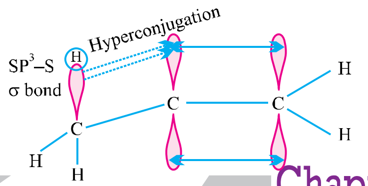


Chapter - 12

Organic Chemistry: Some Basic Principles And Techniques

- The branch of chemistry which deals with hydrocarbons and their derivatives is called organic chemistry.
- Carbon forms large number of organic compound because of its properties of catention and tetravalency.
- **Functional Group :** An atom or a group of atoms joined in a specific manner, which provides certain characteristics chemical properties to the organic compounds, is called functional group.
- **Homologues :** A group or series of an organic compound each containing a characteristics functional group from a homologous series and the members of the series are called "homologues".
- **Fission of a Covalent Bond :**

  (a) Homolytic cleavage : In this cleavaage, one of the electrons of the shared pair in a covalent bond goes with each of the bonded atoms.

$$Cl \cdot \!-\!\!-\! \cdot Cl \rightarrow \underbrace{l\dot{C} + \dot{C}l}_{\text{Free Radicals}}$$

  (b) Heterolytic cleavage : In heterolytic cleavage the bond breaks in such a fashion that the shared pair of electrons remains with one of the fragment.

$$H_3C \cdot \;\cdot Cl \rightarrow \underbrace{H_3\overset{+}{C} + \bar{C}l}_{\text{ions.}}$$

- **Electron Displacement Effects in Bovalent Bonds.**

  Inductive effect (I) : Polarisation of a bond caused by the polarisation of adjacent bond is referred to as the inductive effect.

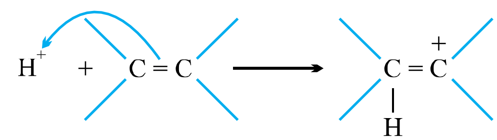
Two types of inductive effect → + Inductive effect (+ I)
→ – Inductive effect (– I)

$$\overset{\delta\delta\delta+}{CH_3} \rightarrow \overset{\delta\delta+}{CH_2} \rightarrow \overset{\delta+}{CH_2} \rightarrow \overset{\delta-}{Cl}$$

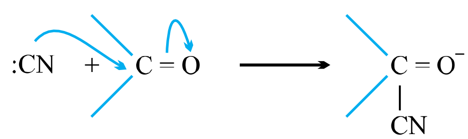
- It is a permanent effect and decrease with the increase in distance.

  – I effect : $—NO_2 > —F > —Cl > —Br > —I > —OCH_3 > – C_6H_5$

  + I effect : $—C(CH_3)_3 > — CH(CH_3)_2 > —C_2H_5 > —CH_3$
- **Electromeric effect :** The complete transfer of the shared pair of π electrons of a multiple bound to one of the atoms in the presence of the attracking reagen is called electromeric effect.
- If the transference of e^- towards attacking reagent **+ E effect.**
- If the transference of e^- takes place away from attacking reagent **– E effect.**

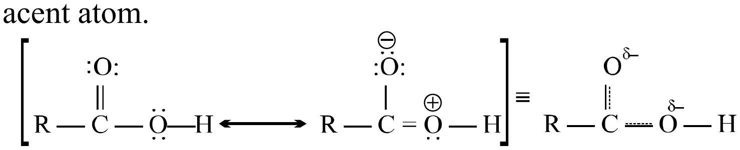


(+E – Effect)

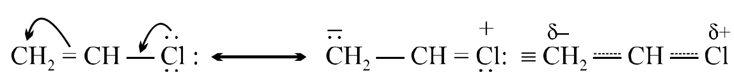


(– E –Effect)

- **Resonance effect (+ R effect) :** The polarity produced in the molecule by the interaction of two π-bond and lone pair of electrons present on an adjacent atom.



Contributing structure Hybrid structure

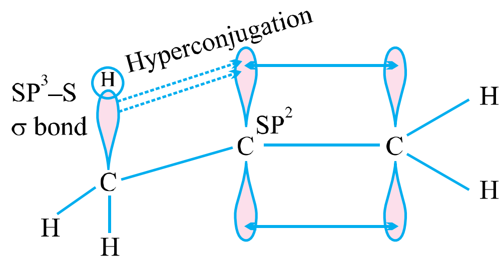


+ R Effect : —ÖH , —ÖR , —ṄH$_2$, —ṄHR etc

– R Effect : $—NO_2$, —COOH , —CHO , >C = O , —CN

- **Hyper conjugation :** It is special kind of resonance in which delocalisation of e^- takes place through overlap between σ-bond orbital and π-orbital.

  It is also called no bond resonance.

