KD EDUCATION ACADEMY (9582701166

Time : 3 Hour 20 Minute | STD 11 Science Chemistry
kd 90+ ch- 8 organic chemistry | Total Marks : 160

*** Choose The Right Answer From The Given Options.[1 Marks Each]** **[68]**

1. Homolyte fission leads to formation of:

(A) Nucleophile. (B) Carbanion. (C) Free radical. (D) Arbocation.

Ans. :

c. Free radical.

Explanation:

$$cl - cl \xrightarrow{hv} 2c\dot{l}$$

2. Which functional group is present in a molecule of $CH_3OCH_2CH_3$?

(A) Ether (B) Carboxyl (C) Aldehyde (D) Ester

Ans. :

a. Ether

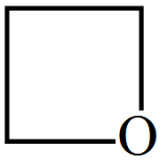
Explanation:

The functional group present in $CH3-O-CH_2CH_3$ is an ether group $-O-$.

Note: In general, ethers can be represented as $R-O-R'$.

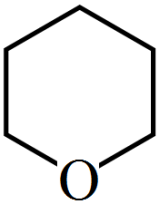
3. Which of the following is a homocyclic alicyclic compound?

(A)

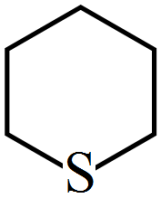


(B)

(C)

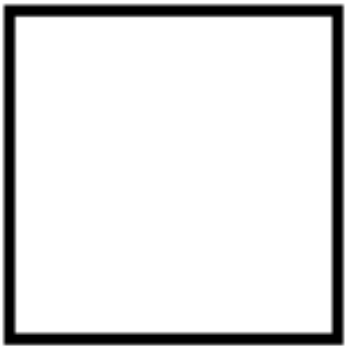


(D)



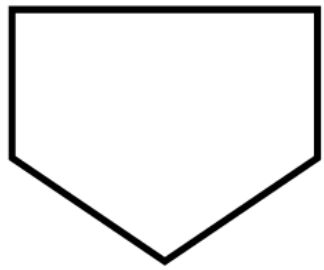
Ans. :

b.

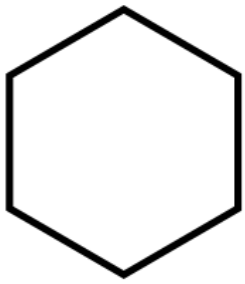


ExPlanation:

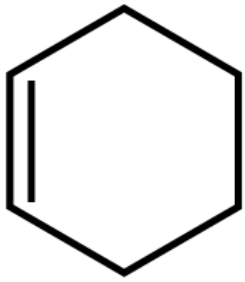
Alicyclic (aliphatic cyclic) compounds contain carbon atoms joined in the form of a ring. Homocyclic means it contains only C-atoms in the ring, e.g.



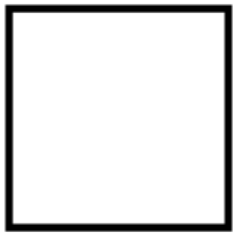
Cyclopentane



Cyclohexane



Cyclohexene



Cyclobutane

4. The fragrance of flowers is due to the presence of some steam volatile organic compounds called essential oils. These are generally insoluble in water at room temperature but are miscible with water vapour in vapour phase. A suitable method for the extraction of these oils from the flowers is:

(A) Distillation.
(B) Crystallisation.
(C) Distillation under reduced pressure.
(D) Steam distillation.

Ans. :

d. Steam distillation.

Explanation:

Essential oils are insoluble in water, soluble in steam and have high vapour pressure. Therefore, they can be separated by steam distillation.

5. $CH_3 - CH = CH - C \equiv CH$ has IUPAC name:

(A) pent - 2 - en- 4 - yne
(B) pent - 4 - yn - 2 - ene
(C) pent - 1 - yn - 3 - ene
(D) pent - 3 - en - 1 - yne

Ans. :

d. pent - 3 - en - 1 - yne

6. Passing H_2S gas into a mixture of Mn^{2+},Ni^{2+},Cu^{2+},Hg^{2+} ions in acidified aqueous solution precipitates:

(A) CuS and HgS
(B) MnS and CuS
(C) MnS and NiS
(D) NiS and HgS

Ans. :

a. CuS and HgS

Explanation:

Cu^{2+} and Hg^{2+} lie in IInd group of qualitative analysis H_2S in acid medium is reagent for it.

$HCl \rightarrow H^+ + Cl^-$

$H_2S \leftrightharpoons 2H^+ + S^{2-}$

7. The indicator which is used to find the strength of caustic soda solution with the help of oxalic acid is:

(A) Methyl orange
(B) Phenolphthalein
(C) Potassium permanganate
(D) None of the above

Ans. :

b. Phenolphthalein

Explanation:

An indicator is a chemical substance that undergoes a colour change at the endpoint. The endpoint of an acid-base titration can be determined using acid-base indicators.

Acid Base indicators are either weak organic acids or weak organic bases. The colour change of an indicator depends on the pH of the medium.

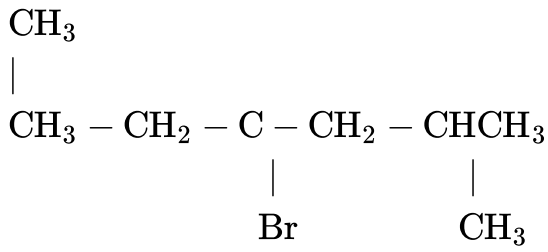
The un-ionized form of an indicator has one colour, but its ionized form has a different colour.

Phenolphthalein is used to find the strength of caustic soda solution with the help of oxalic acid.

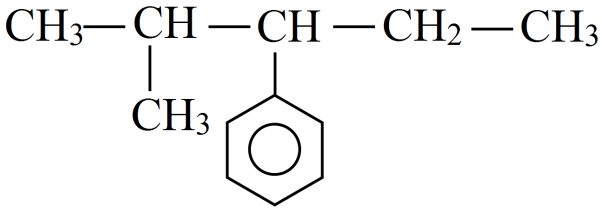
8. Which of the following is not in accordance to IUPAC system?

(A) $Br - CH_2 - CH = CH_2$

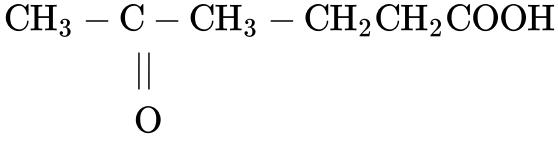
1-bromoprop 2-ene

(B) 

4-bromo-2, 4-dimethyle hexane

(C) 

2-methyl-3-phenylpentane

(D) 

5-oxohexanoic acid

Ans. :

a. 

1-bromoprop 2-ene

9. The order of priority in IUPAC system:

(A) $-CONH_2, -CHO, -SO_3H, -COOH$

(B) $-COOH, -SO_3H, -CONH_2, -CHO$

(C) $-SO_3H, -COON, -CONH_2, -CHO$

(D) $-CHO, -COOH, -SO_3H, -CONH_2$

Ans. :

c. $-SO_3H, -COON, -CONH_2, -CHO$

10. Which is not the characteristic of $\pi-$bond?

(A) π bond is formed when a sigma bond already exists.

(B) π bonds are formed from hybrid orbitals.

(C) π bond may be formed by the overlapping of p orbitals.

(D) π bond results from lateral overlap of atomic orbitals.

Ans. :

b. π bonds are formed from hybrid orbitals.

Explanation:

π bond is formed between two atoms if a sigma bond already exists between them.

π bonds are formed only by pure orbitals (p−orbitals), not from hybrid orbitals.

They formed by lateral or sideways overlapping.

11. The carbocation stability is:

$\overset{+}{C}H_3 < CH_3\overset{+}{C}H_2 < (CH_3)_2\overset{+}{C}H < (CH_3)_3\overset{+}{C}$

and alkyl radical stability is:

(A) $\dot{C}H(CH_3)_2 < \dot{C}H_3 < \dot{C}H_2CH_3 < \dot{C}(CH_3)_3$

(B) $\dot{C}H(CH_3)_3 < \dot{C}H(CH_3)_2 < \dot{C}H_3 < \dot{C}H_2CH_3$

(C) $\dot{C}H(CH_3)_3 < \dot{C}H(CH_3)_2 < \dot{C}H_2CH_3 < \dot{C}H_3$

(D) $\dot{C}H_3 < \dot{C}H_2CH_3 < \dot{C}H(CH_3)_2 < \dot{C}(CH_3)_3$

Ans. :

d. $\dot{C}H_3 < \dot{C}H_2CH_3 < \dot{C}H(CH_3)_2 < \dot{C}(CH_3)_3$

12. The trends in physical properties of compounds within a homologous series are due to:

(A) Change in size (B) Change in weight

(C) Functional group (D) Both a and b

Ans. :

d. Both a and b

Explanation:

The trends in physical properties of compounds within a homologous series are primarily due to the progression of sizes and therefore, weights of the molecules that form the homologous series.

13. The colour of bromine solution is:

(A) Red (B) Purple (C) Green (D) Blue

Ans. :

a. Red

Explanation:

Bromine is a chemical element with symbol Br and atomic number 35.

It is the third-lightest halogen, and is a fuming red-brown liquid at room temperature that evaporates readily to form a similarly coloured gas.

14. Group showing strongest +M effect:

(A) $-NH_2$ (B) $-N(CH_3)_2$ (C) $-NHCH_3$ (D) $-O^-$

Ans. :

d. $-O^-$

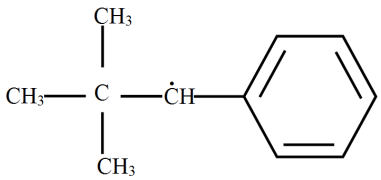
Explanation:

(-) charge is a stronger donor than lone pairs hence the strongest +M effect is shown by $-O^-$.

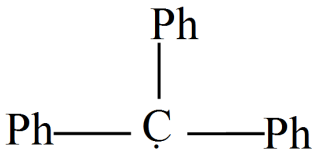
Also, the other species does not contain any negative charge thus option D is correct.

15. Consider the following compounds

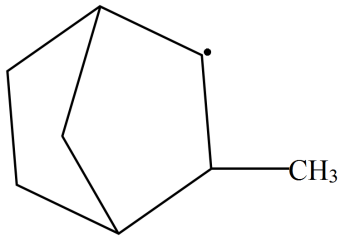
i.



ii.



iii.



Hyper conjugation occurs in:

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

Ans. :

a. III

Explanation:

Because it has 'H' in conjugation with free radical.

