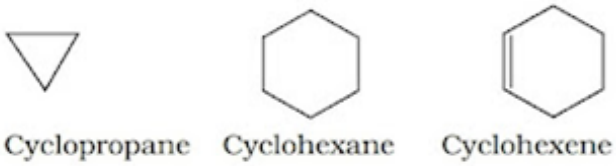
These compounds contain open chains of carbon atoms in their molecules. The carbon chains may be either straight chains or branched chains. They are also called aliphatic compounds.



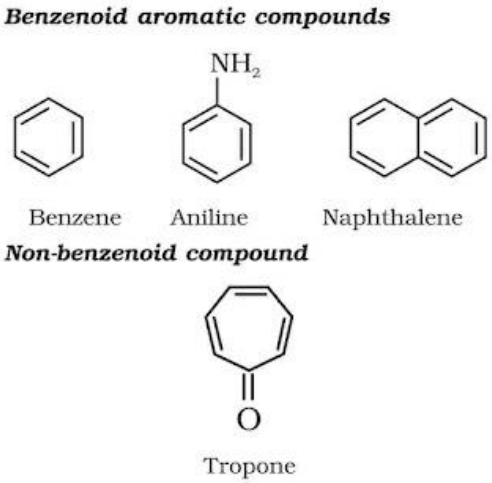
Closed Chain or Ring Compounds

These compounds contain chains or rings of atoms in their molecules.

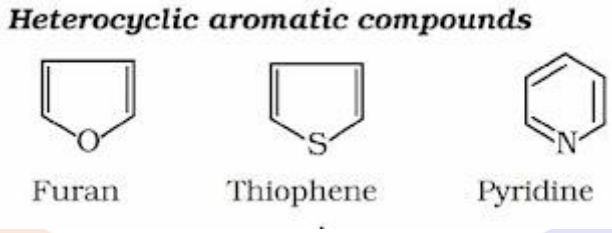
Alicyclic Compounds: These compounds contain a ring of three or more carbon atoms in them. They resemble aliphatic compounds in many of their properties.



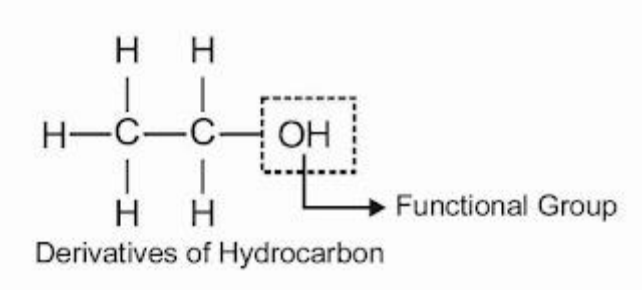
Aromatic Compounds: These have a cyclic system containing at last one benzene ring. The parent member of the family is called benzene. Benzene has a homocyclic hexagonal ring of six carbon atoms with three double bonds in the alternate positions.



Heterocyclic Compounds: In these compounds, the ring contains one or more atoms of either nitrogen, oxygen or sulphur in addition to carbon atoms. The atom other than carbon (such as N, O, S) present in the ring is called hetero atoms.



Functional Groups: An atom or group of atoms which largely determines the properties of the organic compounds particularly the chemical properties.



Homologous Series: Homologous series may be defined as "a series of similarly constituted compounds in which the members possess the same functional group and have similar chemical characteristics". The two consecutive members differ in their molecular formula by $-CH_2-$ group.

1. CH_3OH - Methyl alcohol
2. C_2H_5OH - Ethyl alcohol
3. C_3H_7OH - Propyl alcohol
4. C_4H_9OH - Butyl alcohol
5. $C_5H_{11}OH$ - Pentyl alcohol
6. $C_6H_{13}OH$ - Hexyl alcohol

Nomenclature of Organic Compounds

The term 'nomenclature' means the system of naming of organic compounds. There are two systems of nomenclature:

1. Trivial or Common System

In this nomenclature, the names of organic compounds were assigned based on their source of origin or certain properties. For instance, citric acid got its name from the source (citrus fruits) from which it was first isolated. Formic acid was named so as it was first obtained from red ant. In Latin ant word is formica.

2. IUPAC System of Nomenclature

A systematic method of naming has been developed and is known as the IUPAC (International Union of Pure and Applied Chemistry) system of nomenclature. In this systematic nomenclature, the names are correlated with the structure such that the reader or listener can deduce the structure from the name.

Summary-

1. **Condensed Structural Formula:** The structural formulae obtained by omitting some or all the covalent bonds and by indicating the number of identical groups attached to an atom by subscript is called condensed structural formula.
2. **Bond-line Structural Formula:** In this formula of organic compounds, carbon and hydrogen atoms are not shown and line representing C –C bonds and drawn in zig-zag fashion. The only atoms specifically written are those that are neither nor hydrogen bonded to carbon.
3. **Cyclic Compounds:** These are compounds in which carbon atoms are joined in rings i.e., they are closed chain compounds.
4. **Aromatic Compounds:** Benzene and its derivatives are called aromatic compounds.
5. Functional group: Functional group is an atom or group of atoms or reactive part of the compound which determines physical and chemical properties of compounds.
6. **Homologous Series:** Homologous series is a series of compounds which has same functional group same general formula and show gradation in physical and chemical properties of compounds.
7. **Isomerism:** The phenomenon of existence of two or more compounds possessing the same formula but different structural formula and different physical and chemical properties are called isomerism.
8. **Structural Isomerism:** Compounds having the same molecular formula but different structures are classified as structural isomers. Chain Isomerism: The isomers, which differ in carbon atom chain, are called chain isomers and this phenomenon is called chain isomerisms.
9. **Position Isomerism:** The isomers, which differ in position of substituent or functional groups are called position isomers and this phenomenon is called position isomerism.
10. **Functional Isomerism:** Those isomers, which differ in functional groups are called functional isomers and this phenomenon is called functional isomerism.
11. **Metamerism:** Those isomers, which differ in alkyl group attached with the di or tri valent atom of functional group. These are called metamers and this phenomenon is called metamerism.
12. **Stereoisomerism:** Those compounds that have the same composition and sequence of covalent bond but differ in relative positions of their atoms or groups in space.
13. **Free Radical:** An atom or group of atoms containing odd unpaired electrons in excited state is known as free radical.

NCERT LINE BY LINE QUESTIONS

(1.) How many σ and π bonds are present in the following molecule respectively? **[Page: 335]**
$CH_2 = C = CHCH_3$

(a.) 2, 9 (b.) 7, 3
(c.) 9, 2 (d.) 8, 2

(2.) Consider the following four compounds: **[Page: 348]**

(a.) I and II (b.) II and IV
(c.) II and III (d.) III and IV

(3.) Benzene and aniline both are liquids. Their mixture can be separated by **[Page: 359]**

(a.) using a funnel (b.) simple distillation
(c.) vacuum distillation (d.) none of these.

(4.) Which of the following statements is not correct for a nucleophile? **[NEET-2O15, Page: 351]**

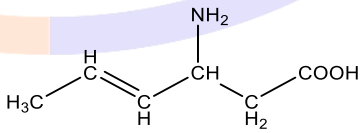
(a.) Ammonia is a nucleophile. (b.) Nucleophiles attack on lower e^- density sites.
(c.) Nucleophiles are not electron seeking. (d.) Nucleophile is a Lewis Acid.

(5.) Which of the following groups contains only electrophiles ? **[Page: 351]** (I) $AIC1_3, SO_3, \overset{\oplus}{N}O_2$ (II) $\overset{\oplus}{N}O, CH_3^{\oplus}, CH_3 - \overset{\oplus}{C} = 0$ (III) $C_2H_5^-, \dot{C}_2H_5, C_2H_5^{\oplus}$ (IV) BF_3, NH_3, H_2O

(a.) I, II and IV (b.) II and IV
(c.) I only (d.) I and II

(6.) Which of following statements is not correct? **[Page: 352]**

(a.) Carbocation posses sextet of electrons. (b.) The order of carbocation stability $\overset{\oplus}{C}H_3 > (CH_3)_2\overset{\oplus}{C}H > (CH_3)_3\overset{\oplus}{C}$
(c.) Carbocation has trigonal planar in shape (d.) Carbocation is formed by heterolytic cleavage

(7.) The IUPAC name of the compound is 

[Page: 345]

(a.) 5-amino-2-heptenoic acid (b.) 5-amino hex-2-enecarboxylic acid
(c.) 3-amino-5-heptenoic acid (d.) None of the above

(8.) Assertion (A): Sliver salt method is used to determine molecular mass of esters. Reason (R): Silver salt of the organic acid on ignition gives Ag metal and thus from the weights of silver salt taken and silver method, molecular mass of organic acid can be determined.

(a.) Both A and R are true and R is the correct explanation of A. (b.) Both A and R are true but R is not the correct explanation of A.
(c.) A is true but R is false. (d.) Both A and R are false.

(9.) Which of the following carbocations is most stable ? **[Page: 349]**

(a.) $CH_3\overset{\oplus}{C}H_2$ (b.) $CH_2=\overset{\oplus}{C}H$

(c.) $CH\equiv\overset{\oplus}{C}$ (d.) $C_6H_5^{\oplus}$

(10.) In Duma's method for estimation of nitrogen, 0.25 g of an organic compound gave 40 ml of nitrogen collected at 300 K temperature and 725 mm pressure. If the aqueous tension at 300 K is 25 mm, the percentage of nitrogen in the compound is **[Page: 364]**

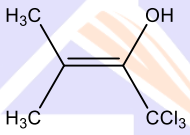
(a.) 16.76 (b.) 15.76

(c.) 17.36 (d.) 18.20

(11.) The ascending order of stability of the carbanion $\overset{!}{C}H_3(P), C_6H_5\overset{!}{C}H_2, (Q), (CH_3)_2\overset{!}{C}H(R)$, and $CH_2=CH\overset{!}{C}H_2(S)$ is **[HOT, Page: 35O]**

(a.) $P<R<S<Q$ (b.) $R<P<S<Q$

(c.) $R<P<Q<S$ (d.) $P<R<Q<S$

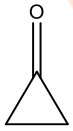
(12.) The IUPAC name of 

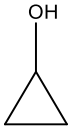
[Page: 344]

(a.) 2-trichloromethyl propan-2-01 (b.) 2-hydroxyl-2-trichloromethyl propane

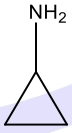
(c.) 1, 1, 1-trichloro-2-methy1 propane (d.) 2-hydroxyl-l, 1, 1-trichloro-2-methylpropane Practice Questions Framed from IMCERT Text

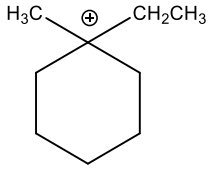
(13.) Which of the following is a heterocyclic compound ? **[Page: 339]**

(a.) 