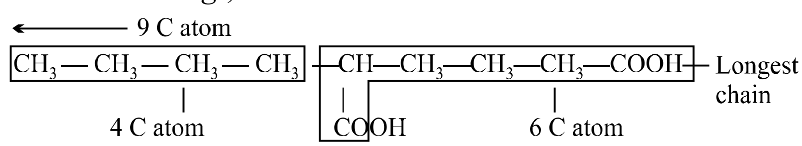


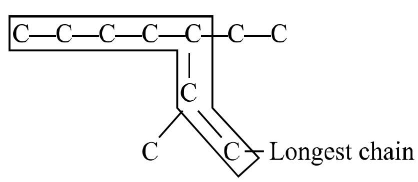
- **IUPAC Nomenclature of Organic Compounds :** Following rules are used to write the IUPAC name of an organic compound.

  Rule 1.

- **Longest chain rule :** The chain containing the principal functional group, secondary functional group and multiple bonds as many as possible is the longest possible chain.

  In the absence of functional group, secondary group and multiple bonds, the chain containing the maximum number of C-atoms will be the longest possible chain *e.g.*,





Choose the word root from the table given below for the longest possible chain.

Word Root for Carbon Chain

Chain length	Word root	Chain length	Word root
C_1	Meth-	C_7	Hept
C_2	Eth-	C_8	Oct
C_3	Prop-	C_9	Non
C_4	But-	C_{10}	Dec
C_5	Pent-	C_{11}	Undec
C_6	Hex-	C_{12}	Dodec

Rule 2

- **Lowest number rule :** Numbering is done in such a way so that :

  (1) branching if present gets the lowest number.

  (2) the sum of numbers of side chain is lowest.

  (3) principal functional group gets the lowest number.

  Select the principal functional group from the preference series :

  $—COOH > —SO_3H > —COOR > —COX > —CONH_2 > —CN > —NC > —CHO > C = O > —OH > —SH > —NH_2 > —OR > = > \equiv$

  Functional group other than the principal functional group are called substituents.

Rule 3

- **Naming the prefixes and suffixes :** Prefix represents the substituent and suffix is used for principal functional group.

  Primary prefixes are cyclo, bicyclo, di, tri, tetra, tetrakis etc.

Secondary prefixes are tabulated below :

Substituent	Prefix	Substituent	Prefix
—F	Fluoro	—N=N—	diazo
—Cl	Chloro	—N=O	nitroso
—Br	Bromo	$—NO_2$	nitro

Primary suffix are **ene, ane** or **yne** used for double, singe and triple bonds respectively.

Secondary suffixes are tabulated below :

S.No.	Class	Formula	Prefix	Suffix
1.	Acid halides	$\overset{\displaystyle O}{\underset{}{\overset{\Vert}{—C—X}}}$	halocarbonyl	—oyl halide
2.	Alcohols	—OH	hydroxy	—ol
3.	Aldehydes	—CHO	formyl —carbaldehyde	—al
4.	Ketones	C = O	oxo	—one
5.	Amides	$—CONH_2$	carbamoyl	—amide

6.	Amine	$—NH_2$	amino	—amine
7.	Carboxylic acid	—COOH	carboxy	—carboxylic acid
8.	Ester	—COOR	alkoxy carbonyl	—alkyl alkan**oate**
9.	Nitriles	—CN	cyano	—nitrile
10.	Sulphonic acid	$—SO_2—OH$	sulpho	—sulphonic acid

Here according to the rules, given above, the IUPAC name of a compound can be written as ⇒ Prefixes + Word root + Suffixes.

- **Primary prefix + secondary prefix + Word root + primary suffix + secondary suffix**

$$\text{for } e.g.,\ \overset{4}{CH_3}\ \underset{\boxed{OH}}{\overset{3}{CH}} — \overset{2}{CH_2}\ \boxed{\overset{1}{CHO}}\ \text{— Principal functional group (—al)}$$

OH — substituent (hydroxy)

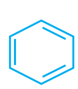
$$\underbrace{3 — \text{Hydroxy}}_{\text{prefix}}\underbrace{\text{but}}_{\text{word root}}\underbrace{\text{anal}}_{\text{suffix}}$$

- If more than two similar functional groups are present, all the groups are considered as substituent, for *e.g.*,

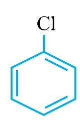
$$\underset{CN}{\overset{3}{CH_2}} — \underset{CN}{\overset{3}{CH}} — \underset{CN}{\overset{1}{CH_2}}$$

Propane-1, 2, 3-tricyanide

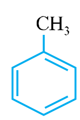
- **Naming of Aromatic compounds :** IUPAC accepted their common trivial names *e.g.*,



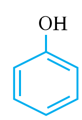
benzene



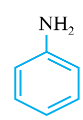
chlorobenzene



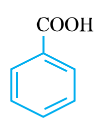
toluene



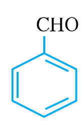
phenol



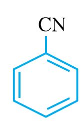
aniline



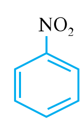
benzoic acid



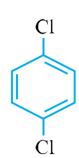
benzaldelyde



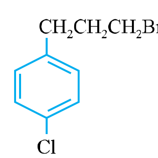
benzonitrile



nitrobenzene



1, 4-dichlorobenzene



1-bromo-3-(4-chlorophenyl)propane

- **Purification and Characterization of Organic Compounds :**

  (1) Lassaigne's test for nitrogen : Lassiagne's extract is heated with $FeSO_4$ solution in presence of alkali, the solution is cooled and acidified with dil. H_2SO_4. If a green or blue colouration is obtained, it confirms the presence of N in the organic compound. The chemistry of the test is :