OR

Hyperconjugation occurs through the H- atoms present on the carbon atom next to the double bond i.e alpha hydrogen atoms. There is no alpha -H in the structure I and II. So, hyperconjugation occurs in structure III only ie.

16. On complete combustion, 0.246g of an organic compound gave 0.198g of carbon dioxide and 0.1014g of water. The percentage composition of carbon and hydrogen in the compound respectively are:

	%C	%H
(a)	21.95	4.58
(b)	21.95	5.58
(c)	11.95	5.58
(d)	11.95	4.58

Ans. :

	%C	%H
(a)	21.95	4.58

Explanation:

Given mass of CO_2 = 0.198g and mass of H_2O = 0.1014g

As we know % of $\mathrm{C} = \frac{12}{44} \times \frac{\mathrm{m_{CO_2}}}{\mathrm{w}} \times 100$

Percentage of carbon $= \frac{12 \times 0.198 \times 100}{44 \times 0.246} = 21.95\%$

Also, $\%$ of $\mathrm{H} = \frac{2}{18} \times \frac{\mathrm{m_{H_2O}}}{\mathrm{w}} \times 100$

Percentage of hydrogen $= \frac{2 \times 0.1014 \times 100}{18 \times 0.246} = 4.58\%$

17. Which of the following statements is incorrect regarding the naming of complex compounds?

(A) NH^{2-}, will be named as 'amido'

(B) 'en' will be named as 'ethylenediamine'

(C) $C_2O_2S_2^{2-}$ will be named as 'dithio oxalato'

(D) CH^{3-} will be named as 'methyl'

Ans. :

a. NH^{2-}, will be named as 'amido'

Explanation:

$$NH_2 - \overset{\overset{O}{||}}{C} - \text{named as amido}$$

NH^{2-} will be named as amido is incorrect regarding the naming of complex.

18. In paper chromatography, chromatography paper contains water trapped in it, which acts as the:

(A) Mobile phase.

(B) Stationary phase.

(C) Stationary medium.

(D) None of these.

Ans. :

b. Stationary phase.

Explanation:

In paper chromatography, chromatography paper contains water trapped in it, which acts as the stationary phase.

19. Which one of these shows least -I effect:

(A) $-OH_2^+$ (B) $-NH_3^-$ (C) $-NO_2$ (D) $-F$

Ans. :

d. $-F$

Explanation:

Since + charge is more electronegative than neutral atom therefore correct order is $-OH_2^+ > -NH_3^- > -NO_2 > -F$. Hence least $-I$ effect is shown by $-F$.

20. Glycerol is purified by:

(A) Vacuum distillation.

(B) Simple distillation.

(C) Steam distillation.

(D) Fractional distillation.

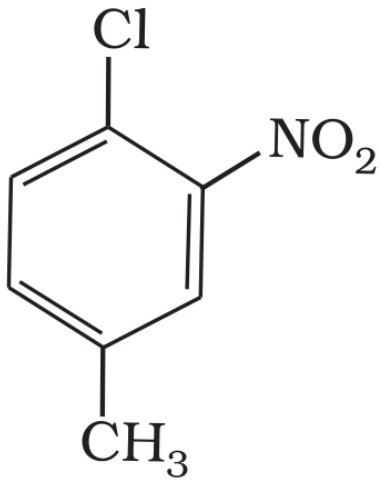
Ans. :

a. Vacuum distillation.

Explanation:

Because glycerol decomposes at its normal boiling point.

21. The IUPAC name for,

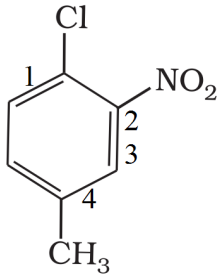


(A) 1-Chloro-2-nitro-4-methylbenzene.
(B) 1-Chloro-4-methyl-2-nitrobenzene.
(C) 2-Chloro-1-nitro-5-methylbenzene.
(D) M-nitro-p-chlorotoluene.

Ans. :

b. 1-Chloro-4-methyl-2-nitrobenzene.

Explanation:



1-Chloro-4-methyl-2-nitrobenzene

22. The increasing order of stability of the following free radicals:

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

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

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

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

Ans. :

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

23. Dumas method is used for estimation of:

(A) Carbon (B) Nitrogen (C) Oxygen (D) Sulphur

Ans. :

b. Nitrogen

Explanation:

The Dumas method in analytical chemistry is a method for the quantitative determination of nitrogen in chemical substances based on a method first described by Jean-Baptiste Dumas in 1826.

24. Which functional group is present in a molecule of CH_3Cl?

(A) Amine (B) Halide (C) Ether (D) Ketone

Ans. :

b. Halide

Explanation:

Methyl chloride, CH_3Cl is an alkyl chloride. The functional group present is chlorine atom $-Cl$.

Note: In general we can write alkyl halides as R-X where X is halogen atom (Cl, Br, I or F).

25. The absorption of hydrogen by platinum is known as:

(A) Hydrogenation
(B) Reduction
(C) Dehydrogenation
(D) Occlusion

Ans. :

d. Occlusion

Explanation:

A huge amount hydrogen gas generally loosely bounds with the surface of the platinum metal. This is known as occlusion and the hydrogen is known as occluded hydrogen.

26. IUPAC name of $CH_3OC_2H_5$ is:

(A) Ethoxy methane
(B) Methoxy ethane
(C) Both (a) and (b)
(D) None of these

Ans. :

b. Methoxy ethane

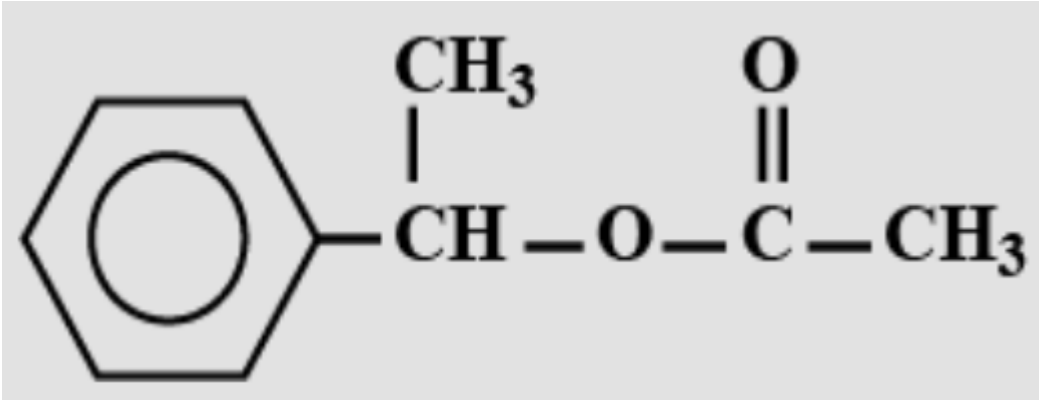
Explanation:

According to IUPAC nomenclature system, ethers are known as alkoxy alkane.

The ether oxygen is taken with a smaller alkyl group and creates the alkoxy group while larger alkyl group is considered as a alkyl group.

So the name will be methoxy ethane.

27. The IUPAC name is:



(A) 1-phenyl-1-acetyloxyethane
(B) 1-acetoxyeihylbenzene
(C) 1-phenylethyl ethanoate
(D) 1-methylbenzyl acetate

Ans. :

c. 1-phenylethyl ethanoate

Explanation:

In the outside ring functional group present is an ester of ethyl ethonate at benzene ring position 1 so by taking out one hydrogen it becomes 1-Phenyl ethylethanoate.

28. Which of the following represents ketones?

(A) > C = O (B) - OH (C) - CHO (D) - COOH

Ans. :

a. > C = O

Explanation:

COOH = carboxylic acid, −CHO = aldehydes > C = O = ketones, OH = alcohol.

29. Groups that can show both +M and -M effect:

(A) vinyl (B) phenyl

(C) -NO (D) All of these

Ans. :

d. All of these

Explanation:

CH_2 = CH− and phenyl both contain double bonds, Since we know -NO, C=C both can show +M and -M effect both hence all of the above options are correct.

30. The number of sigma and pi bonds in a molecule of cyanogen are:

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

Ans. :

b. 3, 4

Explanation:

Cyanogen, $N \equiv C - C \equiv N$ has three sigma and four 'pi' bonds.

31. All members of a homologous series have the same:

(A) Chemical formula. (B) Empirical formula.

(C) Boiling point. (D) Melting point.

Ans. :

b. Empirical formula.

Explanation:

Homologous series differ by a CH_2 group. It has a mass of 14 units. They can be represented by a common general formula for alkanes, alkenes, alkynes, and other functional groups. They can thus, be represented by a common empirical formula.

For example alkanes has empirical formula C_nH_{2n+2} and for alkenes it is C_nH_{2n} etc.

32. Which of the following is the correct IUPAC name?

(A) 3-Ethyl-4, 4-dimethylheptane. (B) 4, 4-Dimethyl-3-ethylheptane.

(C) 5-Ethyl-4, 4-dimethylheptane. (D) 4, 4-Bis (methyl)-3-ethylheptane.

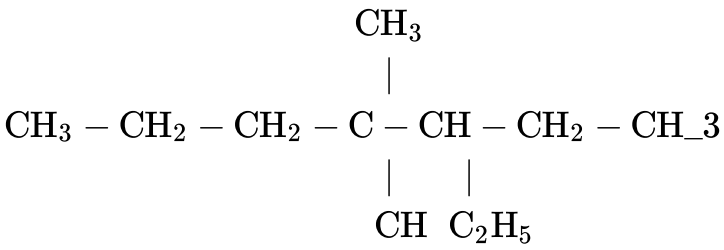
Ans. :

a. 3-Ethyl-4, 4-dimethylheptane.

Explelation:

While writing IUPAC name, the alkyl groups are written in alphabetical order. Thus lower locant 3 is assigned to ethyl. Prefix, di, tri, and tetra are not included in alphabetical order.

The structure is



33. Which one of the following can show +I effect?

(A) CBr_3 (B) CH_3 (C) CCl_3 (D) CHO

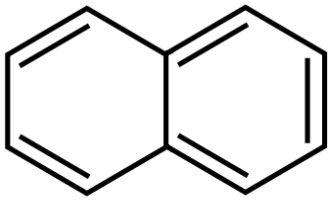
Ans. :

b. CH_3

Explanation:

Only CH_3 shows +I effect rest of them shows -I effect, since other groups contain electronegative atom which will pull electrons towards it causing -I effect.

34. Which type of compound is shown by the following structure:



(Naphthalene)

(A) Alicyclic compound. (B) Benzenoid aromatic compound.