(b.) 

(c.) 

(d.) 

(14.) The total number of contributing structures showing hyperconjugation (involving C-H) bonds for the following carbocation is [Page: 356] 

(a.) 5 (b.) 6

(c.) 7 (d.) 8

(15.) The IUPAC name of the compound having the formula $HC\equiv C-CH=CH_2$ is **[Page: 346]**

(a.) 1-buty n-3-ene (b.) but-l-yne-3-ene

(c.) 1-buten-3-yne (d.) 3-buten-l-yne

(16.) In Lassainge's test the sulphur present in organic compound is changed into **[Page: 363]**

(a.) Na_2SO_3 (b.) CS_2

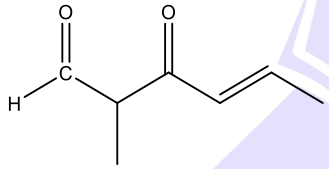
(c.) Na_2SO_4 (d.) Na_2S

(17.) Which of the following is used for the detection of carbon and hydrogen? **[Page: 362]**

(a.) CuO (b.) NaOH

(c.) $CaCO_3$ (d.) $CuCO_3$

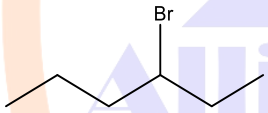
(18.) The IUPAC name of the compound **[NEET-2017, Page: 343]**

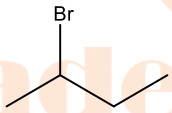


(a.) 5-formylhex-2-en-3-one (b.) 5-methyl-4-oxohex-2-en-5-al

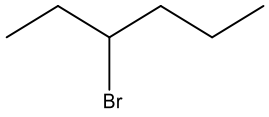
(c.) 3-keto-2-merhylhex-5-enal (d.) 3-keto-2-methylhex-4-enal

(19.) 2-bromobutane represents by which of the following formula? **[Page: 342]**

(a.) 

(b.) 

(c.) $H_3C-CH_2CH_2CH_2Br$

(d.) 

(20.) The number of structural isomers possible from the molecular formula C_3H_9N is **[Page: 348]**

(a.) 2 (b.) 3

(c.) 4 (d.) 5

(21.) Assertion : During test for nitrogen with Lassaigne's extract on adding $FeCl_3$ solution sometimes a red ppt. is obtained. Reason: Sulphur is also present. **[Page: 363]**

(a.) Both A and R are true and R is the correct explanation of A.

(b.) Both A and R are true but R is not the correct explanation of A.

(c.) A is true but R is false.

(d.) Both A and R are false.

(22.) Which of the following is not an electrophile} **[Page: 351]**

(a.) Cl^+ (b.) BH_3

(c.) NO_2^+ (d.) $C_2H_5O^-$

(23.) Electronegativity of carbon atoms depends upon their state of hybridisation. In which of the following compounds, the carbon mark with the star $(*)$ is most electronegative? [**NCERT**

Exemplar, Page: 335] (i) $CH_3-CH_2-\overset{*}{C}H_2-CH_3$ (ii) $CH_3-\overset{*}{C}H=CH-CH_3$ (iii) $CH_3-CH_2-C\equiv\overset{*}{C}H$ (iv) $CH_3-CH_2-CH=\overset{*}{C}H_2$

(a.) Only (i)
(b.) Only (iii)
(c.) (ii) and (iii)
(d.) Only (iv)

(24.) The most suitable method for the separation of 1:1 mixture of ortho and para nitrophenols is **[NEET-2017]**

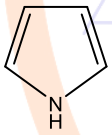
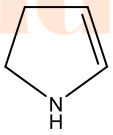
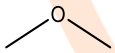
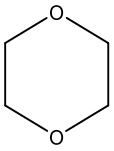
(a.) Sublimation
(b.) Chromatography
(c.) Crystallisation
(d.) Steam distillation

(25.) Column I Column II **[page: 349]**

Column I	Column II
(A) Nucleophile only	(P) $R_4\overset{\oplus}{N}$
(B) Electrophile only	(Q) $R-N\equiv C$
(C) Neither nucleophile nor electrophile	(R) SO_3
(D) Both nucleophile and electrophile	(S) $CH_2=O$

(a.) A →S, B →Q, C → P, D →R
(b.) A→R, B →P, C →S, D→Q
(c.) A →P, B →S, C →R, D →Q
(d.) A →Q, B →R,C →P, D →S

(26.) Which of following is an aromatic heterocyclic compound? **[Page: 340]**

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

(27.) Which compound was synthesised by F. Wohler from an inorganic compound ? **[Page: 334]**

(a.) Methane
(b.) Urea
(c.) Ethanoic Acid
(d.) Chloroform

(28.) Which statement is correct in paper chromatography?. **[Page: 361]**

(a.) Moving phase is liquid and stationary phase is solid
(b.) Moving phase is liquid and stationary phase is liquid
(c.) Moving phase is solid and stationary phase is solid
(d.) Moving phase is solid and stationary phase is liquid

(29.) Assertion (A): Lassaigne's test is not shown by diazonium salts. Reason (R): Diazonium salts lose N_2 on hearing much before they have a choice to react with fused Na metal. **[Page: 362]**

(a.) Both A and R are true and R is the correct explanation of A.
(b.) Both A and R are true but R is not the correct explanation of A.
(c.) A is true but R is false.
(d.) Both A and R are false.

(30.) Match Column I with Column II **[Page: 341]**

Column I Alkyl group	Column II Name
(A) $H_2C = CH—$	(P) Prop – 2 – enyl
(B) $HC \equiv C—$	(Q) Prop – 1 – enyl
(C) $CH_2 = CHCH_2—$	(R) Ethynyl
(D) $CH_3CH = CH—$	(S) Ethenyl

(a.) A→P, B→S, C→R, D→Q
(b.) A→ S, B →P, C →R, D→Q
(c.) A→S, B →R, C→Q D→P
(d.) A→S, B →R, C→P, D→Q

(31.) Kjeldahl's method is not applicable to which of the following compounds ? **[Page: 365]**

(a.) Azo compounds
(b.) Nitro compounds
(c.) Pyridine
(d.) All of the above

(32.) How many chain isomers could be obtained from the alkane ? C_6H_{14} **[Page: 348]**

(a.) 4
(b.) 5
(c.) 6
(d.) 7

(33.) Assertion (A): The stability of alkyl carbocation decreases in the order of $3^\circ > 2^\circ > 1^\circ$ Reason (R): The (+I) effect decreases as the distance between the alkyl group and the reaction site increases. **[Page: 352]**

(a.) Both A and R are true and R is the correct explanation of A.
(b.) Both A and R are true but R is not the correct explanation of A.
(c.) A is true but R is false.
(d.) Both A and R are false.

(34.) Purification of petroleum is carried out by **[Page: 358]**

(a.) Fractional distillation
(b.) Simple distillation
(c.) Steam distillation
(d.) None of the above

(35.) What is the shape of carbon in $H_2C=O$? **[Page: 335]**

(a.) Tetrahedral
(b.) Trigonal planar
(c.) Bipyramidal
(d.) None of these

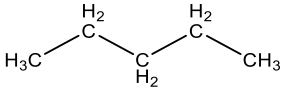
(36.) The most stable species among the following is **[Page: 349]**

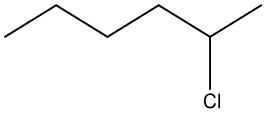
(a.) $\overset{\oplus}{C}H_3$
(b.) $\overset{\oplus}{C}H_2Br$
(c.) $\overset{\oplus}{C}HBr_2$
(d.) $\overset{\oplus}{C}Br_3$

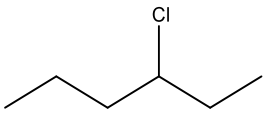
(37.) In the Lassaigne's test for nitrogen in an organic compound, the Prussian Blue colour is obtained due to the formation of [Page: 363]

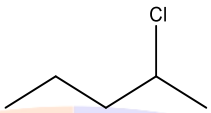
(a.) $Fe_4\left[Fe(CN)_6\right]_3$
(b.) $Na_4\left[Fe(CN)_6\right]$
(c.) $Fe_2\left[Fe(CN)_6\right]$
(d.) $Fe_3\left[Fe(CN)_6\right]_4$

(38.) Which of the following does not represent 2-chloropentane ? **[Page: 336]**

(i) 

(ii) 

(iii) 

(iv) 

(a.) (ii), (iii) and (iv) (b.) Only (ii)

(c.) (ii) and (iii) (d.) (iii) and (iv)

(39.) The violet colour is due to the formation of?

(a.) $\left[Fe(CN)_5 NO\right]^3$ (b.) $\left[Fe(NO)_5 CN\right]^+$

(c.) $\left[Fe(CN)_5 NOS\right]^3$ (d.) $\left[Fe(CN)_5 NOS\right]^4$

(40.) Which of the following compounds the carbon marked with star $(*)$ is expected to have greatest positive charge ?. **[NCERT Exemplar, Page: 352]**

(a.) $\overset{*}{C}H_3 - CH_2 - \overset{+}{M}gC1^-$ (b.) $\overset{*}{C}H_3 - CH_2 - Br$

(c.) $\overset{*}{C}H_3 - CH_2 - Cl$ (d.) $\overset{*}{C}H_3 - CH_2 - CH_3$

(41.) Assertion (A): The carbocation $CF_3 - \overset{\oplus}{C}H_2$ is less stable than $\overset{\oplus}{C}F_3$. Reason (R): In case of $CF_3 - \overset{\oplus}{C}H_2$ the strongly electron withdrawing $-CF_3$ group intensifies the $+$ ve charge but in case of $\overset{\oplus}{C}F_3$, the lone pair of electrons on each of the three F-atoms overlap with empty P-orbital of carbocation carbon thereby dispersing the $(+$ ve) charge. **[Page: 355]**

(a.) Both A and R are true and R is the correct explanation of A. (b.) Both A and R are true but R is not the correct explanation of A.

(c.) A is true but R is false. (d.) Both A and R are false.