  $$\underset{\text{From organic compound}}{Na + C + N} \longrightarrow NaCN$$

  $$2NaCN + FeSO_4 \rightarrow Fe[CN]_2 + Na_2SO_4; Fe[CN]_2 + 4NaCN \rightarrow \underset{\text{Sod. ferrocyanide}}{Na_4[Fe(CN)_6]}$$

  $$3Na_4[Fe(CN)_6] + 4Fe^{3+} \xrightarrow{xH_2O} \underset{\text{Ferric ferrocyanide (Prussian Blue)}}{Fe_4[Fe(CN)_6]_3.xH_2O} + 12Na^+$$

  This test is very delicate and is given by all compounds containing C and N. NH_2NH_2, NH_4C, $NaNO_3$ etc. do not respond to this test since they do not contain carbon.

  Formation of blood red colour indicates the presence of both N and S.

  $$\underset{\text{From organic compound}}{Na + C + N + S} \xrightarrow{\Delta} \underset{\text{Sod. thiocyanate or Sod. sulphocyanide}}{NaSCN}$$

  $$Fe^{3+} + \overset{+}{Na}\overset{-}{SCN} \rightarrow \underset{\text{Ferric thiocyanate (blood red colour)}}{[Fe(SCN)]^{2+}} + Na^+$$

- **Detection of sulphur :** If S is present, during fusion with Na metal, Na_2S is formed which may be tested as follows :

  (i) With sodium nitroprusside violet colouration is produced :

  $$Na_2S + \underset{\text{Sodium nitroprusside}}{Na_2[Fe(CN)_5(NO)]} \rightarrow \underset{\text{(Voilet colour)}}{Na_4[Fe(CN)_5(NOS)]}$$

  (ii) With lead acetate, black ppt. of PbS is formed.

  $$Na_2S + (CH_3COO)_2Pb \rightarrow PbS + 2CH_3COONa$$

- **Detection of halogens :**

  (a) Lassaigne's test : When the organic compounds is fused with Na metal, the halogens combine with Na to form sodium halides.

  The presence of these halides is tested with $AgNO_3$ solution.

  (i) A white ppt. soluble in NH_4OH indictes chlorine.

  (ii) A pale yellow ppt. partially soluble in ammonia indicates bromine.

(iii) A yellow ppt. insoluble in ammonia indicates iodine.

If the organic compound also contain N or S, the sodium extract is first boiled with dil. HNO_3 to decompose any cyanides or sulphides, otherwise these will form ppt. with $AgNO_3$ solution.

- **Detection of phosphorus :** Phosphorus is detected by fusing the organic compound with sodium peroxide, in which phosphorus is converted into sodium phosphate.

  The fused mass is extracted with H_2O and then boiled with conc. HNO_3 and then ammonium molybdate is added. Appearance of yellow ppt. or yellow colouration due to the formation of ammonium phosphomolybdate indicates the presence of phosphorus.

- **Estimation of carbon and hydrogen : Liebig's method :** A known mass of the organic compound is heated strongly with excess of dry copper oxide in a current of dry air or oxygen (free from CO_2) when carbon present in the organic compound compound is oxidised to CO_2 and hydrogen to H_2O.

  $$C + 2CuO \xrightarrow{\Delta} CO_2 + 2Cu;\ 2H + CuO \xrightarrow{\Delta} H_2O + Cu$$

  Percentage of carbon $= \dfrac{12}{44} \times \dfrac{\text{Mass of } CO_2 \text{ formed}}{\text{Mass of substance taken}} \times 100$

  Percentage of carbon $= \dfrac{2}{18} \times \dfrac{\text{Mass of } H_2O \text{ formed}}{\text{Mass of substance taken}} \times 100$

- **Estimation of nitrogen :**

  (a) Dumas method :

  $$C + 2CuO \xrightarrow{\Delta} CO_2 + 2Cu;\ 2H + CuO \xrightarrow{\Delta} H_2O + Cu$$

  $N + CuO \longrightarrow N_2$ + Small amounts of oxides of nitrogen

  Oxides of nitrogen $+ Cu \xrightarrow{\Delta} CuO + N_2$

  Percentage of nitrogen $= \dfrac{28}{22400} \times \dfrac{\text{Vol. of } N_2 (\text{in cm}^3) \text{ at STP}}{\text{Mass of substance taken}} \times 100$

  (b) Kjeldahl's method :

  $$\text{Organic compound} + H_2SO_4 \xrightarrow{\Delta} (NH_4)_2SO_4 \xrightarrow[\Delta]{2NaOH} Na_2SO_4 + 2NH_3 + 2H_2O$$

  $$2NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$$

Percentage of nitrogen :

$$= \frac{1.4 \times \text{Molarity of the acid} \times \text{Vol. of acid used} \times \text{Basicity of the acid}}{\text{Mass of substance taken}}$$