(C) Non-benzenoid aromatic compound. (D) Acyclic compound.

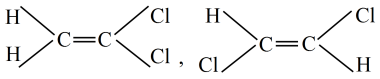
Ans. :

b. Benzenoid aromatic compound.

Explanation:

Since, the given compounds contain benzene nucleus so, naphthalene is a benzenoid aromatic compound.

35. The following compounds show:



(A) Configuration isomerism. (B) Conformationat isomerism.

(C) Structural isomerism. (D) Stereo isomerism.

Ans. :

c. Structural isomerism.

36. The first three members of a homologous series are CH_4,C_2H_6,C_3H_8. The fifth member of this series will be:

(A) C_5H_{10} (B) C_5H_{14} (C) C_5H_{12} (D) C_5H_8

Ans. :

c. C_5H_{12}

Explanation:

General formula of homologous series is C_nH_{2n+2}.

First member is methane i.e. CH_4

Second member is ethane i.e. C_2H_6

Third member is propane i.e. C_3H_8

Forth member is butane i.e. C_4H_{10}

Similarly, fifth member is pentane i.e

37. Marsh gas is:

(A) C_6H_6 (B) CH_4 (C) C_2H_2 (D) CO

Ans. :

b. CH_4

Explanation:

Marsh gas is methane, CH_4.

It is called so because it is often obtained from marshy places.

38. Among the following which has greatest -I effect?

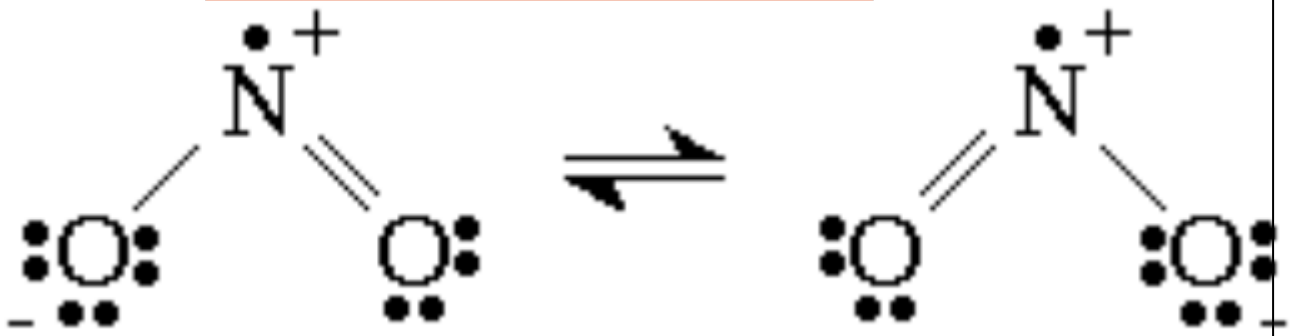
(A) $-OH$ (B) $-NH_2$ (C) $-NO_2$ (D) $-F$

Ans. :

c. $-NO_2$

Explanation:

$-NO_2$ is the strongest -I group among all the neutral group because of the presence of + charge on N atom as shown in structure.



39. Correct IUPAC name for $H_3C-\underset{\underset{C_2H_5}{|}}{CH}-\underset{\underset{C_2H_5}{|}}{CH}-CH_3$ _____.

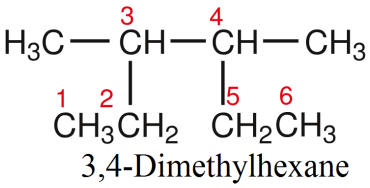
(A) 2- Ethyl-3-methylpentane. (B) 3, 4- Dimethylhexane.

(C) 2-Sec-butylbutane. (D) 2, 3-Dimethylbutane.

Ans. :

b. 3, 4- Dimethylhexane.

Explanation:



3,4-Dimethylhexane

40. The order of -I effect of orbitals is:

(A) $sp^3>sp^2>sp$ (B) $sp>sp^2>sp^3$

(C) $sp^2>sp^3>sp$ (D) $sp^2>sp>sp^3$

Ans. :

b. $sp > sp^2 > sp^3$

Explanation:

As %s character increases, electronegativity of orbitals increases which means its tendency to pull electron towards itself also increases hence -I effect increases.

41. The presence of carbon in an organic compound is detected by heating it with:

(A) Sodium metal to convert it to NaCN.

(B) CaO to convert it into CO which burns with a blue flame.

(C) CuO to convert it into CO_2 which turns lime water milky.

(D) Cu wire to give a bluish-green flame.

Ans. :

c. CuO to convert it into CO_2 which turns lime water milky.

Explanatioin:

The given organic compound is mixed with dry copper oxide (CuO) and heated in a hard glass tube. The products of the reaction are passed over (white) anhydrous copper sulphate and then bubbled through lime water.

If copper sulphate turns blue due to the formation of $CuSO_4.5H_2O$ (by water vapor) then the compound contains hydrogen. If lime water is turned milky by CO_2, then the compound contains carbon.

42. What is the correct order of decreasing stability of the following cations.

I. $CH_3 - \overset{+}{C}H - OCH_3$

II. $CH_3 - \overset{+}{C}H - OCH_3$

III. $CH_3 - \overset{+}{C}H - CH_2 - OCH_3$

(A)
II > I > III

(B) II > III > I

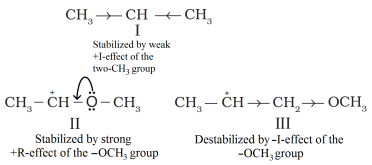
(C)
III > I > II

(D)
I > II > III

Ans. :

a. II > I > III

Explanation:

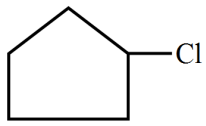


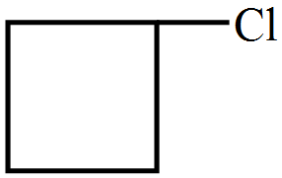
Thus, the stability of carbocation decreasws in the order: II > I >III.

43. In cyclic compounds, the bond-line formula for chlorocyclohexane is represented by which of the following representations?

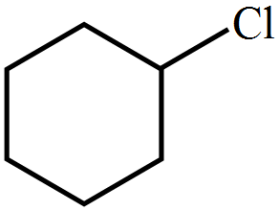
(A)

(B)

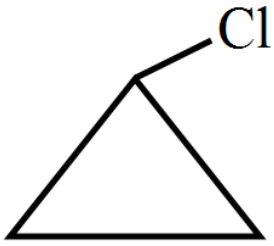




(C)

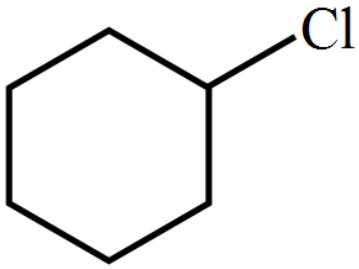


(D)



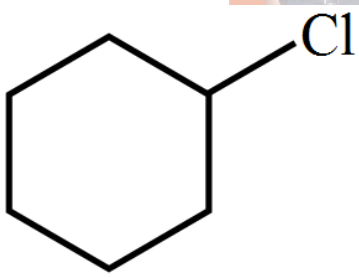
Ans. :

c.

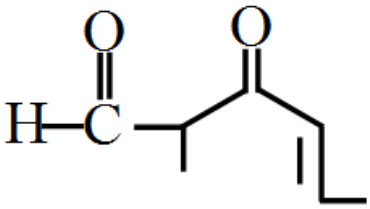


Explanation:

Structure of chlorocyclohexane is:



44. The IUPAC name of the compound



(A) 5-Formyl hex-2-en-3-one.

(B) 5-methyl-4-oxohex-2-en-5-al.

(C) 3-keto-2 methyl hex-5-enal.

(D) 3-keto-2-methyl hex-4-enal.

Ans. :

a. 5-Formyl hex-2-en-3-one.

Explanation:

Aldehyde group is preferred over keto group.

45. Generally pi bond is formed from the lateral overlap of:

(A) s−s orbitals
(B) p−p orbitals
(C) d−d orbitals
(D) Both B and C

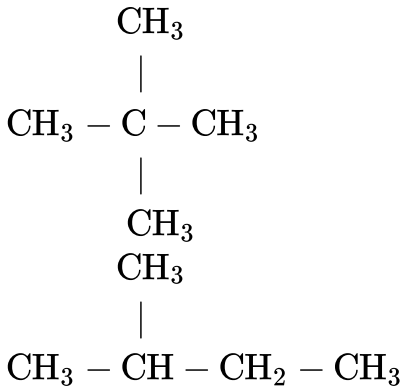
Ans. :

d. Both B and C

Explanation:

π bond is formed by lateral (side ways) overlap of either p−p, d−d or d−p orbitals.

46. Study the structures given below carefully and choose the type of isomerism they represent.

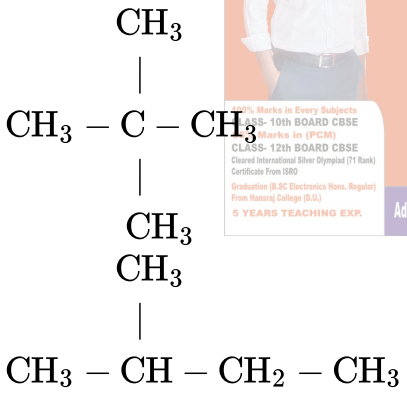


(A) Chain isomerism.
(B) Position isomerism.
(C) Functional isomerism.
(D) Metamerism.

Ans. :

a. Chain isomerism.

Explanation:



chain isomers as they have different carbon chains.

47. Carbon and hydrogen are detected by heating the organic compound with _____.

(A) Magnesium oxide
(B) Cupric oxide
(C) Zinc oxide
(D) Sulphur dioxide

Ans. :

b. Cupric oxide

Explanation:

The detection of various elements present in an organic compound is called qualitative analysis. Carbon and hydrogen are present in almost all the organic compounds.

Carbon and hydrogen are detected by heating the organic compound with cupric oxide (CuO) strongly, where carbon is oxidized to carbon dioxide and hydrogen to water.

Carbon dioxide is tested by lime water test, whereas water is tested by anhydrous copper sulphate test.

48. Why does ethane have a higher boiling point than methane?

(A) Difference in size
(B) Functional group
(C) Difference in shape
(D) None of above

Ans. :

a. Difference in size

Explanation:

Ethane have a higher boiling point than methane because molecules of ethane (C_2H_6) have more Van der Waals forces (intermolecular forces) with neighboring molecules than methane (CH_4) due to the greater number of atoms present in the molecule of ethane compared to methane.