(42.) The total number of secondary hydrogen present in 3,3-diethylpentane is **[Page: 349]**

(a.) 8 (b.) 9

(c.) 10 (d.) 12

(43.) Assertion (A): The IUPAC name of the compound $C_6H_5COOCH_2CH_2COOH$ is 3-benzyloxypropionic acid. Reason (R): $C_6H_5CH_2O$ group is called benzyloxy group. **[Page: 334]**

(a.) Both A and R are true and R is the correct explanation of A. (b.) Both A and R are true but R is not the correct explanation of A.

(c.) A is true but R is false. (d.) Both A and R are false. Practice Questions Framed from IMCERT Text

(44.) The most stable carbocation, among the following is **[Odisha NEET-2019, Page: 349]**

(a.) $(CH_3)_3 C - \overset{\oplus}{C}H - CH_3$ (b.) $CH_3 - CH_2 - \overset{\oplus}{C}H - CH_2 - CH_3$

(c.) $CH_3-\overset{\oplus}{C}H-CH_2-CH_2-CH_3$ (d.) $CH_3-CH_2-\overset{\oplus}{C}H_2$

(45.) The total number of position isomers in the formula $C_3H_6Br_2$ is **[Page: 348]**

(a.) 3 (b.) 4

(c.) 5 (d.) 6

(46.) On complete combustion, 0.246 g of an organic compound gave 0.198 g of carbon dioxide and 0.1014 g of water. What is the % composition of carbon in the compound? **[Page: 364]**

(a.) 44% (b.) 29.15%

(c.) 40% (d.) 21.95%

(47.) In the hydrocarbon $\underset{6}{CH_3}-\underset{5}{CH}=\underset{4}{CH}-\underset{3}{CH_2}-\underset{2}{C}\equiv\underset{1}{CH}$ the state of hybridisation of carbons 1, 3 and 5 is respectively?. **[QR code, Page: 335]**

(a.) sp^2, sp, sp^3 (b.) sp, sp^3, sp^2

(c.) sp, sp^2, sp^3 (d.) sp^3, sp^2, sp

(48.) The number of isomers in $C_4H_{10}O$ will be **[Page: 348]**

(a.) 7 (b.) 8

(c.) 5 (d.) 6

(49.) **[NCERT Exemplar, Page: 350]**

Column I	Column II
(A) Free radical	(P) Trigonal planar
(B) Carbocation	(Q) pyramidal
(C) Carbanion	(R) Linear
(D) H – C ≡ N	(S) Trigonal bipyramidal

(a.) A →R, B→R, C →P, D →P (b.) A →P, B→P, C→Q, D→R

(c.) A→Q, B→Q, C→P, D→S (d.) A→P, B→Q C→R, D →S

(50.) Write the IUPAC name for CH_3CH_2COOH. **[Page: 345]**

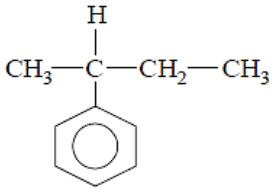
(a.) Ethyl Formic Acid (b.) Ethyl Carboxylic Acid

(c.) Ethane Methanoic Acid (d.) Propanoic Acid

TOPIC WISE PRACTICE QUESTIONS

TOPIC 1: Classification and Nomenclature of Organic Compounds

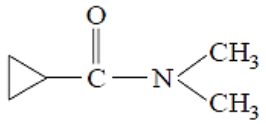
1. IUPAC name of following compound is:



(a) 2 - cyclohexylbutane (b) 2 - phenylbutane
(c) 3 - cyclohexylbutane (d) 3 - phenylbutane

2. IUPAC name of $(CH_3)_3$ CCl is
1) 1-butyl chloride 2) 3-chloro butane
3) 2-chloro-2-methylpropane 4) 2-butyl chloride

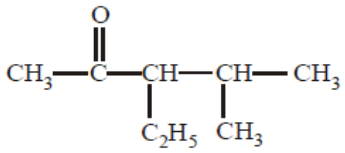
3. IUPAC name of the following compound



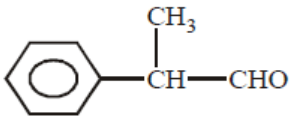
1) N, N-dimethylcyclopropane carboxamide 2) N-methylcyclopropanamide'
3) cyclopropionamide 4) None of these

4. Which of the following is a 3-methylbutyl group?
1) $CH_3CH_2CH_2CH_2CH_2^-$ 2) $(CH_3CH_2)_2CH^-$
3) $(CH_3)_3CCH_2^-$ 4) $(CH_3)_2CHCH_2CH_2^-$

5. The IUPAC name of the compound CH_3 — $CH(CH_3)$ — CO – CH_3, is
1) 3-methyl 2-butanone 2) 2-methyl 3-butanone
3) isopropyl methyl ketone 4) methyl isopropyl ketone



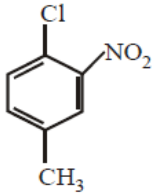
6. The IUPAC name of is"
1) 3-(Methylethyl) penetan-2-one 2) 3-(Methylethyl) penetan-4-one
3) 3-Ethyl-4-methylpentan-2-one 4) 3-Ethyl-2-methylpentan-4-one



7. The IUPAC name of is
1) 2-phenylpropan-3-al 2) formylethylbenzene
3) 2-phenylpropanal 4) ethylformylbenzene

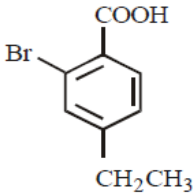
8. The IUPAC name of HOOC—CH CH—COOH is:
1) But-2-ene-4-dicarboxylic acid 2) But-2-ene-1, 4-dioc acid
3) Ethene dicarboxylic acid 4) Ethene dioic acid

9. The IUPAC name for



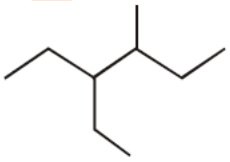
1) 1-Chloro-2-nitro-4-methyl benzene 2) 1-Chloro-4-methyl-2-nitrobenzene
3) 2-Chloro-1-nitro-5-methyl benzene 4) *m*-Nitro-*p*-chlorotoluene

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



1) 6 – bromo – 4 – ethylbenzene carboxylic acid
2) 2 – bromo – 4 – ethylbenzene carboxylic acid
3) Ortho – bromo – paraethyl benzoic acid
4) 4 – bromo – 3 – ethyl benzoic acid

11. The correct IUPAC name of the following compound



is

1) 4 - methyl - 3 – ethylhexane 2) 3 - ethyl - 4 - methylhexane
3) 3, 4 – ethylmethylhexane 4) 4 - ethyl - 3 – methylhexane

12. Cyclohexadiene contains ___vinylic and ___ allylic hydrogen atoms?

1) 2 and 2 2) 4 and 4 3) 2 and 4 4) 4 and 2

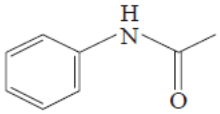
13. Match Column-I (organic compound) with Column-II (common name of the compound) and choose the correct option.

Column-I (Organic compound)	**Column-II (Common name of compound)**
(A) $C_6H_5OCH_3$	(p) Neopentane
(B) $H_3CCH_2CH_2OH$	(q) Anisole
(C) $(H_3C)_4C$	(r) Acetophenone
(D) $C_6H_5COCH_3$	(s) *n*–Propyl alcohol.

(a) A – (r), B – (s), C – (p), D – (q)
(b) A – (r), B – (p), C – (s), D – (q)
(c) A – (q), B – (s), C – (p), D – (r)
(d) A – (q), B – (s), C – (r), D – (p)

14. The C – H bond distance is longest in
1) C_2H_6 2) C_2H_2 3) $C_2H_2Br_2$ 4) C2H4

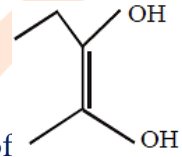
15. The IUPAC name of the following compound is



1) N – phenyl ethanamide 2) N – phenyl ethanone
3) N – phenyl methanamide 4) None of these

16. The IUPAC name of the compound $CH_3OCH_2CH_2CH_2OCH_2CH_3$ is
1) 3-ethoxy-1-methoxypropane 2) 1-ethoxy-3-methoxypropane
3) 2, 5-dioxyhexane 4) ethoxypropane oxymethane

17. The IUPAC name of CH3COCH$(CH_3)_2$ is
1) 2-methyl-3-butanone 2) 4-methylisopropyl ketone
3) 3-methyl-2-butanone 4) isopropylmethyl ketone



is :

18. IUPAC name of
1) But – 2–ene – 2, 3– diol 2) Pent – 2–ene – 2, 3 – diol
3) 2–methylbut –2– ene – 2, 3 – diol 4) Hex – 2– ene – 2, 3 – diol

19. IUPAC name of CH_3 - CH = CH - C ≡ CH is :
1) pent-2-ene-4-yne 2) pent-1-yne-3-ene 3) pent-3-ene-1-yne 4) none of these

20. The number of secondary hydrogens in 2, 2-dimethylbutaneis :
1) 8 2) 6 3) 4 4) 2

21. The general formula $C_nH_{2n}O_2$ could be for open chain
1) carboxylic acids 2) diols 3) dialdehydes 4) diketones

22. The compound named trichloroethene is –
1) westron 2) perclene 3) westrosol 4) orlon

TOPIC 2: Isomerism in Organic Compounds

23. $C_6H_5C \equiv N$ and $C_6H_5N \overset{\rightarrow}{=} C$ are which type of isomers?
1) Position 2) Functional 3) Tautomerism 4) Linkage

24. Maleic acid and fumaric acids are
1) chain isomers 2) functional isomers 3) tautomers 4) geometrical isomers

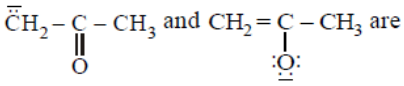
25. During debromination of meso - dibromobutane,the major compound formed is
1) n - butane 2) 1 – butane 3) *cis* - 2 - butene 4) *trans* - 2 - butene

26. Which of the following is optically active?
1) n - Propanol 2) 2 – Chlorobutane 3) n - Butanol 4) 3 - Hydroxy pentane

27. Only two isomeric monochloro derivatives are possible for
a) n – butane 2) 2, 4 – dimethylpentane 3) benzene 4) 2 - methylbutane

28. The number of possible open chain (acyclic) isomeric compounds for molecular formula C5H10 would be
1) 8 2) 7 3) 6 4) 5

29. The process of separation of a racemic modification into d and l-enantiomers is called
1) resolution 2) dehydration 3) revolution 4) dehydrohalogenation

30.  and are

1) resonating structures 2) tautomers 3) geometrical isomers 4) optical isomers

31. Geometrical isomers differ in

1) position of functional group. 2) position of atoms.
3) spatial arrangement of atoms. 4) length of carbon chain.