- **Estimation of halogens : (Carius method) :**

  Percentage of chlorine $= \frac{35.5}{14.5} \times \frac{\text{Mass of AgCl formed}}{\text{Mass of substance taken}} \times 100$

  Percentage of bromine $= \frac{80}{188} \times \frac{\text{Mass of AgBr formed}}{\text{Mass of substance taken}} \times 100$

  Percentage of iodine $= \frac{127}{235} \times \frac{\text{Mass of AgI formed}}{\text{Mass of substance taken}} \times 100$

- **Percentage of sulphur** $= \frac{32}{233} \times \frac{\text{Mass of } BaSO_4 \text{ formed}}{\text{Mass of substance taken}} \times 100$

- **Estimation of phosphorus :** A known mass of the organic compound is heated with fuming HNO_3 in a Carius tuble when phosphorus of the organic compound is oxidized to H_3PO_4. Phosphoric acid thus formed is precipitated as magnesium ammonium phosphate by adding magnesia mixture (a solution containing $MgCl_2$, NH_4Cl and NH_4OH.)

  Percentage of phosphorus : $\frac{62}{222} \times \frac{\text{Mass of } Mg_2P_2O_7 \text{ formed}}{\text{Mass of substance taken}} \times 100$

- **Estimation of oxygen :** A definite mass of an organic compound is decomposed by heating with N_2 gas. The mixture is then passed over red hot coke when all oxygen is converted to CO. This mixture is then passed through I_2O_5 when CO is oxidised to CO_2 producing iodine. The % of oxygen can be derived from the amount of CO_2 or I_2 produced.

  Percentage of oxygen : $\frac{16}{44} \times \frac{\text{Mass of } CO_2 \text{ formed}}{\text{Mass of substance taken}} \times 100$

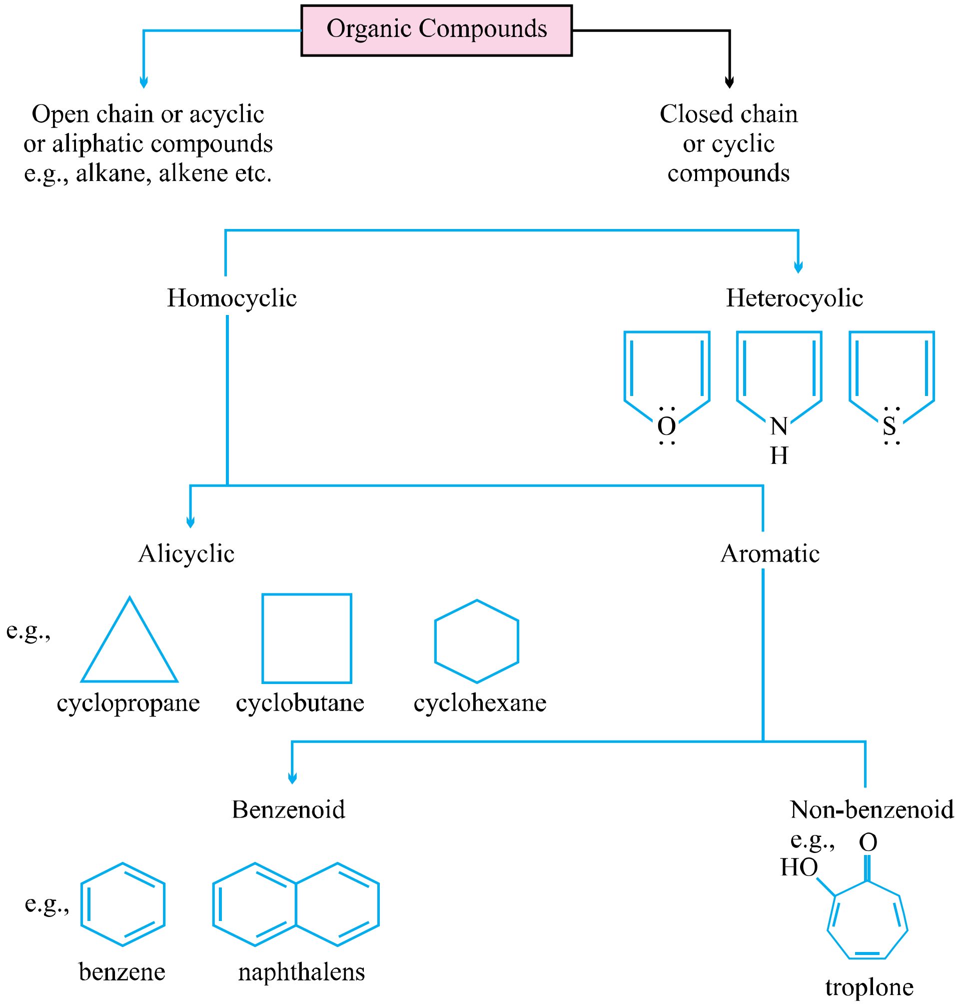
Method of Purification of organic compounds :

- **Crystallisation :** Process of solidification of a pure substance from its dissolved state. This method is based upon differences in their solubility in a given solvent or in mixture of solvents.