49. Nucleophile is a species that should have:

(A) A pair of electrons to donate.
(B) Positive charge.
(C) Negative charge.
(D) Electron deficient species.

Ans. :

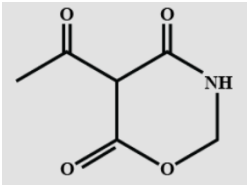
a. A pair of electrons to donate.
c. Negative charge.

Explanation:

Nucleophile (nucleus-loving) is a chemical species that donates an, electron pair to an electrophile (electron-loving). Hence, a nucleophile should have either a negative charge or an electron pair to donate.

Thus, options (a) r and (c) are correct.

50. Identify which functional group are not present in the given compound?



(A) Ketone
(B) Ester
(C) Amide
(D) Ether

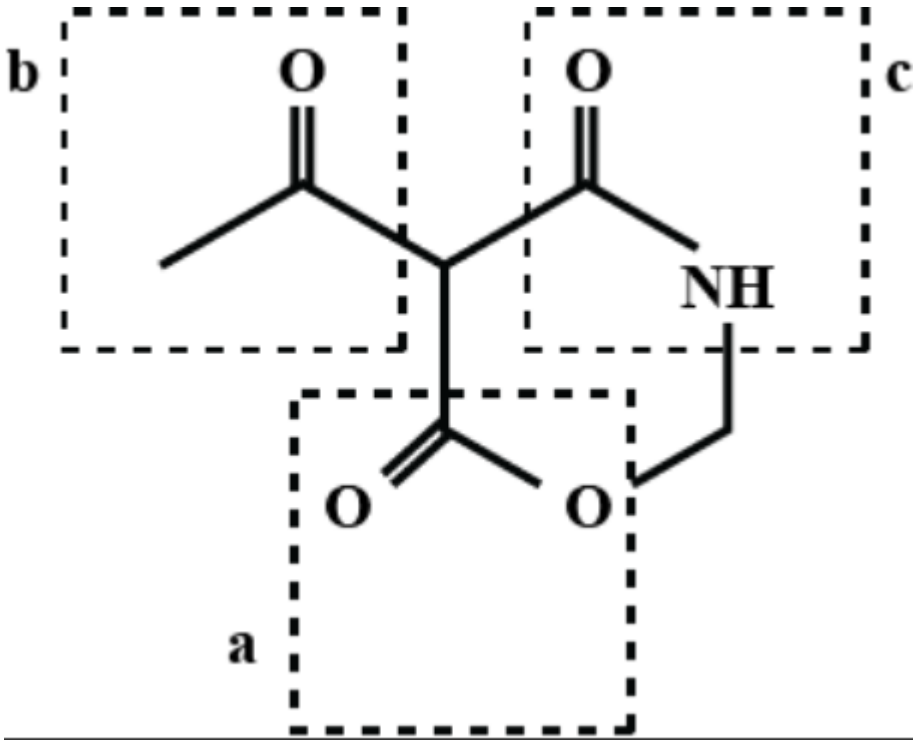
Ans. :

d. Ether

Explanation:

Box a encloses ester group, b encloses ketone group while c encloses amide group.

Here ether group is not present.



51. Give the functional group of the following.-OH

(A) Aldehydic group (B) Alcoholic group

(C) Ketonic group (D) Carboxylic group

Ans. :

b. Alcoholic group

Explanation:

−OH represents an alcoholic group. It represents alcohols such as ethanol CH_3, $-CH_2$, −OH. The general formula of alcohols is R−OH.

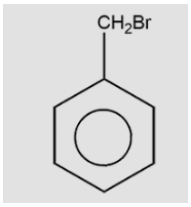
52. In Carius method of estimation of halogens, 250mg of an organic compound gave 141mg of AgBr. The percentage of bromine in the compound is (atomic mass Ag = 108 and Br = 80)

(A) 24 (B) 36 (C) 48 (D) 60

Ans. :

a. 24

53. IUPAC name of the above compound is:



(A) Bromo methyl benzene (B) Phenyl methyl bromide

(C) Benzyl bromide (D) Benzal bromide

Ans. :

a. Bromo methyl benzene

54. Transition state 2 is structurally most likely as:

Transition state 2 is structurally most likely as :

(A) Intermediate 1 (B) Transition state 3

(C) Intermediate 2 (D) Product

Ans. :

c. Intermediate 2

Explanation:

Generally transition state tries to bring stability with less energy difference. From the figure it is evident that energy difference between TS^2 and intermediate 2 is least.

So it is most likely that TS^2 and intermediate 2 have similar structures.

55. The functional group present in organic acid is:

(A) $-OH$ (B) $-CHO$ (C) $-COOH$ (D) $> C = O$

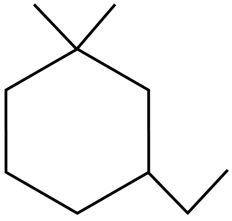
Ans. :

c. $-COOH$

Explanation:

The functional group present every organic acid is $-COOH$ as it dissociate in water as $-COO^-$ and H^+.

56. What is the correct IUPAC name of the following?



(A) 3-ethyl-1,1-dimethylcyclohexane. (B) 1-ethyl-3,3-dimethylcyclohexane.

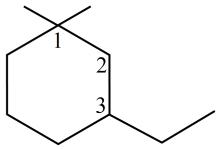
(C) 1,1-dimethyl-3-ethylcyclohexane. (D) None of the above.

Ans. :

a. 3-ethyl-1,1-dimethylcyclohexane.

Explanation:

The correct IUPAC name of the following structure is



3-ethyl-1,1-dimethylcyclohexane
(Substituent name in alphabetical order)

57. Which substance has the lowest boiling point?

(A) $CH_3CH_2CH_2CH_2OCH_3$ (B) $CH_3CH_2OCH_2CH_3$

(C) $CH_3CH_2CH_2CH_3$ (D) $CH_3CH_2C{=}OCH_3$

Ans. :

c. $CH_3CH_2CH_2CH_3$

Explanation:

$CH_3CH_2CH_2CH_3$ (n−butane) has the lowest boiling point as it has lowest molecular weight and is non polar. It has weakest intramolecular forces of attraction.

All others are polar compounds and so has dipole-dipole inbteraction.

58. The number of structural isomers possible for the molecular formula = C_3H_9N is:

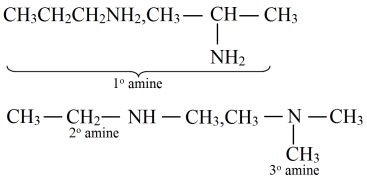
(A) 4 (B) 5 (C) 2 (D) 3

Ans. :

a. 4

Explanation:

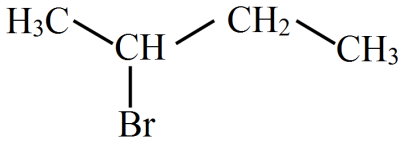
Structural isomers of C_3H_9N are



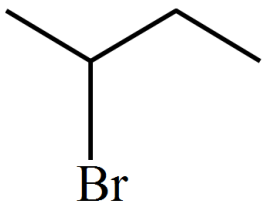
59. The correct way(s) of representing 2-bromobutane is/ are:

(A) $CH_3CHBrCH_2CH_3$

(B)



(C)



(D) All of the above

Ans. :

d. All of the above

60. Pi bond is formed:

(A) By the overlapping of atomic orbitals on the axis of nuclei.

(B) By mutual sharing of p - electrons.

(C) By sideways overlapping of half filled p - orbitals.

(D) By overlapping of s-orbitals with p - orbital.

Ans. :

c. By sideways overlapping of half filled p - orbitals.

Explanation:

If a bond between two atoms is broken when one atom is rotated around the bond axis, that bond is called a pi bond.

Pi bonds are formed by the sideways overlap of parallel half filled p−orbitals on adjacent atoms as shown in the figure.

They are not formed from hybrid orbitals.

61. In Kjeldahl's method for estimation of nitrogen, $CuSO_4$ acts as:

(A) Oxidising agent. (B) Reducing agent.

(C) Catalytic agent. (D) Hydrolysis agent.

Ans. :

d. Hydrolysis agent.

Explanation:

In Kjeldahl's method (used for the estimation of nitrogen) the organic compound is heated with conc. H_2SO_4 in the presence of K_2SO_4 (used to elevate boiling point of H_2SO_4) and $CusO_4$ (used as catalyst) to convert all the nitrogen into $(NH_4)_2SO_4$

62. The bond that consist of an upper and a lower sharing of electron orbitals is called as:

(A) A pi bond (B) A sigma bond

(C) A hydrogen bond (D) An ionic bond

Ans. :

a. A pi bond

Explanation:

The bond that consist of an upper and a lower sharing of electron orbitals is called as a pi bond.

A pi bond is formed by lateral (side ways) overlap.

For example, two 2pz orbitals of two C atoms laterally overlap to for pi bond in ethene $CH_2 = CH_2$.

63. Which of the following pairs are members of a homologous series?

(A) CH_3OCH_3; CH_3CH_2OH (B) CH_3CHO; CH_3CH_2CHO

(C) CH_3CH_2COOH; CH_3COOCH_3 (D) $(CH_3)_2CHOH$; CH_3CH_2OH

Ans. :

b. CH_3CHO; CH_3CH_2CHO

Explanation:

Acetaldehyde i.e CH_3CHO and propionaldehyde i.e CH_3CH_2CHO belong from the aldehyde family hence they are homologous series.

64. Successive members of homologous series differ from one another in their mass by:

(A) 10 units (B) 15 units (C) 20 units (D) 14 units

Ans. :

d. 14 units

Explanation:

A series of organic compounds with the same general formula but differ from adjacent members by "$-CH_2-$" group are referred to as homologous series of compounds. Successive members of homologous series differ from one another in their mass by 14 units.

For example: CH_4 and C_2H_6 are homologous series. Its molar mass is 16 and 30gm/mole respectively.

Hence, it is differed by unit 14.

65. The principle involved in paper chromatography is:

(A) Adsorption (B) Partition (C) Solubility (D) Volatility

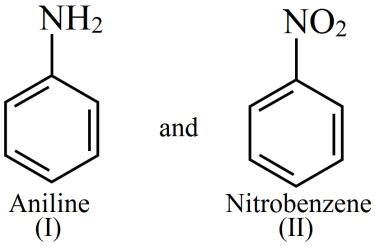
Ans. :

b. Partition

Explanation:

In paper chromatography, separation of the components of a mixture depends upon their partitioning between water held in the stationary phase (i.e. adsorbent paper) and the liquid present in the mobile phase.

66. Consider the following compounds,



Aniline (I) and Nitrobenzene (II)

Which of the following statements is/ are true regarding I and II?