32. Number of chiral carbons in $\beta-D-(+)-$ glucose is
1) five 2) six 3) three 4) four

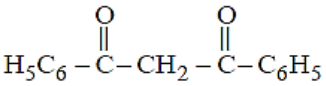
33. Which one of the following pairs represents stereoisomerism?
1) Structural isomerism and geometrical isomerism
2) Optical isomerism and geometrical isomerism
3) Chain isomerism and rotational isomerism.
4) Linkage isomerism and geometrical isomerism

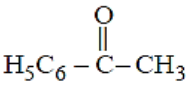
34. Which of the following will have a meso-isomer also?
1) 2, 3- Dichloropentane 2) 2, 3-Dichlorobutane
3) 2-Chlorobutane 4) 2-Hydroxypropanoic acid

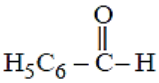
35. An aromatic compound of formula C_7H_7Cl has in all ....isomers :
1) 5 2) 2 3) 4 4) 3

36. How many optically active stereoisomers are possible for lactic acid ?
1) 1 2) 2 3) 4 4) 3

37. Keto-enol tautomerism is observed in :

(a) 

(b) 

(c) 

(d) Both (a) and (b)

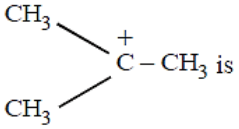
38. The compound $C_4H_{10}O$ can show
1) metamerism 2) functional isomerism
3) position isomerism 4) All of these

39. Which one of the following conformations of cyclohexane is chiral?
1) Boat 2) Twist boat 3) Rigid 4) Chair

TOPIC 3: Concepts of Reaction Mechanism in Organic Compounds and Purification

40. Homolytic fission of C–C bond in ethane gives an intermediate in which carbon is
1) *sp3*-hybridised 2) *sp2*-hybridised 3) *sp*-hybridised 4) *sp2d*-hybridised

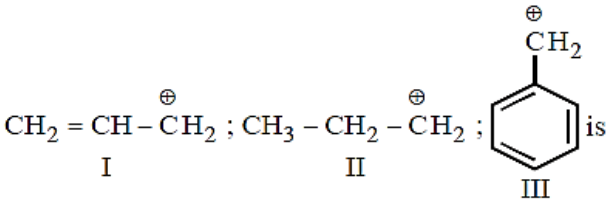
41. Among the following, the true property about



1) it is non-planar 2) its C+ is *sp*2-hybridized
3) an electrophile can attack on its C+ 4) it does not undergo hydrolysis

42. Hyperconjugation is most useful for stabilizing which of the following carbocations ?
1) *neo*-Pentyl 2) *tert*-Butyl 3) *iso*-Propyl 4) Ethyl

43. The order of stability of the following carbocations :



1) III > II > I 2) II > III > I 3) I > II > III 4) III > I > II

44. In the following groups

-OAc (I) -OMe (II)

$-OSO_2Me$ (III) $-OSO_2CF_3$ (IV)

the order of leaving group ability is

1) I > II > III > IV 2) IV > III > I > II 3) III > II > I > IV 4) II > III > IV > I

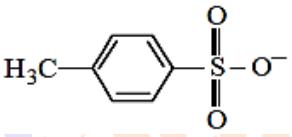
45. Most stable carbocation is

1) *p*—NO2—C6H4—CH2 2) $C_6H_5CH_2^+$

3) $p-Cl-C_6H_4-CH_2^+$ 4) $p-CH_3O-C_6H_4-CH_2^+$

46. The decreasing order of nucleophilicity among the nucleophiles

(A) $CH_3\overset{\overset{O}{\|}}{C}-O^-$ (B) CH_3O^-

(C) CN^- (D) 

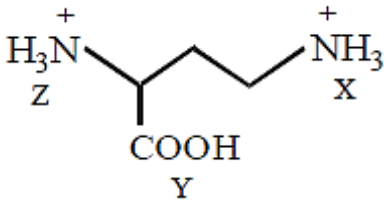
1) C, B, A, D 2) B, C, A, D 3) D, C, B, A 4) A, B, C, D

47. Decreasing order of reactivity towards nucleophilic addition to carbonyl group among cyclopentanone, 3-pentanone and *n*-pentanal is

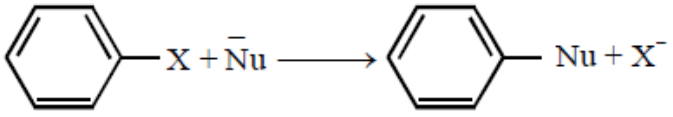
1) 3-pentanone, cyclopentanone, *n*-pentanal. 2) *n*-pentanal, 3-pentanone, cyclopentanone.

3) *n*-pentanal, cyclopentanone, 3-pentanone. 4) cyclopentanone, 3-pentanone, *n*-pentanal.

48. Select the appropriate relation with respect to acidity of X, Y, Z for the given compound, with increasing order.



1) Z > X > Y 2) Y > Z > X 3) Z < X > Y 4) X > Y > Z

49.  the reaction is not possible because

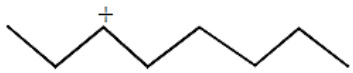
1) Nu- faces steric hinderance on attacking the leaving group.

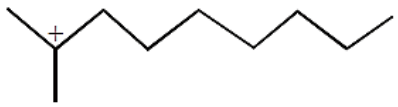
2) electrons are delocalised in the benzene ring.

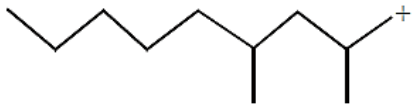
3) reaction is thermodynamically controlled.

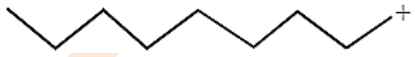
4) C – X bond possesses a double bond character.

50. Select the most stable carbocation amongst the following

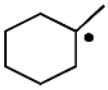
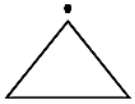
(a) 

(b) 

(c) 

(d) 

51. In which of the following pairs A is more stable than B?

	A	B
(a)		
(b)		
(c)		
(d)	$Ph_3C^{\bullet}$	$(CH_3)_3C^{\bullet}$

52.

Arrange the carbanions,

$(CH_3)_3\bar{C}$, $\bar{C}Cl_3$, $(CH_3)_2\bar{C}H$, $C_6H_5\bar{C}H_2$

in order of their decreasing stability :

(a) $(CH_3)_2\bar{C}H > \bar{C}Cl_3 > C_6H_5\bar{C}H_2 > (CH_3)_3\bar{C}$

(b) $\bar{C}Cl_3 > C_6H_5\bar{C}H_2 > (CH_3)_2\bar{C}H > (CH_3)_3\bar{C}$

(c) $(CH_3)_3\bar{C} > (CH_3)_2\bar{C}H > C_6H_5\bar{C}H_2 > \bar{C}Cl_3$

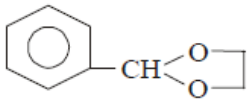
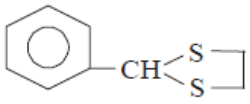
(d) $C_6H_5\bar{C}H_2 > \bar{C}Cl_3 > (CH_3)_3\bar{C} > (CH_3)_2\bar{C}H$

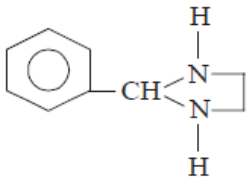
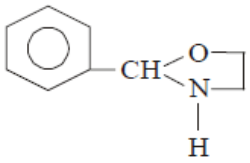
53. The increasing order of the boiling points for the following compounds is :

C_2H_5OH	C_2H_5Cl	$C_2H_5CH_3$	$C_2H_5OCH_3$
(I)	(II)	(III)	(IV)

1) (III) < (IV) < (II) < (I)
2) (IV) < (III) < (I) < (II)
3) (II) < (III) < (IV) < (I)
4) (III) < (II) < (I) < (IV)

54. Which of the following compounds has most acidic hydrogen?

(a)  (b) 

(c)  (d) 

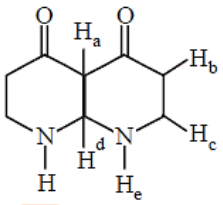
55. The increasing order of stability of the following free radicals is

(a) $(C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C} < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$

(b) $(CH_3)_2\dot{C}H < (CH_3)_3\dot{C} < (C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C}$

(c) $(CH_3)_3\dot{C} < (CH_3)_2\dot{C}H < (C_6H_5)_2\dot{C}H < (C_6H_5)_3\dot{C}$

(d) $(C_6H_5)_3\dot{C} < (C_6H_5)_2\dot{C}H < (CH_3)_3\dot{C} < (CH_3)_2\dot{C}H$

56. 

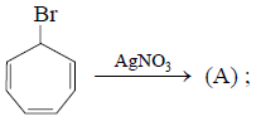
Identify most acidic hydrogen present in the above compound:

1) a 2) b 3) c 4) d

57. Out of the following compounds, which will have a zero dipole moment?

1) 1, 1-Dichloroethylene 2) *cis*-1, 2-Dichloroethylene

3) *trans*-1, 2-Dichloroethylene 4) None of these compounds

58. 

Which statement is incorrect in respect of the above reaction?

1) Product is aromatic. 2) Product has high dipole moment.

3) Product has less resonance energy. 4) Product is soluble in polar solvent.

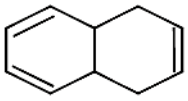
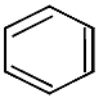
59. Which of the following represents a set of nucleophiles?

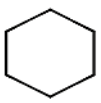
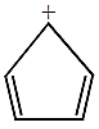
1) BF_3, H_2O, NH_2^- 2) $AlCl_3$, BF_3, NH_3 3) CN^-, RCH_2^-, ROH 4) All of these

60. The structure of $H_2C = C = CH_2$ is

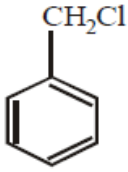
1) linear 2) planar 3) non-planar 4) has several resonance structures

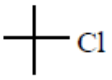
61. Which of the following will show aromatic behaviour ?

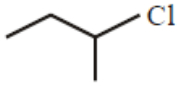
(a)  (b) 

(c)  (d) 

62. Which of the following reactions cannot proceed by S_N1 mechanism ?

(a) 

(b) 

(c) 

(d) 

63. Ketene, $CH_2 = C = O$, has

1) only sp^2 hybridized carbon atom. 2) only sp hybridized carbon atom.