- **Sublimation :** It is a process of conversion of a solid into gaseous state on heating without interchaning into liquid. The process is used for the separation of volatile solids, which subline on heating from the non-volatile solids.
- **Distillation :** It is a process of conversion of a liquid into vapours by heating followed by condensation of vapours. The method is used for the purification of liquids which boil without decomposition and are present with non-volatile impurities.
- **Fractional distillation :** Process used to separate mixture of two or more miscible liquids having different boiling points. It is mainly used in distillation of petroleum, coaltar and crude alcohol.
- **Distillation under reduced pressure :** This process is used when the liquid has a tendency to decompose near its boiling point. Under reduced pressure, the liquid will boil at a low temperature without decomposing.
- **Steam distillation :** Purification of a substance from non-volatile impurities provided the substance itself is volatile in steam and insoluble in water.
- **Chromatography :** Technique of separating the consitituents of a mixture by the differential movement of individual components through the stationary phase under the influence of mobile phase. Two types of chromatography.

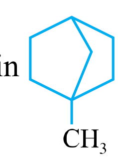
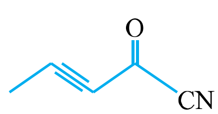
Chromatography

- Adsorption Chromatography
  - Column
  - Thin layer (TLC)
- Partition Chromatography
  - Paper chromatography



1-Mark Questions

Some Basic Concepts of Organic Chemistry

1. Identify the most electronegative element in CH_2FCl.
2. Write the hybrid orbitals used by 'C' in ethene .
3. Identifiy the tertiary (3°) and quarternary (4°) carbon in 
4. How many σ and π bonds are there in 
5. What is the functional group of (i) an aldehyde (ii) a nitro compound ?

2-Mark Questions

6. How many σ and π bonds are present in each of the following molecules ?

   (a) $HC \equiv CCH = CHCH_3$ (b) $CH_2 = C = CH—CH_2CH_3$

   [**Ans.** (a) $\sigma = 10, \pi = 3$ (b) $\sigma = 12, \pi = 2$]

7. Mention the hybridisation of C* and shape of the compound.

   (a) $H_2C^* = O$ (b) $CH_3—C^* \equiv N$

8. Which bond in more polar in the following pair of molecules :

   (a) $CH_3—H$ or $CH_3—Br$ (b) $CH_3—NH_3$ or $CH_3—OH$

9. Draw formula of first four members of homologeous series begining with the compound $CH_2 = CH_2$.

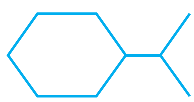
10. (a) Why does carbon exhibit catenation to maximum extent ?

    (b) Give hybridization of each carbon in following compound $CH_2=CH—CN$.

1-Mark Questions

Nomenclature

1. Write the IUPAC name of

   (a) 

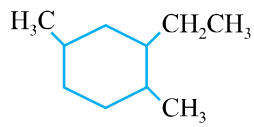
$$\begin{array}{l} \qquad\quad CH_3 \\ \qquad\quad\ | \\ \text{(b)}\ CH_3—C—CH = CH — CH_2 — COOH \\ \qquad\quad\ | \\ \qquad\quad CH_3 \end{array}$$

2. Draw structure of 3-isopropyl-2-methylhexane.

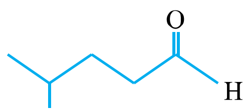
3. Write the structure of compound that contains both 1° and 2° alcohol.

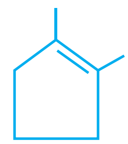
4. Give IUPAC name of following :

$$\begin{array}{l} \qquad\quad CH_2 — CH_3 \qquad\qquad\quad CH_3 \quad CH_2CH_3 \\ \text{(a)} \qquad\ | \qquad\qquad\qquad\qquad\quad\ | \qquad\quad | \\ CH_3 — CH — CH_2 — CH_2 — CH — CH — CH_2CH_3 \end{array}$$

(b) 

5. Give IUPAC name of following bond-line formulae :

(a) 

(b) 

2-Mark Questions

6. Write the correct order of priority of the following functional groups :

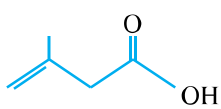
$$-C \equiv N, \quad -\overset{O}{\overset{\|}{C}}-, \quad -OH, \quad -\overset{O}{\overset{\|}{C}}-OH$$

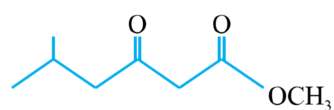
7. Write the structural formula of :

(i) O-Ethylanisole

(b) 4-ethyl-1-fluoro-2-nitrobenzene

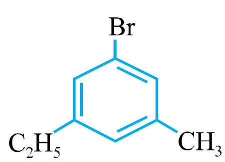
8. Identify the functional groups in :

(a) 

(b) 

9. Give IUPAC name of following :

(a) $$\begin{array}{l} CH_3-(CH_2)_3-\underset{\displaystyle |}{CH}-CH(CH_3)-CH(CH_3)_2 \\ \qquad\qquad\qquad\quad CH_2-CH_2-CH(CH_3)_2 \end{array}$$

(b) 

10. Give condensed and bond-line structural formulae and identify the functional group(s) present, if any for :

(a) Cyclo octa-1, 5-dine

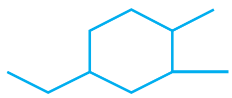
(b) 2(4-isobutylphenyl) propanoic acid

3-Mark Questions

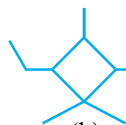
11. Draw the structure of :

    (a) Pent-3-enoic acid
    (b) 4-Methylpentanone
    (c) 4-Ethyl-3-fluorophenol.