(A) I shows +R-effect, whereas II shows -R-effect.

(B) I shows -R-effect, whereas II shows +R-effect.

(C) Both I and II show +R-effect.

(D) Both I and II show -R-effect.

Ans. :

a. I shows +R-effect, whereas II shows -R-effect.

67. In which of the following inductive effect is possible:

(A) Butane (B) Benzene (C) Cyclohexane (D) Butanal

Ans. :

d. Butanal

Explanation:

To show inductive effect compound must contain electronegative element/eletropositive element attatched to C-atom.

So that movement of electrons away from chain/towards chain would occur. This is possible only in case of Butanal among given options.

68. σ_{C-C} : 4; σ_{C-H} : 6; $\pi_{C=C}$: 1; $\pi_{C\equiv C}$: 2 These number of σ and π-bonds are present in which of the following molecule?

(A) $CH \equiv C - CH = CH - CH_3$

(B) $CH_2 = C = CH - CH_3$

(C) $CH_2 = CH - CH = CH_3$

(D) None of the above.

Ans. :

a. $CH \equiv C - CH = CH - CH_3$

*** a statement of Assertion (A) is followed by a statement of Reason (R). [2]**

Choose the correct option.

69. **Note:** In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

Assertion (A): All the carbon atoms in H2C = C = CH2 are sp2 hybridised

Reason (R): In this molecule all the carbon atoms are attached to each other by double bonds.

i. Both A and R are correct and R is the correct explanation of A.

ii. Both A and R are correct but R is not the correct explanation of A.
iii. Both A and R are not correct.
iv. A is not correct but R is correct.

Ans. :

iv. A is not correct but R is correct.

Explanation: hybridization of C can be find out by counting σ bonds and π bonds present on C atom.

$$\overset{3\sigma}{\underset{1\pi}{CH_2}} = \overset{2\sigma}{\underset{1\pi}{C}} = \overset{3\sigma}{\underset{1\pi}{CH_2}}$$

If C has 3σ bounds, it is sp^2 hybridized. if C has 2σ bound, it is sp hybridized.

70. **Note:** In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below each question.

Assertion (A): Sulphur present in an organic compound can be estimated quantitatively by Carius method.

Reason (R): Sulphur is separated easily from other atoms in the molecule and gets precipitated as light yellow solid.

i. Both A and R are correct and R is the correct explanation of A.
ii. Both A and R are correct but R is not the correct explanation of A.
iii. Both A and R are not correct.
iv. A is not correct but R is correct.

Ans. :

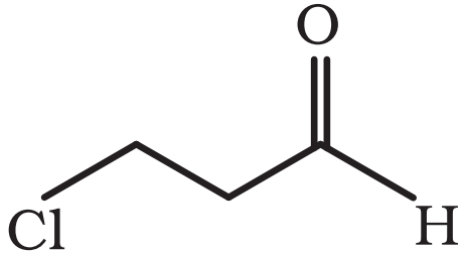
iii. Both A and R are not correct.

Explanation:

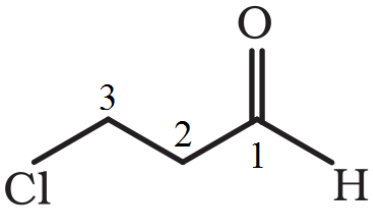
Sulphur is estimated by Carius method in the form of white precipitate of $BaSO_4$ on heating with fuming and $BaCl_2$.If light yellow solid is obtained means impurities are present. It is filtered washed and then dried to get pure $BaSO_4$.

*** Answer The Following Questions In One Sentence.[1 Marks Each]** **[10]**

71. Give the IUPAC names of the following compounds:



Ans. :



3–chloropropanal

72. The best and latest technique for isolation, purification and separation of organic compounds is:

a. Crystallisation.
b. Distillation.
c. Sublimation.
d. Chromatography.

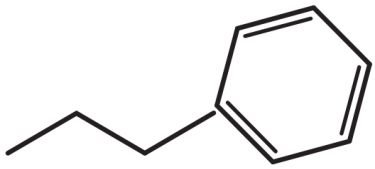
Ans. :

d. Chromatography.

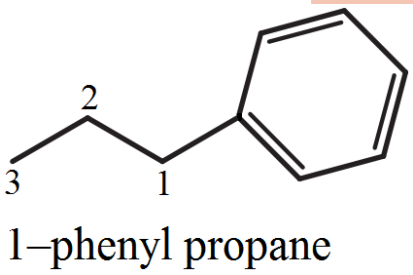
Explanation:

Chromatography is the most useful and the latest technique of separation and purification of organic compounds. It was first used to separate a mixture of coloured substances.

73. Give the IUPAC names of the following compounds:



Ans. :



1–phenyl propane

74. How can you separate a mixture of three immiscible liquids having different boiling points?

Ans. : We can separate with the help of separating funnel due to difference in densities. As they differ in boiling points, the forces of attraction between molecules will be different, therefore, they will have different densities, hence they can be separated by differential extraction using separating funnel as these are immiscible.

75. Identify the most electronegative element in CH_2FCl.

Ans. : 'F' (fluorine) is most electronegative element.

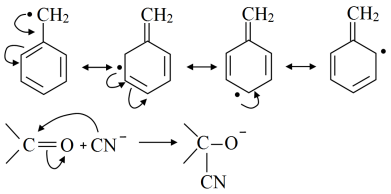
76. $\mathrm{CH_2=\bar{C}H}$ is more basic than $\mathrm{HC\equiv C^-}$. Explain why?

Ans. : $\mathrm{CH_2=\overset{sp^2}{C}H^-}\ \mathrm{HC\equiv\overset{sp}{C}^-}$

Since, sp-carbon is more electronegative than sp^2-carbon, therefore, $\mathrm{CH\equiv C^-}$ is less willing to donate a pair of electrons than $\mathrm{H_2C=CH^-}$. In other words, $\mathrm{H_2C=CH^-}$ is more basic than $\mathrm{HC\equiv C^-}$.

77. Why is benzylic free radical more stable than allylic free radical?

Ans. : This is due to more resonance of benzylic free radical.



78. Give the IUPAC name of the following compound $CH_3 - \underset{\underset{Br}{|}}{CH} - \underset{\underset{O}{||}}{C} - \underset{\underset{CH_3}{|}}{CH} - CH_3$

Ans. : $\overset{1}{CH_3} - \overset{2}{\underset{\underset{Br}{|}}{CH}} - \overset{3}{\underset{\underset{O}{||}}{C}} - \overset{4}{\underset{\underset{CH_3}{|}}{CH}} - \overset{5}{CH_3}$

2−bromo-4-methyl pentan-3-one

79. Give the IUPAC name of the following compound:

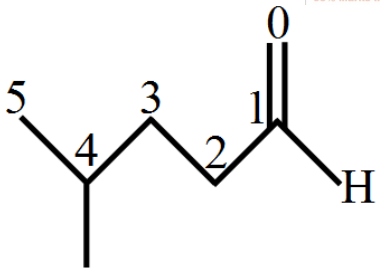
$CH_3 - CH_2 - \underset{\underset{CH_3}{|}}{CH} - \underset{\underset{O}{||}}{C} - H$

Ans. : $\overset{4}{CH_3} - \overset{3}{CH_2} - \overset{2}{\underset{\underset{CH_3}{|}}{CH}} - \overset{1}{\underset{\underset{O}{||}}{C}} - H$

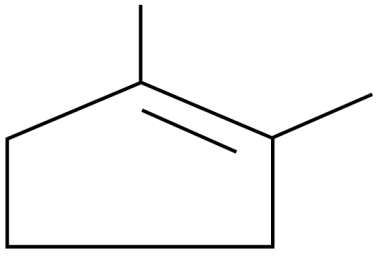
2−Methylbutanal

80. Give IUPAC name of following bond line formula:

i.



ii.



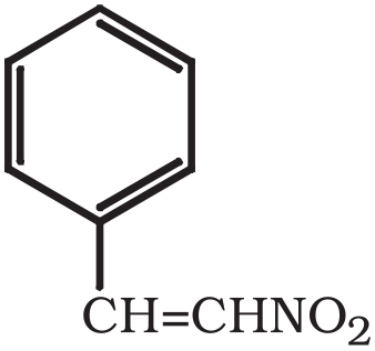
Ans. :

i. 4-methyl pentanal.

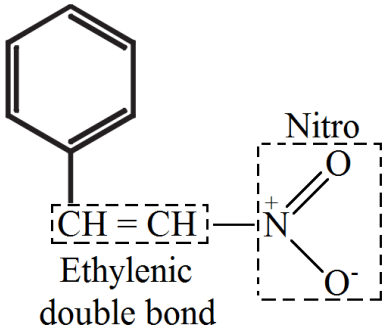
ii. 1, 2-dimethyl cyclopentene.

*** Given Section consists of questions of 2 marks each.** **[10]**

81. Identify the functional groups in the following compounds:



Ans. :



82. Give the common name of:

i. Methanol olido.
ii. Ethanol.
iii. Ethoxyethane.
iv. Ethanoic acid.
v. 1, 4-dimethyl benzene.

Ans. :

i. Methyl alcohol.
ii. Ethyl alcohol.
iii. Diethyl ether.
iv. Acetic acid.
v. P-xylene.

83. Why does SO_3 act as an electrophile?

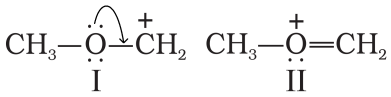
Ans. :

Three highly electronegative oxygen atoms are attached to sulphur atom. This makes sulphur atom electron deficient. Due to resonance, sulphur also acquires positive charge. Both these factors make SO_3 an electrophile.

84. "Stability of carbocations depends upon the electron releasing inductive effect of groups adjacent to positively charged carbon atom involvement of neighbouring groups in hyperconjugation and resonance."

Draw the possible resonance structures for  and predict which of the structures is more stable. Give reason for your answer.

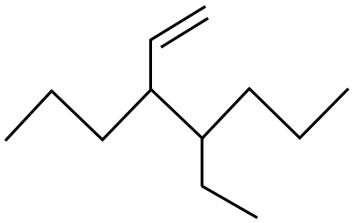
Ans. :



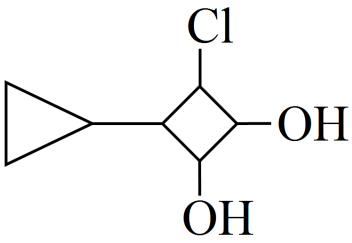
I II

85. Give IUPAC names of the following structures.

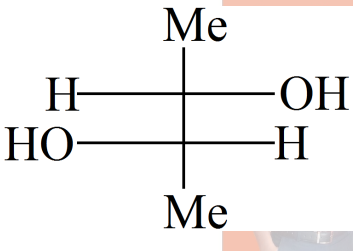
i.