3) sp^2 and sp hybridized carbon atoms. 4) sp^2, sp and sp^3 hybridized carbon atoms.

64. Which one of the following does not have sp^2 hybridized carbon ?

1) Acetonitrile 2) Acetic acid 3) Acetone 4) Acetamide

65. How many p-bonds are present in naphthalene?

1) 4 2) 5 3) 6 4) 7

66. The shape of methyl carbanion is similar to that of –

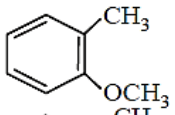
1) BF_3 2) NH_3 3) methyl free radical 4) methyl carbocation

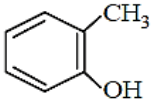
67. Which of the following represents the correct order of stability of the given carbocations ?

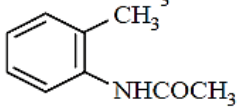
(a) $F_3\overset{+}{C} > F_3C-\overset{+}{\underset{|}{C}} > \overset{+}{C}H_3$ (b) $H_3\overset{+}{C} > F_3C-\overset{+}{\underset{|}{C}} > F_3\overset{+}{C}$

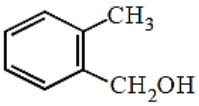
(c) $F_3C-\overset{+}{\underset{|}{C}} > F_3\overset{+}{C} > H_3\overset{+}{C}$ (d) $F_3C-\overset{+}{\underset{|}{C}} > H_3\overset{+}{C} > F_3\overset{+}{C}$

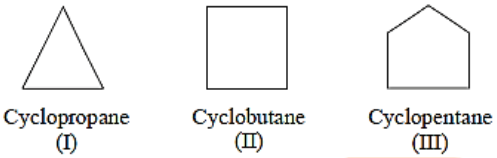
68. Which one of the following is most reactive towards electrophilic reagent?

(a) 

(b) 

(c) 

(d) 

69. 

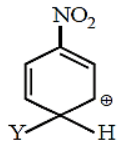
Cyclopropane (I) Cyclobutane (II) Cyclopentane (III)

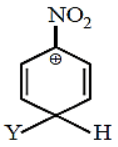
The correct order of heats of combustion of above compounds is:

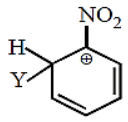
1) I > II > III 2) II > I > III 3) III > II > I 4) III > I > II

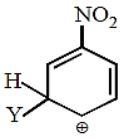
NEET PREVIOUS YEARS QUESTIONS

1. Which of the following carbocations is expected to be most stable? **[2018]**

(a) 

(b) 

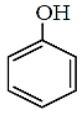
(c) 

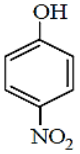
(d) 

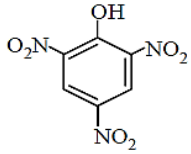
2. Which of the following is correct with respect to – I effect of the substituents? (R = alkyl) **[2018]**

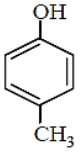
1) $-NH_2 < -OR < -F$ 2) $-NR_2 < -OR < -F$ 3) $-NR_2 > -OR > -F$ 4) $-NH_2 > -OR > -F$

3. Which one is the most acidic compound? **[2017]**

(a) 

(b) 

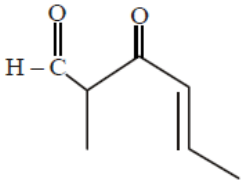
(c) 

(d) 

4. The most suitable method of separation of 1 : 1 mixture of ortho and para-nitrophenols is : **[2017]**

1) Chromatography 2) Crystallisation 3) Steam distillation 4) Sublimation

5. The IUPAC name of the compound **[2017]**



is :

1) 5-formylhex-2-en-3-one 2) 5-methyl-4-oxohex-2-en-5-al
3) 3-keto-2-methylhex-5-enal 4) 3-keto-2-methylhex-4-enal

6. The correct statement regarding electrophile is - **[2017]**

1) Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from another electrophile
2) Electrophiles are generally neutral species and can form a bond by accepting a pair of electrons from a nucleophile
c) Electrophile can be either neutral or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile
4) Electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from a nucleophile

7. The pair of electron in the given carbanion, $CH_3C = C^-$, is present in which of the following orbitals? **[2016]**

1) $2p$ 2) sp^3 3) sp^2 4) sp

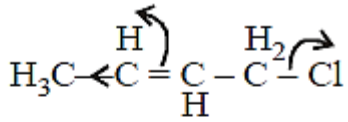
8. Which of the following statements is not correct for a nucleophile? **[2015]**

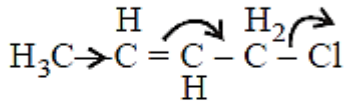
1) Nucleophile is a Lewis acid 2) Ammonia is a nucleophile
3) Nucleophiles attack low e^- density sites 4) Nucleophiles are not electron seeking.

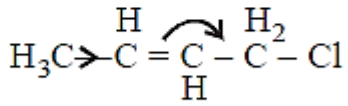
9. In Duma's method for estimation of nitrogen, 0.25 g of an organic compound gave 40 mL of nitrogen collected at 300K temperature and 725 mm pressure. If the aqueous tension at 300 K is 25 mm, the percentage of nitrogen in the compound is : **[2015]**

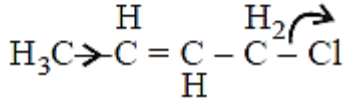
1) 18.20 2) 16.76 3) 15.76 4) 17.36

10. Which of the following is the most correct electron displacement for a nucleophilic reaction to take place? **[2015]**

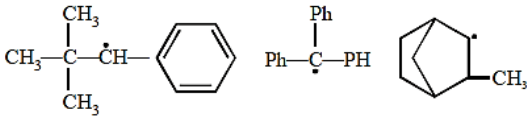
(a) 

(b) 

(c) 

(d) 

11. Consider the following compounds

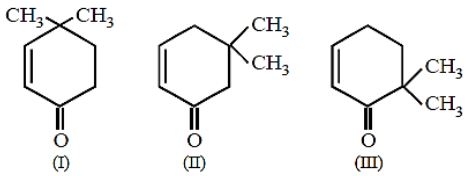


(I) (II) (III)

Hyperconjugation occurs in : **[2015]**

(a) II only 2) III only 3) I and III 4) I only

12. Given

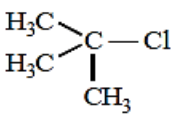


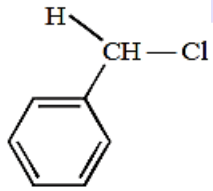
(I) (II) (III)

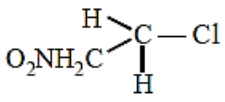
Which of the given compounds can exhibit tautomerism? **[2015]**

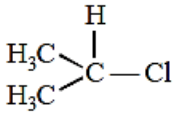
1) I and III 2) II and III 3) I, II and III 4) I and II

13. In which of the following compounds, the C – Cl bond ionisation shall give most stable carbonium ion? **[2015]**

(a) 

(b) 

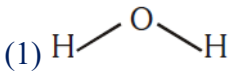
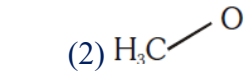
(c) 

(d) 

14. In the Kjeldahl's method for estimation of nitrogen present in a soil sample, ammonia evolved from 0.75 g of sample neutralized 10 mL of 1 MH_2SO_4. The percentage of nitrogen in the soil is : **[2014]**

1) 37.33 2) 45.33 3) 35.33 4) 43.33

15. The compound that is most difficult to protonate is:- **[2019]**

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

16. The most stable carbocation, among the following is:- **[2019-ODISSA]**

(1) $(CH_3)_3C-\overset{\oplus}{C}H-CH_3$ (2) $CH_3-CH_2-\overset{\oplus}{C}H-CH_2-CH_3$

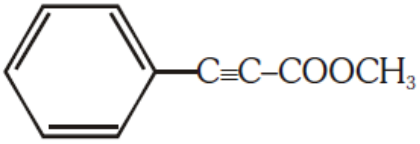
(3) $CH_3-\overset{\oplus}{C}H-CH_2-CH_2-CH_3$ (4) $CH_3-CH_2-\overset{\oplus}{C}H_2$

17. A liquid compound (x) can be purified by steam distillation only if it **is** **[2020-covid-19]**

(1) Steam volatile, immiscible with water (2) Not steam volatile, miscible with water

(3) Steam volatile, miscible with water (4) Not steam volatile, immiscible with water

18. How many (i) sp^2 hybridised carbon atoms and (ii) π bonds are present in the following compound? **[2020-covid-19]**



(1) 7, 5 (2) 8, 6 (3) 7, 6 (4) 8, 5

19. A tertiary butyl carbocation is more stable than a secondary butyl carbocation because of which of the following **[2020]**

1) Hyperconjugation 2) –I effect of $-CH_3$ groups 3) +R effect of $-CH_3$ groups 4) –R effect of $-CH_3$ group

20. Paper chromatography is an example of : **[2020]**

1. Column chromatography 2. Adsorption chromatography

3. partition chromatography 4. Thin layer chromatography

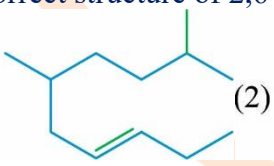
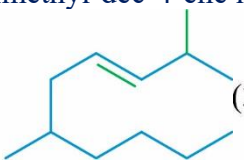
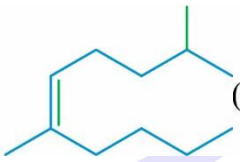
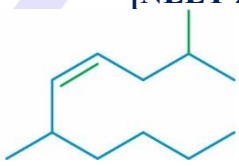
21. Which one of the following methods can be used to obtain highly pure metal which is liquid at room temperature? **[NEET-2021]**

1) Chromatography 2) Distillation 3) Zone refining 4) Electrolysis

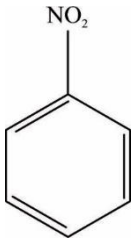
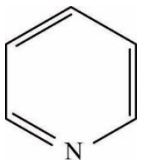
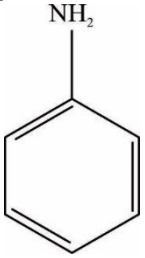
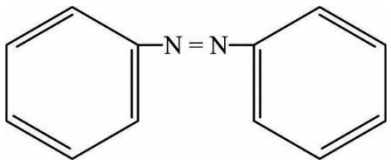
22. The compound which shows metamerism is **[NEET-2021]**