12. Write the IUPAC name of the following compound :



(a)



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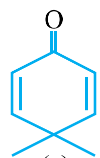


(c)

1 Mark Questions

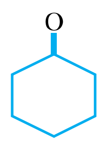
Isomerism

1. Write functional isomer of molecular formula C_3H_6O.
2. Write tautomeric form of following structures :

(a)

$$CH_3 - \overset{\overset{\displaystyle O}{\|}}{C} - CH_3$$

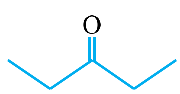
(b)



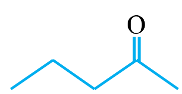
3. Identify the chiral carbon in the given compound CH_3—CHOH—CH_2—CH_3.

2 Mark Questions

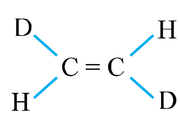
4. What is the relationship between the members of the following pairs of structures ?



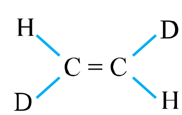
(a)



(b)



(c)



(d)

5. Write all the possible isomers of the aromatic compound C_8H_{10}.

1 Mark Questions

Concepts in Reaction Mechanism

1. Identify electrophilic centre in CH_3CHO.
2. Identify nucleophilic centre in CH_3Br.

3. Arrange the following in decreasing order of stability :

$\dot{C}H_3$, $(CH_3)_2\dot{C}—CH_2CH_3$, $CH_3—CH_2—\dot{C}H_2$

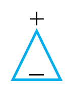
4. Which species can act as an acid and why ?

$CH_3—O^-$ or $CH_3—OH$

5. What types of attacking reagents are produced by heterolytic cleavage of bonds ?

6. Out of CH_3COOH and NO_2CH_2COOH which is more acidic in nature and why ?

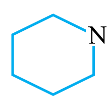
7. Identify the most stable carbonation among the following :

$H_2C=\overset{+}{C}H$,  , $CH_3—CH=\overset{+}{C}H$, $\overset{+}{C}H_3$

8. Identify the weakest nucleophile among the following :

$\overset{-}{N}H_2, CH_3—\overset{-}{N}—CH_3, CH_3—\overset{-}{N}H$

9. Select the nucleophile and electrophile in the following :

 N – H, BF_3

10. Give reason $(CH_3)_3C^+$ is more stable than $CH_3\overset{+}{C}H_3$ and $\overset{+}{C}H_3$.

2 Mark Questions

11. Mark the electrophillic centre in the following molecules :

CH_3CN, CH_3I, CH_3CHO, CH_3CH_2OH

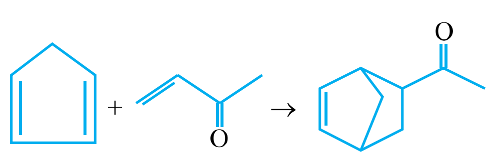
12. Benzyllic free radical is more stable than allylic free radical. Explain with resonance.

13. Classify each of the following carbon intermediates :

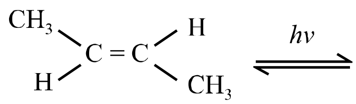
(a) $(CH_3)_3C^{\cdot}$ (b) $CH_3—\overset{\ominus}{C}H—CH_3$

(c) $CH_2=CH—\overset{+}{C}H_2$ (d) $\ddot{C}Cl_2$

14. Classify whether the following reaction is rearrangement addition, or elimination ?



15. Write the product of following reaction.

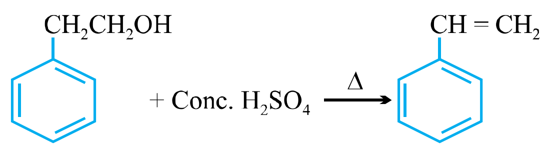
(1) 

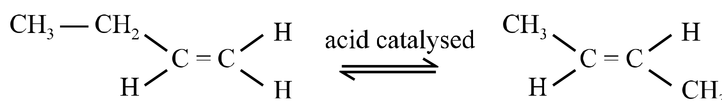
(2) $CH_3CH_2CH_2CH_3 \xrightarrow[\text{Heat}]{AlCl_3}$

5 Mark Questions

16. Write structure of various carbocation that can be obtained from 2-methylbutane. Arrange thee carbocation in order of increasing stability.