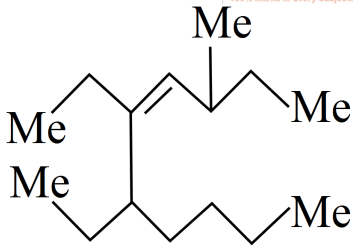
ii.



iii.



iv.



Ans. :

i. 4-ethyl-3-propylhept-1-ene.
ii. 3-chloro-4-cyclopropyl-1,2 cyclobutandiol.
iii. Butan-2, 3-diol.

*** Given Section consists of questions of 3 marks each.** **[27]**

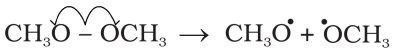
86. Which of the two: $O_2NCH_2CH_2O^-$ or $CH_3CH_2O^-$ is expected to be more stable and why?

Ans. : NO_2 group is an electron-withdrawing group. Hence, it shows –I effect. By withdrawing the electrons toward it, the NO_2 group decreases the negative charge on the compound, thereby stabilising it. On the other hand, ethyl group is an electron-releasing group. Hence, the ethyl group shows +I effect. This increases the negative charge on the compound, thereby destabilising it. Hence, $O_2NCH_2CH_2O^-$ is expected to be more stable than $CH_3CH_2O^-$.

87. For the following bond cleavages, use curved-arrows to show the electron flow and classify each as homolysis or heterolysis. Identify reactive intermediate produced as free radical, carbocation and carbanion.

$$CH_3O - OCH_3 \rightarrow CH_3\dot{O} + \dot{O}CH_3$$

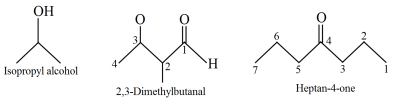
Ans. : The bond cleavage using curved-arrows to show the electron flow of the given reaction can be represented as



It is an example of homolytic cleavage as one of the shared pair in a covalent bond goes with the bonded atom. The reaction intermediate formed is a free radical.

88. Write bond line formulas for: Isopropyl alcohol, 2,3-Dimethylbutanal, Heptan-4- one.

Ans. :



89. If a liquid compound decomposes at its boiling point, which method (s) can you choose for its purification. It is known that the compound is stable at low pressure, steam volatile and insoluble in water.

Ans. : Steam distillation can be used for its purification. This method is applied to separate substances which are steam volatile and immiscible with water.

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

i. $HNO_3 + H_2SO_4$
ii. CH_3COCl
iii. alc. KCN

Ans. :

i.

i. $CH - \overset{\overset{O}{\|}}{C} \oplus$ is electrophile

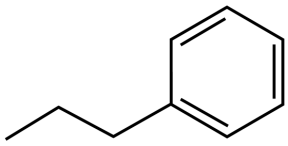
$$CH_3 - \overset{\overset{O}{\|}}{C} - Cl^- \longrightarrow CH_3 - \overset{\overset{O}{\|}}{C} \oplus + Cl^-$$

ii. CN^- is nucleophile

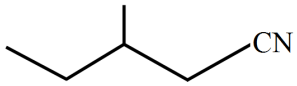
$$KCN \longrightarrow K^+ + CN^-$$

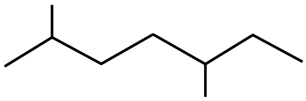
91. Give the IUPAC names of the following compounds:

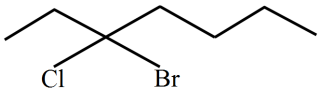
i.

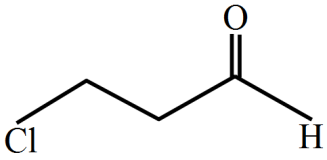


ii.

iii. 

iv. 

v. 

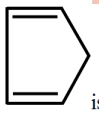
vi. 

vi. Cl_2CHCH_2OH

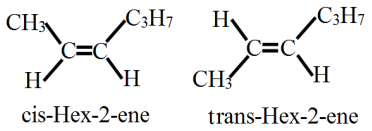
Ans. :

i. Propylbenzene.
ii. 3-methylpentanitrile.
iii. 2, 5-dimethylheptane.
iv. 3-bromo-3-chloroheptane.
v. 3-chloropropanal.
vi. 2, 2-dichloroethanol.

92. i. Draw cis and trans-structures for Hex-2-ene. Which isomer will have higher boiling point and why?

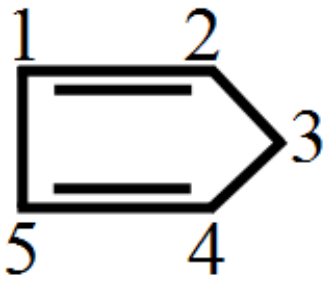
ii. Explain why  is not aromatic

Ans. :

i. 

cis-Hex-2-ene trans-Hex-2-ene

cis-Hex-2-ene has higher dipole moment and therefore, it has higher boiling point.

ii. 

is not aromatic, Due to the presence of sp^3 carbon (carbon 3), the system is not planar, Futher, it contains only four n electsons. Hence, it is not aromatic because it does not contain planar delocalised cloud with

$(4n + 2)\pi$ electrons.

93. The following techniques are used to quantitatively estimate extra elements in organic compound. Identify the name of the method and the element estimated by this method.

i. A known mass of an organic compound is heated with fuming HNO_3 in presence of $AgNO_3$.
ii. Organic compound is heated with dry copper oxide in atmosphere of CO_2.
iii. Organic compound is heated with conc. H_2SO_4.

Ans. :

i. Estimation of halogen by Carius method.
ii. Estimation of nitrogen by Dumas method.
iii. Estimation of nitrogen by Kjeldahl's method.

94. What is the hybridisation of each carbon in $H_2C = C = CH_2$.

Ans. : In $\underset{(1)}{H_2C} = \underset{(2)}{C} = \underset{(3)}{CH_2}$, carbon (1) and (3) are sp^2 hybridised and carbon (2) is sp hybridized.

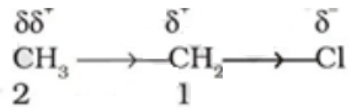
* Case study based questions [8]

95. Read the passage given below and answer the following questions from 1 to 5.

A reagent that brings an electron pair to the reactive site is called a nucleophile (Nu:) i.e., nucleus seeking and the reaction is then called nucleophilic. A reagent that takes away an electron pair from reactive site is called electrophile (E+) i.e., electron seeking and the reaction is called electrophilic.

Electron Displacement Effects in Covalent Bonds The electron displacement in an organic molecule may take place either in the ground state under the influence of an atom or a substituent group or in the presence of an appropriate attacking reagent. The electron displacements due to the influence of an atom or a substituent group present in the molecule cause permanent polarisation of the bond. Inductive effect and resonance effects are examples of this type of electron displacements. Temporary electron displacement effects are seen in a molecule when a reagent approaches to attack it. This type of electron displacement is called electrometric effect or polarisability effect.

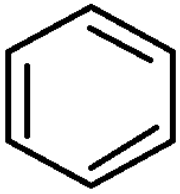
Inductive Effect When a covalent bond is formed between atoms of different electronegativity, the electron density is more towards the more electronegative atom of the bond. Such a shift of electron density results in a polar covalent bond. Bond polarity leads to various electronic effects in organic compounds. Let us consider cholorethane (CH_3 CH_2Cl) in which the C–Cl bond is a polar covalent bond. It is polarised in such a way that the carbon-1 gains some positive charge $(\delta+)$ and the chlorine some negative charge $(\delta-)$ The fractional electronic charges on the two atoms in a polar covalent bond are denoted by symbol (delta) and the shift of electron density is shown by an arrow that points from $(\delta+)$ to $(\delta-)$ end of the polar bond.



In turn carbon-1, which has developed partial positive charge $(\delta+)$draws some electron density towards it from the adjacent C-C bond. Consequently, some positive charge

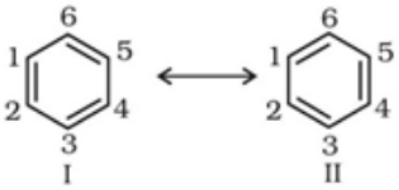
$(\delta\delta+)$develops on carbon-2 also, where $(\delta\delta+)$ symbolises relatively smaller positive charge as compared to that on carbon – 1. In other words, the polar C – Cl bond induces polarity in the adjacent bonds. Such polarisation of σ- bond caused by the polarisation of adjacent $\sigma-$bond is referred to as the inductive effect.

Resonance Structure There are many organic molecules whose behaviour cannot be explained by a single Lewis structure. An example is that of benzene. Its cyclic structure containing alternating C–C single and C=C double bonds shown is inadequate for explaining its characteristic properties.



Benzene

As per the above representation, benzene should exhibit two different bond lengths, due to C–C single and C=C double bonds. However, as determined experimentally benzene has a uniform C–C bond distances of 139 pm, a value intermediate between the C–C single(154 pm) and C=C double (134 pm) bonds. Thus, the structure of benzene cannot be represented adequately by the above structure. Further, benzene can be represented equally well by the energetically identical structures I and II.

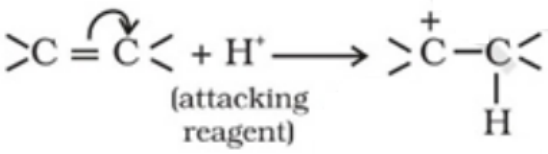


Therefore, according to the resonance theory the actual structure of benzene cannot be adequately represented by any of these structures, rather it is a hybrid of the two structures (I and II) called resonance structures. The resonance structures (canonical structures or contributing structures) are hypothetical and individually do not represent any real molecule. They contribute to the actual structure in proportion to their stability.