1) C_3H_8O 2) C_3H_6O 3) $C_4H_{10}O$ 4) C_5H_{12}

23. The correct structure of 2,6-Dimethyl-dec-4-ene is: **[NEET-2021]**

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

24. The Kjeldahl's method for the estimation of nitrogen can be used to estimate the amount of nitrogen in which one of the following compounds? **[NEET-2022]**

1)  2)  3)  4) 

NCERT LINE BY LINE QUESTIONS – ANSWERS

(1.)	c	**(2.)**	b	**(3.)**	b	**(4.)**	d	**(5.)**	d
(6.)	b	**(7.)**	c	**(8.)**	d	**(9.)**	a	**(10.)**	a
(11.)	b	**(12.)**	c	**(13.)**	c	**(14.)**	b	**(15.)**	c
(16.)	d	**(17.)**	a	**(18.)**	d	**(19.)**	b	**(20.)**	a
(21.)	a	**(22.)**	d	**(23.)**	b	**(24.)**	d	**(25.)**	d
(26.)	a	**(27.)**	b	**(28.)**	b	**(29.)**	a	**(30.)**	d
(31.)	d	**(32.)**	b	**(33.)**	b	**(34.)**	a	**(35.)**	b
(36.)	a	**(37.)**	a	**(38.)**	c	**(39.)**	d	**(40.)**	c
(41.)	a	**(42.)**	a	**(43.)**	b	**(44.)**	c	**(45.)**	b
(46.)	d	**(47.)**	b	**(48.)**	a	**(49.)**	b	**(50.)**	d

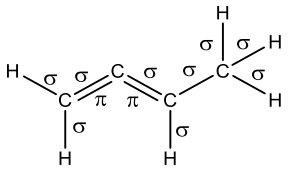
TOPIC WISE PRACTICE QUESTIONS - ANSWERS

1) 2	**2)** 3	**3)** 1	**4)** 4	**5)** 1	**6)** 3	**7)** 3	**8)** 2	**9)** 2	**10)** 2
11) 2	**12)** 2	**13)** 3	**14)** 1	**15)** 1	**16)** 1	**17)** 3	**18)** 2	**19)** 3	**20)** 4
21) 1	**22)** 3	**23)** 2	**24)** 4	**25)** 4	**26)** 2	**27)** 1	**28)** 3	**29)** 1	**30)** 1
31) 3	**32)** 1	**33)** 2	**34)** 2	**35)** 3	**36)** 2	**37)** 4	**38)** 4	**39)** 2	**40)** 2
41) 2	**42)** 2	**43)** 4	**44)** 2	**45)** 4	**46)** 2	**47)** 3	**48)** 2	**49)** 4	**50)** 2
51) 4	**52)** 2	**53)** 1	**54)** 2	**55)** 2	**56)** 1	**57)** 3	**58)** 3	**59)** 3	**60)** 3
61) 2	**62)** 4	**63)** 3	**64)** 1	**65)** 2	**66)** 2	**67)** 2	**68)** 2	**69)** 3	**70)** 1

NEET PREVIOUS YEARS QUESTIONS-ANSWERS

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

NCERT LINE BY LINE QUESTIONS – SOLUTIONS



(1.) (c) $9\sigma, 2\pi$ $CH_2 = C = CH - CH_3$

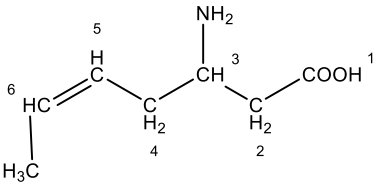
(2.) (b) Alkyl halides. Functional isomers have same molecular formula but different functional groups. Alcohols are functional isomers of ethers. Aldehydes are functional isomers of ketones. Cyanides are the functional isomers of isocyanides. Only alkyl halides do not show functional isomers.

(3.) (b) Simple distillation. The b.p. of benzene (bp 353 K) and aniline (457 K) differs by 104 K and hence can be separated by simple distillation.

(4.) (d) Nucleophiles are*e* rich species, so they are Lewis base.

(5.) (d) Electrophiles are positive charge and*e* deficient species. They are Lewis acid. $AlCl_3$, SO_3 are Lewis acid. $NO_2^+, CH_3^+, CH_3 - C^{\oplus} = O$ are $+$ vely charged species.

(6.) (b) The stability of carbocation is $(CH_3)_3\overset{\oplus}{C} > (CH_3)_2\overset{\oplus}{C}H > \overset{\oplus}{C}H_3$



(7.) (c) 3-amino-5-heptenoic acid

(8.) (d) Correct Assertion: Silver salt method is used to determine the molecular mass of organic acid.

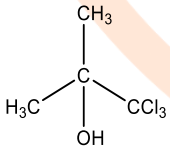
(9.) (a) $CH_3\overset{\oplus}{C}H_2$ The heterolytic bond dissociation energy $(\text{i.e. } R-H \rightarrow R^+ + H-)$ in gas phase depends upon the strength of the C—H bond since the strength of $C-H$ bond decreases in the order of $HC\equiv C-H > C_6H_5-H > H_2C=CH-H > CH_3CH_2-H$ So, CH_3CH_3 has the least heterolytic bond dissociation energy and hence $CH_3CH_2^{\oplus}$ is the most stable carbocation.

(10.) (a) 16.76% Mass of organic compound=0.25 g Experimental values at STP $V_1 = 40ml$ $T_1 = 300K$ $V_2 = ?$ $T_2 = 273K$ $P_1 = 725-25 = 700mm$ $P_2 = 760mm$ $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$V_2 = \frac{P_1V_1T_2}{T_1P_2} = \frac{700\times40\times273}{300\times760} = 33.52ml$ 22400 ml of N_2 at STP weighs=28 g 33.52 ml of N_2 at STP weighs $= \frac{28\times33.52}{22400}$ $=0.0419g$ $\%N = \frac{\text{Mass of Nitrogen at STP}}{\text{Mass of organic compound taken}}\times100$

$= \frac{0.0.419}{025}\times100 = 16.76^{\circ}\%$

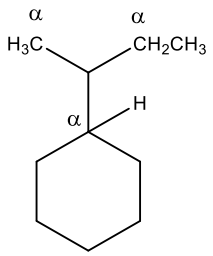
(11.) both $CH_2=CH\overset{!}{C}H_2$ and $C_6H_5\overset{!}{C}H_2$ are stabilised by resonance but delocalisation of π-electrons over the C_6H_5 ring makes $C_6H_5\overset{!}{C}H_2$ (Q) more stable than $CH_2=CH\overset{!}{C}H_2$ (S). Further, $+I$ effect of the alkyl group decreases the stability of carbocations. So, $(CH_3)_2\overset{!}{C}H$ (R) is less stable than $CH_3^-(P)$ group. So, overall stability order increases. $(CH_3)_2\overset{!}{C}H(R) < \overset{!}{C}H_3(P) < CH_2=CH\overset{!}{C}H_2(S) < C_6H_5\overset{!}{C}H_2(Q)$



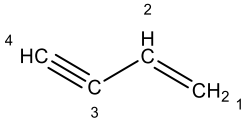
(12.) (c)

(13.) (c) Oxirane is a heterocyclic compound

(14.) (b) There are 6 α -hydrogen's and hence six hyperconjugation structures are possible for the carbocation



given α - H = 3 + 2 + 1 = 6

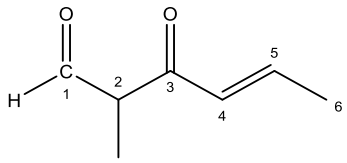


(15.) (c) 1-buten-3-yne 1-buten-3-yne (double bond give preference over triple bond.)

(16.) (d) The sulphur of organic compound gives Na_2S.

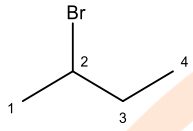
(17.) (a) CuO. Carbon and hydrogen are detected by hearing the compound with copper (II) oxide. Carbon present in the compound is oxidised to CO_2 and hydrogen to H_2O.

(18.) (d) 3-keto-2-methylehex-4-enal

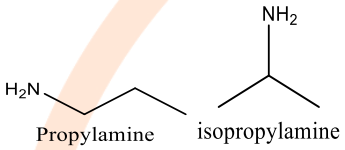


3-keto-2-methylehex-4-enal

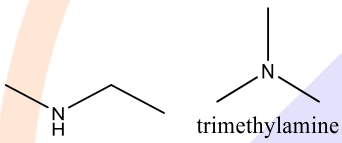
(19.) (b) 2 - bromobutane



(20.)



Propylamine isopropylamine



N-methylethylamine trimethylamine

(21.) (a) On adding $FeCl_3$ solution to sodium extract during testing for nitrogen, a red precipitate is obtained. I*t* is due to the presence of sulphur. $3NaCNS + FeCl_3 \rightarrow Fe(CNS)_3 + 3NaCl$

(22.) (d) $C_2H_5\overset{!}{O}$ is not an electrophile, $C_2H_5\overset{!}{O}$ is a Nucleophile.

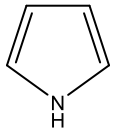
(23.) (b) $CH_3 - CH_2 - C \equiv \overset{*}{C}H$ Electronegativity of carbon atom depends on its hybridised state and % *s*-character. E. N α % S. Character. $sp^3(25\%S) < sp^2$ (33% S) < sp (50% S) and Carbon linked through two π bonds are *sp*-hybridised.

(24.) (d) Steam distillation. The 0- and p-nitrophenols are separated by steam distillation. Since o-isomer is steam volatile due to intramolecular H-bonding while p-isomer is not steam volatile. due to association of molecules by the intermolecular H-bonding.

(25.) (d)

A $\rightarrow$ Q	B $\rightarrow$ R	C $\rightarrow$ P	D $\rightarrow$ S

(26.) (a)



Pyrrole is an aromatic heterocyclic compound.

(27.) (b) P. Wohler synthesised urea from an inorganic compound ammonium cyanate.

(28.) (b) Conceptual.

(29.) (a) Reason in the correct explanation of Assertion.

(30.) $A \rightarrow S \quad C \rightarrow P$

$B \rightarrow R \quad D \rightarrow Q$

(31.) (d) Kjeldahl's method is not applicable to any of the given compounds. As nitrogen of these compounds does not change to ammonium sulphate on hearing with conc. H_2SO_4.