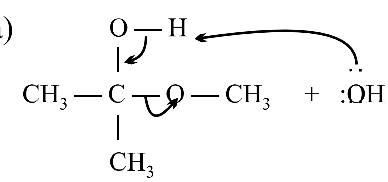
17. Classify the reaction type as elimination, rearrangement addition and substitution.

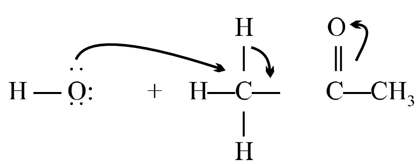
(a) 

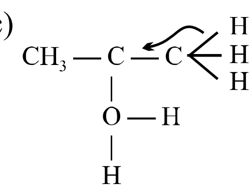
(b) 

(c) $CH_3—CH(Br)—CH(CH_3)_2 \xrightarrow{\text{aq. KOH}} CH_3CH_2—\overset{\overset{\large OH}{|}}{C}—(CH_3)_2$

18. Follow the flow of electrons indicated by the curved arrows and predict the products :

(a) 

(b) 

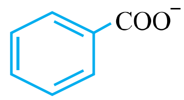
(c) 

19. Name the electrophile/nucleophile generated by following species :

(a) $HNO_3 + H_2SO_4$ (b) CH_3COCl

(c) alc. KCN

20. Identify the nucleophiles, electrophiles and free radicals amongst the following :

Cl^+, BF_3, $(CH_3)_3N$, $\dot{C}H_3$, 

21. Which is more stable and why ?

(a) $C_6H_5\overset{+}{C}H_2$ or $C_6H_{11}\overset{+}{C}H_2$ (b) $(C_6H_5)_2\dot{C}H$ or $C_6H_5\dot{C}H_2$

(c) $C_6H_5\dot{C}H_2$ or $CH_2=CH—\dot{C}H_2$

5 Mark Questions

1. Arrange the following according to given property :

$CH_3\overset{+}{C}H_2, C_6H_5\overset{+}{C}H_2, (CH_3)_3C^+, CH_2=CH\overset{+}{C}H_2$

(dereasing order of stablity)

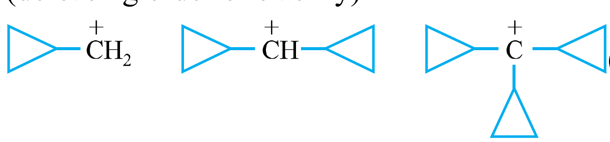
2. $HC\equiv\overset{-}{C}, CH_2=\overset{-}{C}H, CH_3-\overset{-}{C}H_2, \overset{-}{C}H_3$ (increasing order of stability)

3. $C_6H_5\dot{C}HCH_3, C_6H_5CH_2\dot{C}H_2, C_6H_5\dot{C}(CH_3)_2$

(increasing order of stability)

4. $CH_3\overset{+}{C}H—CH_3, CH_3—\overset{+}{C}H—OCH_3, CH_3\overset{+}{C}H—\overset{O}{\overset{\|}{C}}—OCH_3$

(dereasing order of stablity)

5. 

(decreasing order of stablity)

2-Mark Questions

Electronic Displacement in Covalent Bond

1. Name the kind of effect that operates to explain the stability of carbocations.
2. Why inductive effect is also called transmission effect ?

3. Which permanent effect of organic compound is also known as 'No bond resonance effect' ?

4. Which is correct and why ?

$$>C=C< \; + E^+ \qquad \text{Or} \qquad >C=C< \; + E^+$$

5. Write resonating structure of the following and show the movement of electron by curved arrows :

(a) $CH_3—COO^-$ (b) $CH_2 = CH—Cl$

2 Mark Questions

6. Draw the resonating structure of :

(a) $N \equiv \overset{+}{N} — \overset{-}{\ddot{N}} — H$ (b) $CH_3 — \overset{\overset{:O:}{\|}}{C} — \overset{\bar{\cdot\cdot}}{C}H_2$

7. Write resonance structure of :

(a) $C_6H_5NH_2$ (b) $C_6H_5NO_2$

8. Explain why alkyl groups acts as e^- donar when attached to a π-system.

9. Resonance structures of propenal are given below. Which of these resonating structure is more stable ? Give reason.

$$\underset{\text{(I)}}{CH_2 = CH—CH = O} \longleftrightarrow \underset{\text{(II)}}{\overset{+}{C}H_2—CH{=}CH—\overset{-}{C}}$$

10. Explain the following terms :
   (a) Electromeric effect (b) Hyperconjugation

11. (a) Explain + I and – I effect.
   (b) Select the group giving + I effect and – I effect from the following list :
   (i) $—NO_2$ (ii) $—CN$ (iii) Cl^- (d) CH_3^-

12. Explain the importance of inductive effect in determination of acidic or basic strength of substances.

13. Write resonance structure of $CH_2= CH—CHO$. Indicate relative stability of the contributing structures.

5-Mark Questions

1. Give reason for the following :

(a) Chlorobenzene is o^- and p^- directing towards the electrophillic substitution reaction.