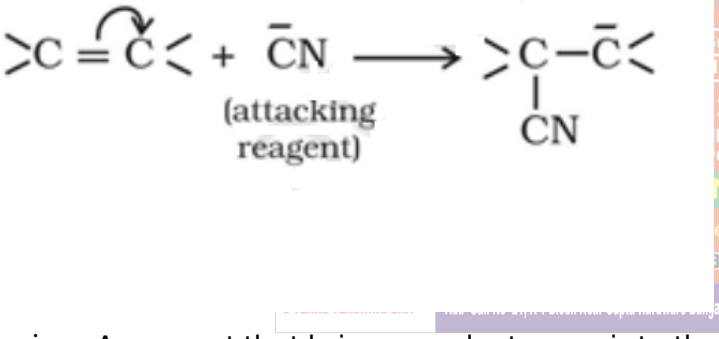
Resonance Effect The resonance effect is defined as 'the polarity produced in the molecule by the interaction of two π-bonds or between a π-bond and lone pair of electrons present on an adjacent atom'. The effect is transmitted through the chain. There are two types of resonance or mesomeric effect designated as R or M effect. (i) Positive Resonance Effect (+R effect) In this effect, the transfer of electrons is away from an atom or substituent group attached to the conjugated system. This electron displacement makes certain positions in the molecule of high electron densities. This effect in aniline is shown as : (ii) Negative Resonance Effect (- R effect) This effect is observed when the transfer of Electrons is towards the atom or substituent Group attached to the conjugated system. For Example in nitrobenzene this electron Displacement can be depicted as : The atoms or substituent groups, which represent +R or –R electron displacement effects are as follows: +R effect: – halogen, –OH, –OR, –OCOR, –NH2, –NHR, –NR2, –NHCOR, – R effect: – COOH, –CHO, > C = O, – CN, – NO_2 The presence of alternate single and double bonds in an open chain or cyclic system is termed as a conjugated system. These systems often show abnormal behaviour. The examples are 1,3- butadiene, aniline and nitrobenzene etc. In such systems, the π-electrons are delocalised and the system develops polarity.

Electromeric Effect (E effect) It is a temporary effect. The organic compounds having a multiple bond (a double or triple bond) show this effect in the presence of an attacking reagent only. It is defined as the complete transfer of a shared pair of π-electrons to one of the atoms joined by a multiple bond on the demand of an attacking reagent. The effect is annulled as soon as the attacking reagent is removed from the domain of the reaction. It is represented by E and the shifting of the electrons is shown by a curved arrow ( ). There are two distinct types of electromeric effect.

a) Positive Electrometric Effect (+E effect)- In this effect the π−electrons of the multiple bond are transferred to that atom to which the reagent gets attached. For example



b) Negative Electromeric Effect (–E effect) -In this effect the $\pi-$ electrons of the multiple bond are transferred to that atom to which the attacking reagent does not get attached. For example: When inductive and electromeric effects operate in opposite directions, the electomeric effect predominates.



i. A reagent that brings an electron pair to the reactive site is called a …
   a. nucleophile
   b. electrophile
   c. amphoteric
   d. amphophillic

ii. A reagent that takes away an electron pair from reactive site is called ..
   a. nucleophile
   b. electrophile
   c. amphoteric
   d. amphophillic

3. The … effect is defined as the polarity produced in the molecule by the interaction of two π-bonds or between a π-bond and lone pair of electrons present on an adjacent atom.
   a. hindrance
   b. inductive
   c. resonance
   d. hyperconjunction

iv. –OH group, represent … electron displacement effect.
   a. M+
   b. M-

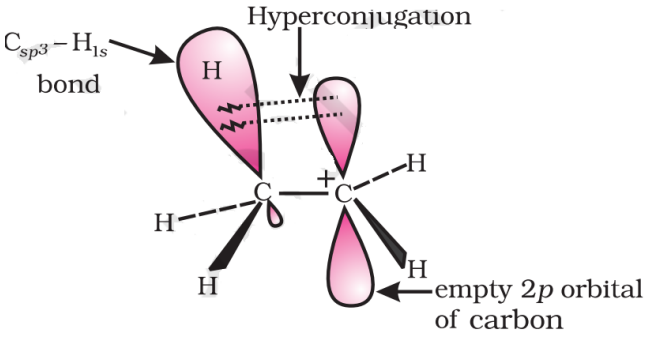
c. R-
d. R+

v. – COOH group, represent ... electron displacement effect.
a. M+
b. M-
c. R-
d. R+

Ans. :

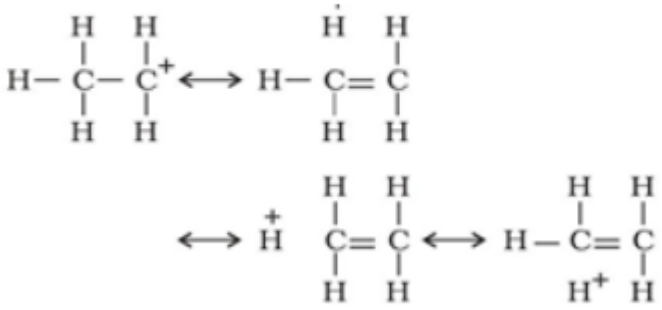
i. (a) nucleophile
ii. (b) electrophile
iii. (c) resonance
iv. (d) R+
v. (c) R-

96. Read the passage given below and answer the following questions from 1 to 5.



Hyperconjugation is a general stabilising interaction. It involves delocalisation of σ electrons of C—H bond of an alkyl group directly attached to an atom of unsaturated system or to an atom with an unshared p orbital. The σ electrons of C—H bond of the alkyl group enter into partial conjugation with the attached unsaturated system or with the unshared p orbital. Hyperconjugation is a permanent effect. To understand hyperconjugation effect, let us take an example of CH 32 + (ethyl cation) in which the positively charged carbon atom has an empty p orbital. One of the C-H bonds of the methyl group can align in the plane of this empty p orbital and the electrons constituting the C-H bond in plane with this p orbital can then be delocalised into the empty p orbital as depicted in Figure.

This type of overlap stabilises the carbocation because electron density from the adjacent σ bond helps in dispersing the positive charge.



In general, greater the number of alkyl groups attached to a positively charged carbon atom, the greater is the hyperconjugation interaction and stabilisation of the cation.

Thus, we have the following relative stability of carbocations:

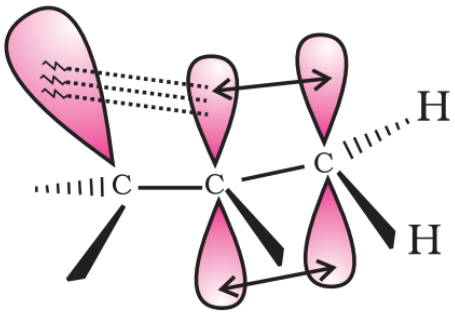
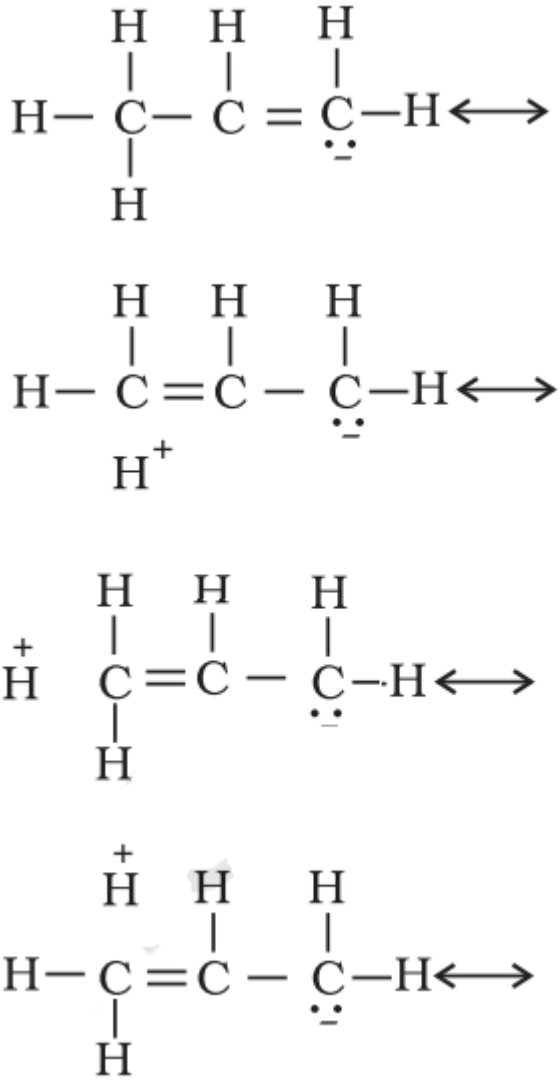


Fig. 12.4(b) *Orbital diagram showing hyperconjugation in propene*

Hyperconjugation is also possible in alkenes and alkylarenes. Delocalisation of electrons by hyperconjugation in the case of alkene can be depicted as in Figure.

There are various ways of looking at the hyperconjugative effect. One of the way is to regard C—H bond as possessing partial ionic character due to resonance.

The hyperconjugation may also be regarded as no bond resonance.



The hyperconjugation may also be regarded as no bond resonance.

Methods of purification of organic compounds Once an organic compound is extracted from a natural source or synthesised in the laboratory, it is essential to purify it. Various

methods used for the purification of organic compounds are based on the nature of the compound and the impurity present in it. The common techniques used for purification are as follows :

i) Sublimation

ii) Crystallisation

iii) Distillation

iv) Differential extraction and

v) Chromatography

Finally, the purity of a compound is ascertained by determining its melting or boiling point. Most of the pure compounds have sharp melting points and boiling points. New methods of checking the purity of an organic compound are based on different types of chromatographic and spectroscopic techniques.

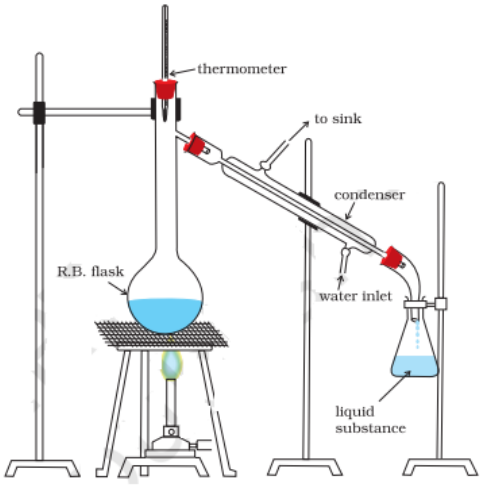
Sublimation On heating, some solid substances change from solid to vapour state without passing through liquid state. The purification technique based on the above principle is known as sublimation and is used to separate sublimable compounds from non- sublimable impurities.

Crystallisation This is one of the most commonly used techniques for the purification of solid organic compounds. It is based on the difference in the solubilities of the compound and the impurities in a suitable solvent. The impure compound is dissolved in a solvent in which it is sparingly soluble at room temperature but appreciably soluble at higher temperature. The solution is concentrated to get a nearly saturated solution. On cooling the solution, pure compound crystallises out and is removed by filtration. The filtrate (mother liquor) contains impurities and small quantity of the compound. If the compound is highly soluble in one solvent and very little soluble in another solvent, crystallisation can be satisfactorily carried out in a mixture of these solvents. Impurities, which impart colour to the solution are removed by adsorbing over activated charcoal. Repeated crystallisation becomes necessary for the purification of compounds containing impurities of comparable solubilities.