(32.) (b) 5 Chain isomers Hexane (n-hexane) 2-methyl penrane (isohexane) 3-methyl pentane 2,3-dimethyl butane 2,2-dimethyl butane (neohexane)

(33.) (b) Correct explanation: More the number of alkyl groups, greater the dispersal of + ve charge and hence greater is the stability.

(34.) (a) Fractional distillation is used for the distillation Of petroleum. This method is used for separating a mixture of two or more miscible, volatile liquids having close (less than 40oC) boiling points. For example, a mixture of acetone (bp 56oc) and methanol (bp 65oC).

(35.) (b) $CH_2=O$ is sp^2 -hybridised and Trigonal Planar in Shape.

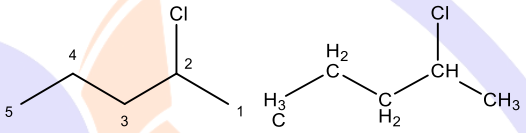
(36.) (a) $\overset{\oplus}{C}H_3$ is most stable because replacement of H-atom by Br increases $+$ ve charge on carbon atom and destabilises the species.

(37.) (a) $Fe_4\left[Fe(CN)_6\right]_3$ Ferri-ferro cyanide $Na+C+N \xrightarrow{\Delta} NaCN$

$2NaCN+FeSO_4 \rightarrow Fe(CN)_2+Na_2SO_4$ $\quad Fe(CN)_2+4NaCN \rightarrow Na_4\left[Fe(CN)_6\right]$

$3Na_4\left[Fe(CN)_6\right]+4Fe^{3+} \rightarrow Fe_4\left[Fe(CN)_6\right]_3+12Na^+$

(38.) (c) 2-Chloropentane, correct structure is



(39.) (d) $\left[Fe(CN)_5NOS\right]^{4-}$

(40.) (c) $\overset{*}{C}H_3-CH_2-Cl$ order of electronegativity of the attached group is $Cl>Br>C>Mg$ More electronegative group attached to the carbon will give more positive charge. So, (c) has greatest ($+$ ve) charge.

(41.) (a) Reason is correct explanation of Assertion.

(42.) (a) 3,3-diethylpentane $(CH_3CH_2)_4C$ has $4-CH_2$ groups so $4\times 2=8$ Secondary H-atoms.

(43.) (b) Correctexplanation:- C_6H_5COO is called benzoyloxy group & hence the name is correct.

(44.) (c) due to $+$ H Effect of alkyl group (More α Hydrogen)

(45.) (b) Four

$BrCH_2CH_2CH_2Br$
$BrCH_2-CHBr-CH_3$
$Br_2CHCH_2CH_3$
$CH_3CBr_2CH_3$

(46.) (d) % of Carbon $=\dfrac{12\times 0.198\times 100}{44\times 0.246}=21.95\%$ % of H $=\dfrac{2\times 0.1014\times 100}{18\times 0.246}=4.58\%$

(47.) (b) $\underset{6}{CH_3}-\underset{5}{CH}=\underset{4}{CH}-\underset{3}{CH_2}-\underset{2}{C}\equiv\underset{1}{CH}$

$C-1 \Rightarrow sp$

$C-3 \Rightarrow sp^3$

$C-5 \Rightarrow sp^2$

sp, sp^3, sp^2

(48.) (a) 7 isomers 4 are alcohols and 3 are ethers

$\left.\begin{array}{l} CH_3CH_2CH_2CH_2OH \\ CH_3CHOHCH_2CH_3 \\ (CH_3)_2CHCH_2OH \\ (CH_3)_3COH \end{array}\right]$ Alcohols

$\left.\begin{array}{l} CH_3OCH_2CH_2CH_3 \\ CH_3OCH(CH_3)_2 \\ CH_3CH_2OCH_2CH_3 \end{array}\right]$ ethers

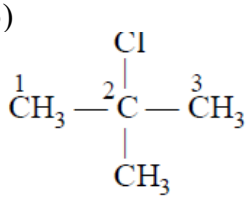
(49.) (b)

A → P	B → P	C → Q	D → R

(50.) (d) Propanoic acid

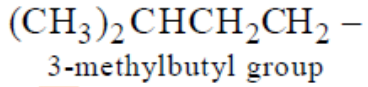
TOPIC WISE PRACTICE QUESTIONS - SOLUTIONS

1. (2) The compound is a derivative of butane.
2. 3)



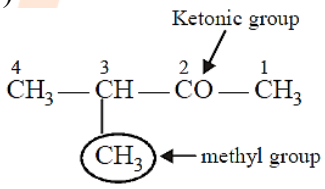
2-chloro-2-methyl propane

3. 1)
4. 4)



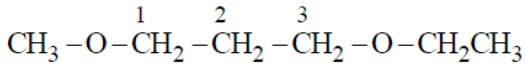
3-methylbutyl group

5. 1)



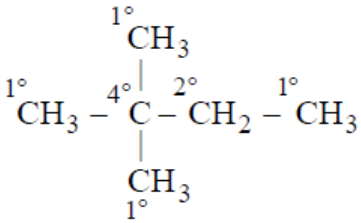
3-methyl-2-butanone

6. 3) 7. 3) 8. 2) 9. 2)
10. 2) The compound is a derivative of benzoic acid. The positions of substituents attached to benzene nucleus are represented by number of C-atoms and not by ortho, meta and para.
11. 2) 12. 2) 13. 3) 14. 1)
15. 1) It is derivative of ethanamide having N-phenyl group
16. 1)

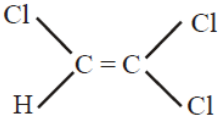


3-Ethoxy-1-methoxypropane

17. 3)
18. 2) The compound contains longest chain of 5C – atoms and e of ene is retained as the suffix name starts with constant
19. 3)
20. 4)

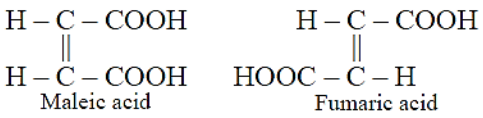


21. 1) $C_nH_{2n}O_2$ is general formula for carboxylic acids.
22. 3) Trichloroethene is Westrosol

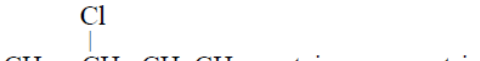


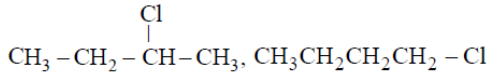
23. 2)

24. 4) Maleic acid and fumaric acids are geometrical isomers.



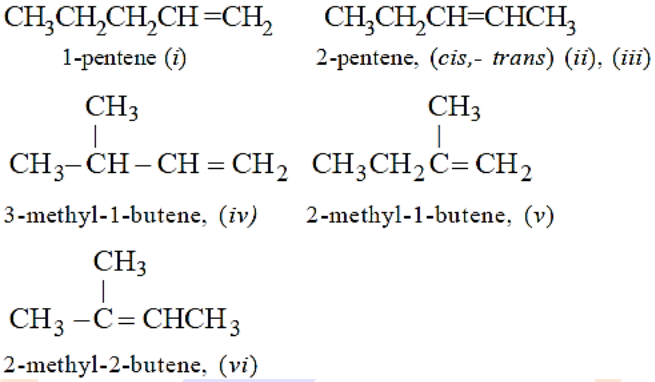
25. (4) It gives trans - 2 - butene.

26. 2)  contains asymmetric C - atom.

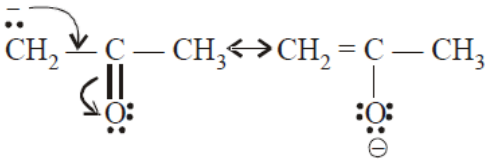


27. 1)

28. 3)C_5H_{10} has 1° degree of unsaturation since the isomers are acyclic, all of these are alkenes. For writing the isomers, first introduce the double bond at different possible positions, and then consider the possibility of branching in the alkyl group.



29. 1) Resolution



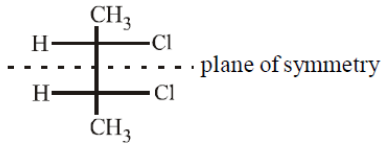
30. 1)

31. 3)

32. 1)

33. 2) Optical and geometrical isomerism pair up to exhibit stereoisomerism. This is because the isomers differ only in their orientation in space.

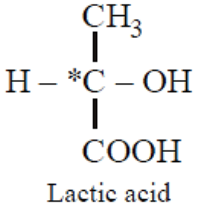
34. 2) The compound has two similar asymmetric C-atoms. It has plane of symmetry and exists in *meso* form.



meso - 2, 3 Dichlorobutane

35. 3)

36. 2) No. of optical isomers = 2^n (where n = No. of chiral atoms)

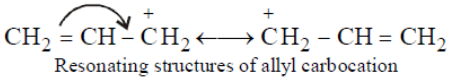


∴ No. of optical isomers of lactic acid = $(2)^1 = 2$

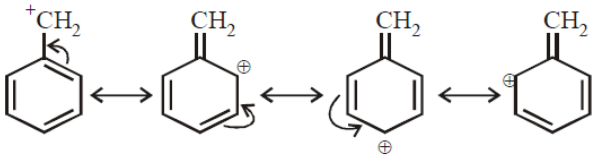
37. (4) Keto-enol tautomerism is shown by carbonyl compounds having a-hydrogen atom.

38. (4)

39. (2) Chiral conformation will not have plane of symmetry. Since twist boat does not have plane of symmetry it is chiral.
40. (2) Homolytic fission of the C – C bond gives free radicals in which carbon is sp^2- hybridised.
41. (2) In carbocations, carbon bearing positive charge is always sp^2-hybridised
42. (2) Stability order of different alkyl carbocations on the basis of hyperconjugation is :
$3° > 2° > 1° >$ methyl
In t-butyl cation, the C-atom bearing the positive charge is attached to three methyl groups therefore it possess nine a-hydrogens. It will give maximum nine hyperconjugative structures leading to maximum stability.
43. (4) Higher stability of allyl and aryl substituted methyl carbocation is due to dispersal of positive charge due to resonance

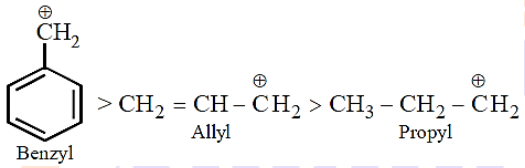


Resonating structures of allyl carbocation



Resonating structures of benzyl carbocation

whereas in alkyl carbocations dispersal of positive charge on different hydrogen atoms is due to hyperconjugation hence the correct order of stability will be

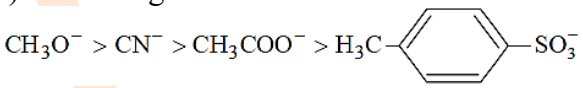


Benzyl

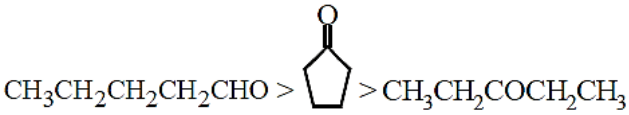
Allyl

Propyl

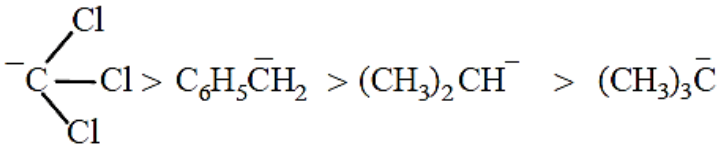
44. 2) The more the electrons withdrawing groups attached to - O atom, the more is the ease of leaving
45. 4)
46. 2) The stronger the base the more is the nucleophilic character and vice versa. Basic character



47. More is the electron - deficiency on the carbonyl carbon, greater will be the reactivity of the carbonyl compounds towards nucleophilic addition.