(b) Inductive effect decrease with the increase in distance.

(c) Hyperconjugation effect is extended form of resonance effect.

2. Arrange the following according to given property :

(a) —NO_2, —COOH, —F, —CN, —I (increasing order of – I effect)

(b) CH_3—, $(CH_3)_2C$—, $(CH_3)_2CH$—, CH_3CH_2—

(decreasing order of + I effect)

Purification Methods

1 Mark Questions

1. What conditions must be satisfied by a suitable solvent in the crystallization method ?
2. Which technique can be used for purification of iodine that contains traces of NaCl ?
3. When do we use hot water funnel for filteration ?

   [**Hint :** When organic substance crystallises during filtration.]
4. A liquid (10 mL) has three components A, B, C. Which technique is most suitable to separate A, B, C from such a small amount of mixture ?
5. A substance has boiling point 355 K, but it starts decomposing near this temp. Which type of distillation process is suitable for its purification ?
6. Name the adsorbent used in column chromatography.
7. Which technique can be used to seperate napthlene from kerosene oil present in its mixture ?
8. A mixture contains nitrobenzene and benzoic acid. How can this mixture be separated into its constituents by technique of extraction using appropriate chemical reagent ?

   [**Hint** : By using hot water as solvent and adopting differential extraction.]

2 Mark Questions

9. The R_f value of A and B in a mixture determined by TLC in a solvent mixture are 0.65 and 0.42 respectively. If the mixture is separated by column chromatography using the same solvent mixture as a mobile phase, which of the two components A or B will elute first ? Explain.

   [**Hint :** A will elute first because it has more R_f value.]
10. Name a suitable technique of separation of the components from a mixture of :

    (a) Water and aniline.

    (b) Methanol and Propanone.

Qualitative and Quantitative Analysis

2-Mark Questions

1. A student was given the compound $C_6H_4(NH_2)SO_3H$ for elemental analysis, while performing Lassaigne's test for N, what colour will he get and why ?
2. Why diazonium salts do not show sodalime test for nitrogen ?

   [**Hint :** Because salts do not liberate NH_3 gas under there conditions.]
3. What is the function of fusing the organic compound with sodium metal ?
4. If silver nitrate solution is added to chlorobenzene, will there be formation of white ppt.
5. Name the oxidising agent used in the combustion tube along with the organic compound. [**Ans.** CuO]

2-Mark Questions

6. Why is it necessary to boil Lassaigne's extract with HNO_3 before testing it for halogens ?
7. 0.25 g of an organic compound containing C, H and O was analysed by the combustion method. The increase in the man of calcium chloride tube and the potash bulbs at the end of the operation was found to be 0.15 g and 0.1837 g respectively. Calculate the percentage composition of the compound.
8. Will CCl_4 give white precipitate of AgCl on heating it will silver nitrate ? Give reason.
9. For which type of compounds Kjeldahl's method is not applicable ?
10. 0.90 of an organic compound on combustion 2.64 g of CO_2 and 0.63 g of H_2O. Calculate the percentage of C and H in the compound.

3-Mark Questions

11. What will happens if a student acidifies the Lassaigne's extract with dil. H_2SO_4 in place of dilute HNO_3. Write the reaction involved.
12. (a) In DNA and RNA, nitrogen atom is present in the ring system. Can Kjeldahl's method is used for the estimation of N-present in these. Give reasons.

    (b) Why is it necessary to use ethanoic acid and not sulphuric acid for acidification of sodium extract for testing sulphur by lead acetate test ?

13. 0.2325 g of an organic compound was analysed for nitrogen by Duma's method. 0.0317 L of moist nitrogen was collected at 25°C and 755.8 mm pressure calculate the percentate of nitrogen.

[**Ans.** Aq. tension of water at 25°C is 23.8 mm Hg]

5-Mark Questions

14. (a) Out of the different gases formed in Duma's method, which gas is not observed over an aqueous solution of KOH.
    (b) What is the function of adding small amount of K_2SO_4 and a little amount of Hg or $CuSO_4$ is Kjeldahl's flask ?
    (c) Explain why a solution of KOH used to absorb CO_2 evolved during the estimation of carbon in an organic compound.
    (d) An organic compound contain diazo group (—N=N—) or nitro group or 'N' in the ring. Name the method used to estimate nitrogen in the compound.
    (e) In victor Meyer's method, what is the gas collected in the gas jar ?

[**Hint :** Oxygen gas]

15. (a) 0.4 g of the compound was Kjeldahl's and ammonia evolved was absorbed into 50 ml of $\frac{M}{4}$ H_2SO_4 solution. The residual acid solution was diluted with distilled water and the volume was made upto 150 ml. 20 ml of this diluted solution required 31 ml of $\frac{M}{20}$ NaOH solution for complete neutratization. Calculate the % of N is compound.[**Ans.** 46.8%]
    (b) Write the formula for the prursian blue colour obtained during Lassaigne's test for nitrogen.
    (c) Give test to detect the presence of sulphur in compound.