Distillation This important method is used to separate

i) volatile liquids from nonvolatile impurities and

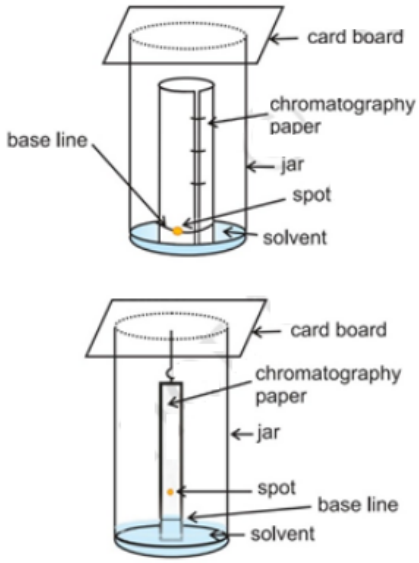
ii) the liquids having sufficient difference in their boiling points.



Liquids having different boiling points vaporise at different temperatures. The vapours are cooled and the liquids so formed are collected separately. Chloroform (b.p 334 K) and aniline (b.p. 457 K) are easily separated by the technique of distillation (Fig 12.5).

The liquid mixture is taken in a round bottom flask and heated carefully. On boiling, the vapours of lower boiling component are formed first. The vapours are condensed by using a condenser and the liquid is collected in a receiver. The vapours of higher boiling component form later and the liquid can be collected separately.

Partition Chromatography: Partition chromatography is based on continuous differential partitioning of components of a mixture between stationary and mobile phases. Paper chromatography is a type of partition chromatography. In paper chromatography, a special quality paper known as chromatography paper is used. Chromatography paper contains water trapped in it, which acts as the stationary phase. A strip of chromatography paper spotted at the base with the solution of the mixture is suspended in a suitable solvent or a mixture of solvents (Fig. 12.13). This solvent acts as the mobile phase. The solvent rises up the paper by capillary action and flows over the spot. The paper selectively retains different components according to their differing partition in the two phases. The paper strip so developed is known as a chromatogram. The spots of the separated coloured compounds are visible at different heights from the position of initial spot on the chromatogram. The spots of the separated colourless compounds may be observed either under ultraviolet light or by the use of an appropriate spray reagent as discussed under thin layer chromatography.



i. Hyperconjunction involves delocalisation of ... electrons of C—H bond of an alkyl group directly attached to an atom of unsaturated system or to an atom with an unshared p orbital.
   a. σ
   b. π
   c. δ
   d. η

ii. Which of the is an example of technique used for purification.
   a. Distillation
   b. Differential extraction
   c. Chromatography
   d. All the above

iii. On heating, some solid substances change from solid to vapour state without passing through liquid state is known as ...

a. Melting
b. Boiling
c. Sublimation
d. Condensation

iv. The hyperconjugation may also be regarded as ....
a. bonding resonance
b. no bond resonance
c. no bond induction
d. bonding induction

v. Chromatography paper contains water trapped in it, which acts as the ... phase.
a. mobile
b. stationery
c. Secondary
d. quaternary

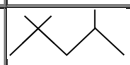
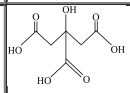
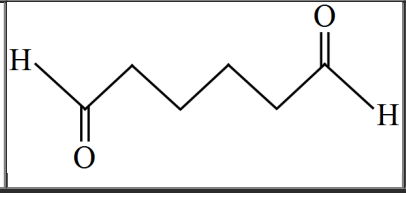
Ans. :

i. (a) σ
ii. (d) All the above
iii. (c) Sublimation
iv. b) no bond resonance
v. b) stationery

*** Given Section consists of questions of 5 marks each.** **[35]**

97. Give condensed and bond line structural formulas and identify the functional group(s) present, if any, for:
i. 2, 2, 4-Trimethylpentane.
ii. 2-Hydroxy-1, 2, 3-propanetricarboxylic acid.
iii. Hexanedial.

Ans. :

	Molecular formula	Bond live structure	Condensed structure	Functional groups
(a)	2, 2, 4-Trimethyl pentane		$(CH_3)_3CCH_2CH(CH_3)_2$	-
(b)	2-Hydroxy-1, 2, 3,-propanetri-carboxylic acid		$HOOCCH_2C(OH)(COOH)CH_2COOH$	-OH(hydroxyl) -COOH (Carboxyl) group
(c)	Hexanedial		$OHC(CH_2)_4CHO$	-CHO aldehyde group

98. Give a brief description of the principles of the following techniques taking an example in each case.

Chromatography.

Ans. : Chromatography:

i. It is applicable for the separation of virtually all inorganic and organic materials, except very insoluble polymers.

ii. In this technique, the mixture of compounds which needs to be separated is applied onto a stationary phase, which may be a solid or a liquid. Another phase which may be a pure solvent, a mixture of solvents or a gas is allowed to more slowly over the stationary phase.

iii. The components of the mixture which have different solubility in the moving phase, start moving. Since, they have different solubility, they move to different lengths on the stationary phase and become stable there,

iv. Thus, the different components of the mixture are separated.

99. What are hybridisation states of each carbon atom in the following compounds?
$CH_2=C=O$, $CH_3CH=CH_2$, $(CH_3)_2CO$, $CH_2=CHCN$, C_6H_6.

Ans. :

i. $\overset{1}{CH_2}=\overset{2}{C}=O$

C-1 is sp^2 hybridised.

C-2 is sp hybridised.

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

C-1 is sp^3 hybridised.

C-2 is sp^2 hybridised.

C-3 is sp^2 hybridised.

iii. $\overset{1}{CH_3}-\overset{2}{\overset{\overset{O}{\|}}{C}}-\overset{3}{CH_3}$

C-1 and C-3 are sp^3 hybridised.

C-2 is sp^2 hybridised.

iv. $\overset{1}{CH_2}=\overset{2}{CH}-\overset{3}{C}\equiv N$

C-1 is sp^2 hybridised.

C-2 is sp^2 hybridised.

C-3 is sp hybridised.

v. C_6H_6

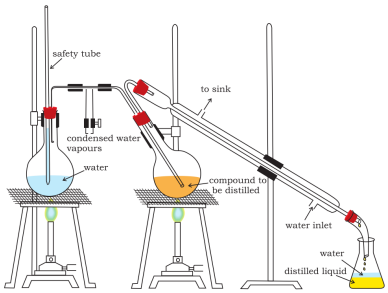
All the 6 carbon atoms in benzene are sp^2 hybridised.

100. A liquid with high boiling point decomposes on simple distillation but it can be steam distilled for its purification. Explain how is it possible?

Ans. : Steam distillation: This type of distillation is essentially a co-distillation with water and is carried out when a solid or liquid, practically insoluble in water, is volatile with steam, possess a vapour pressure of about 10-15 mm of mercury but the impurities are non-volatile. The principle of steam distillation is based on Dalton's law of partial

pressures. Let p_1 and p_2 be the vapour pressures of water vapour and the organic liquid at the distillation temperature. The liquid boils when total pressure is equal to the atmospheric pressure p, i.e.,

$p = p_1 + p_2$ or $p_2 = p - p_1$

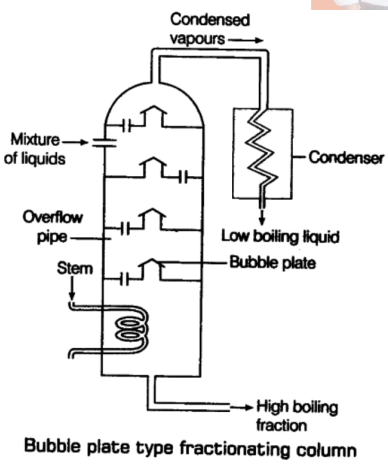


Steam distillation apparatus

This process is used in the purification of compounds such as chlorotoluenes, aniline and nitrobenzene. It is also employed in the isolation of essential oils from flowers.

101. Draw a diagram of bubble plate type fractionating column. When do we require such type of a column for separating two liquids. Explain the principle involved in the separation of components of a mixture of liquids by using fractionating column. What industrial applications does this process have?

Ans. : The bubble plate type fractionating column is shown in the figure. The tower is divided into number of compartments by mean as of shelves having openings. The openings are covered with caps called bubble caps. Each shelf is provided with an overflow pipe which keeps the liquid to a certain level and then allows the rest to trickle down to the lower shelf. Such type of column is used for continuous separation of bulk quantities of liquids, e.g., distillation of fermented liquid for manufacture of rectified spirit.



Bubble plate type fractionating column

Industrial application.

i. Separation of crude oil in petroleum industry into various useful fractions such as gasoline, kerosene oil, diesel oil, lubricating oil, etc.
ii. Separation of acetone and methanol from pyroligneous acid obtained by destructive distillation of wood.

102.
i. Two solids which have different solubilities in a solvent and which do not react when dissolved in it.
ii. Liquid that decompose at its boiling point.
iii. Steam volatile liquid and immiscible with water.
iv. Two liquids which have boiling points close to each other.
v. Two liquids with large difference in their boiling points.

Ans. :

i. Fractional crystallisation.
ii. Distillation under reduced pressure.
iii. Steam distillation.
iv. Fractional distillation.
v. Simple distillation.

103. The ratio of mass percent of C and H of an organic compound $C_xH_yO_z$ is 6 : 1. If one molecule of the above compound ($C_xH_yO_z$) contains half much oxygen of required to burn one molecule of compound C_xH_y completely to CO_2 and H_2O. What is empirical formula of $C_xH_yO_z$?

Ans. : The empirical formula of compound is $C_2H_4O_3$.

Because ratio of mass percent is 6 : 1.

$$\% \text{ of C} = \frac{24}{76} \times 100$$

$$\% \text{ of H} = \frac{4}{76} \times 100$$

$$\text{Ratio} \frac{2400}{76} : \frac{400}{76}$$

$$\text{Ratio } 6 : 1$$

$$C_2H_4 + 3O_2 \longrightarrow CO_2 + 2H_2O$$

$C_2H_2O_3$ has half of oxygen $\left(6 \times \frac{1}{2}\right)$ needed of burning C_2H_4 as given by. above equation.

----- काक चेष्टा बको ध्यानं, श्वान निद्रा तथैव च । अल्पहारी गृह त्यागी, विद्यार्थी पंच लक्षणं ॥ -----