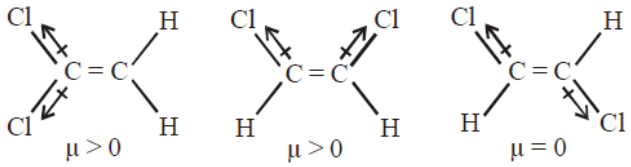


48. (2) Carboxylic acids are stronger acids than $-\overset{+}{N}H_3$ because the corresponding conjugate base ($-COO^-$) is more stable than $-NH_2$. Hence Y is the strongest acid. Since – COOH has – I effect which decreases with distance, therefore, effect is more pronounced in Z than in X. As a result, Z is more acidic than X. Hence the true option is Y > Z > X.
49. (2) Lone pair present at X can enter in the ring. This gives rise to double bond character in C – X bond attached to the ring .
50. (2) Structure 2) is a 3º carbocation, while 1) is 2º and 3) and 4) are 1º carbocations; thus 2) is the most stable.
51. (4)
52. 2)



–ve charge highly dispersed due to – I effect | –M effect delocalises –ve charge | +I effect of CH_3 group intensifies the –ve charge

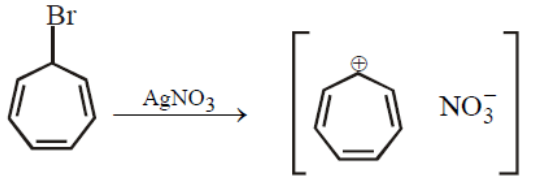
53. 1)
54. 2)
55. 2) The order of stability of free radicals
$(C_6H_5)_3C > (C_6H_5)_2CH > (CH_3)_3C > (CH_3)_2CH$
The stabilisation of first two is due to resonance and last two is due to inductive effect.
56. (1) active methylene has most acidic "H" atom.
57. 3)



(a) (b) (c)

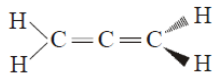
[Note : dipole moment is a vector quantity].

58. 3)

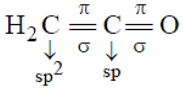


Salt has high dipole moment & stable due to aromatisation and has high R.E.

59. 3)
60. 3) The hydrogen atoms on terminal C-atoms lie in perpendicular planes and hence the molecule as a whole is non-planar.



61. (2)
62. (4) Aliphatic halides react by S_N2 mechanism.
63. (3) Write the expanded structure of the compound and count the total number of σ and π bonds with each carbon atom and assign hybridization state of each carbon atom, accordingly.

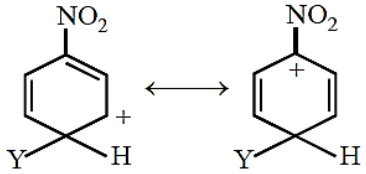


64. (1)
65. (2)
66. (2) Methyl carbanion is sp^3 hybridised, with three bond pairs and one lone pair, same is the case with NH_3.
67. (2) – I group destablises carbocation, and since inductive effect decreases with increasing length of carbon chain. Therefore 2) is the correct option.
68. (2) Due to + M effect of – OH group and hyperconjugation of – CH_3 group.
69. (3) More the no. of carbons more will be the heat of combustion.
70. (1)

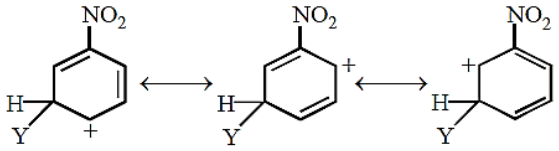
NEET PREVIOUS YEARS QUESTIONS-EXPLANATIONS

1. 4)

$-NO_2$ group is meta-directing group



(Less stable due to more e^- withdrawing effect of $-NO_2$)



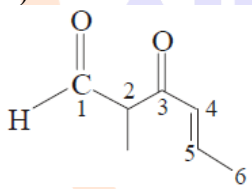
(More stable due to less e^- withdrawing effect of $-NO_2$) greater no. of resonating structures.

2. (1) – I effect increases on increasing electronegativity of atom. So, correct order of – I effect is $-NH_2 < -OR < -F$.
*Most appropriate answer is option (1), however option (2) may also be correct answer.

3. (3) Electron withdrawing – NO_2 group has very strong –I and –R effects so, compound 3 will be most acidic.

4. (3) Steam distillation is the most suitable method of separation of 1 : 1 mixture of ortho and para nitrophenols as there is intramolecular hydrogen bonding in o-nitrophenol.

5. 4)



3-keto-2-methylhex-4-enal ; Aldehydes get higher priority over ketone and alkene in numbering of principal carbon chain.

6. 3)

7. 4)

$CH_3 - C \equiv C^-$

$\left.\begin{matrix}\text{No.of } \sigma \text{ bp} - 1 \\ \ell\text{p} - 1\end{matrix}\right]$ 2 & hybridisation is *sp*

8. 1) Nucleophile is a species that provide electron while species which are deficient of electrons termed as lewis acid, hence nucleophiles are usually lewis bases.

9. (2) Wt. of organic substance = 0.25 g
$V_1 = 40$ mL, $T_1 = 300$ K ; $P_1 = 725 - 25 = 700$ mm of Hg
P2 = 760 mm of Hg (at STP) ; $T_2 = 273$ K

$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$; V_2 = Volume of nitrogen at STP $= \frac{273 \times 700 \times 40}{300 \times 760} = 33.52\text{mL}$

Percentage of nitrogen $= \frac{28 \times \text{volume of } N_2 \text{at STP} \times 100}{22400 \times \text{wt.of organic substance}} = \frac{28 \times 33.52 \times 100}{22400 \times 0.25} = 16.76\%$

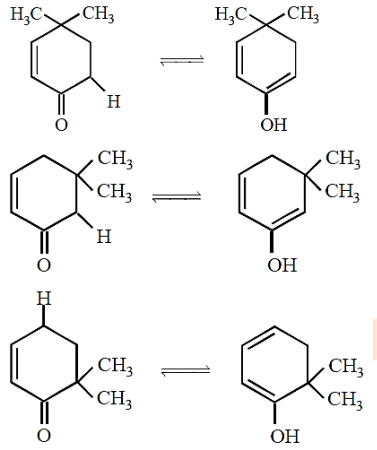
10. 2) π bond is transferred after leaving Cl^-

$CH_3-CH=CH\,CH_2-\overset{\curvearrowright}{Cl} \longrightarrow CH_3-\overset{\curvearrowright}{CH=CH}-\overset{\oplus}{C}H_2 \longrightarrow$

$CH_3-\overset{\oplus}{C}H-CH=CH_2$

11. (2) Only structure (III) has H in conjugation with free radical.
So, hyperconjugation is possible in III only.

12. (3) All of these compounds show tautomerism



13. (1) Tertiary butyl chloride will give the most stable tertiary carbonium ion among the other given compounds

14. 1)

$10\,mL,\ 1M\ H_2SO_4 = 20\,mL,\ 1M\ NH_3$

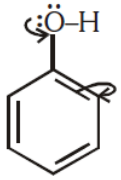
$\because$ wt of N in one mole $NH_3 = 14$

$\therefore\ 20 \times 10^{-3}\ mol\ NH_3 \longrightarrow 20 \times 10^{-3} \times 14$ nitrogen

$\therefore$ 0.75 g of sample contains

$$= \frac{14 \times 20 \times 10^{-3}}{0.75} \times 100 = 37.33\%$$

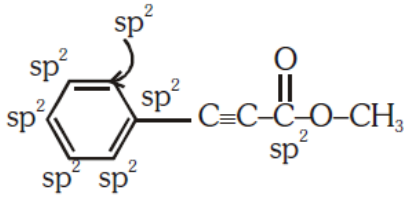
15. 4) In case of phenol lone pair of oxygen is delocalized in ring.



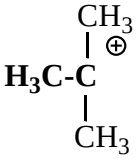
16. 3) Due to +H effect of alkyl group (more α H)

17. 1) Compounds purified by steam distillation which are immiscible in water but steam volatile.

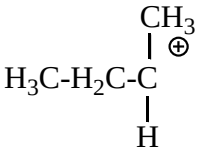
18. 3)



7-sp^2 carbons, 6 π bonds



19. 1) has 9 hyper conjugative structure

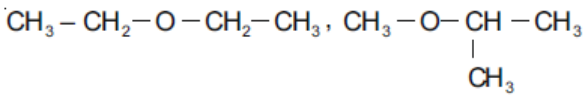


has 5 hyper conjugative structure.

20. 3)Paper chromatography is an example partition chromatography

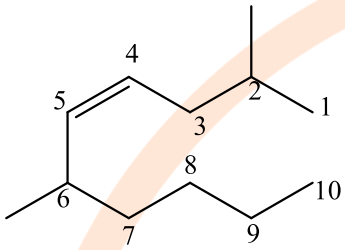
21. 2)Distillation method is generally used for the purification of metals having low boiling point such as Hg, Zn etc.

22. 3)Compounds with formula $C_4H_{10}O$ can be ethers which may exhibit metamerism. For example



and $CH_3—O—CH_2—CH_2—CH_3$ are metamers as structure of alkyl chains are different around the functional group.

23. 4)



24. Nitro, Azo and compounds with nitrogen in ring system will not answer Kjeldahl's method