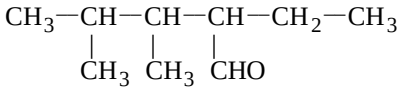
Chapter

12 Organic Chemistry–Some Basic Principles and Techniques

TYPE A : MULTIPLE CHOICE QUESTIONS

1. The IUPAC name of following compound is



[1997]

(a) 2-ethyl –3, 4-dimethylpentanal
(b) 2, 3-dimethyl –4-aldohexane
(c) 3-Aldo –4, 5-dimethylhexane
(d) 1, 3, 4, 5-tetraethylbutanal

2. The number of enantiomers of the compound CH_3 CHBr CHBr COOH is : *[1997]*

(a) 2 (b) 3
(c) 4 (d) 6

3. The process of decomposition of organic compound by the application of heat is :*[1999]*

(a) pyrolysis (b) evaporation
(c) sublimation (d) condensation

4. Turpentine oil can be purified by: *[1999]*

(a) Steam distillation
(b) Sublimation
(c) Vacuum distillation
(d) Fractional distillation

5. Which pairs have same percentage of carbon?

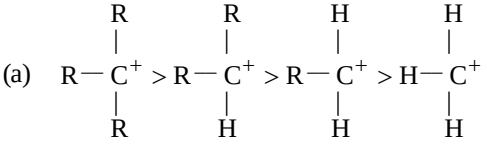
(a) CH_3COOH and $C_6H_{12}O_6$ *[2000]*

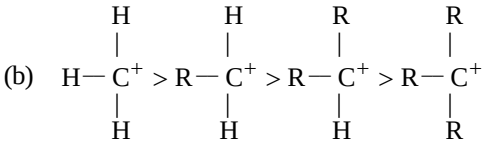
(b) CH_3COOH and $C_{12}H_{22}O_{11}$

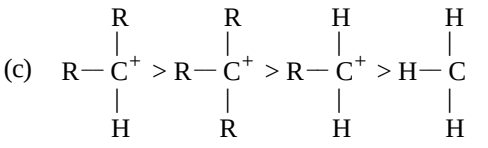
(c) CH_3COOH and C_2H_5OH

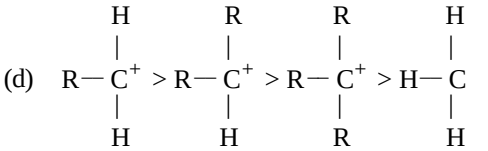
(d) $C_6H_{12}O_6$ and $C_{12}H_{22}O_{11}$

6. The decreasing order of stability of alkyl carbonium ion is in the order of : *[2001]*

(a) 

(b) 

(c) 

(d) 

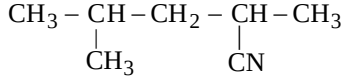
7. The number of sigma electrons in toluene are

(a) 6 (b) 9 *[2001]*
(c) 15 (d) 30

8. The most suitable method for removing water traces from ethanol is : *[2001]*

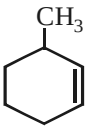
(a) distillation
(b) passing dry HCI
(c) reacting it with Mg
(d) heating with sodium metal

9. IUPAC name of



[2002]

(a) 2-cyano –3-methylhexane
(b) 2, 4-dimethylcyanopentane
(c) 3-methyl –5-cyanohexane
(d) 2-cyano –3-methylhexane

10. IUPAC name of  is *[2003]*

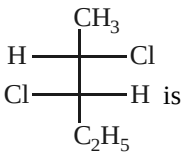
(a) 3-methylcyclohexene
(b) 1-methylcyclohex-2-ene
(c) 6-methylcyclohexene
(d) 1-methylcyclohex-5-ene

11. The most reactive nucleophile among the following is : ***[2003]***

(a) CH_3O^- (b) $C_6H_5O^-$

(c) $(CH_3)_2CHO^-$ (d) $(CH_3)_3CO^-$

12. The absolute configuration of the following : ***[2003]***



(a) 2S, 3R (b) 2S, 3S

(c) 2R, 3S (d) 2R, 3R

13. Which of the following compound possesses the C—H bond with the lowest bond dissociation energy? ***[2003]***

(a) Toluene

(b) Benzene

(c) *n*-pentane

(d) 2, 2-dimethylpropane

14. The dipole moment is the highest for : ***[2004]***

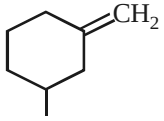
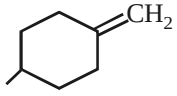
(a) *trans*-2-butene

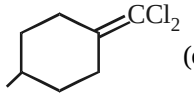
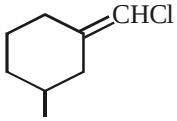
(b) 1, 3 -dimethylbenzene

(c) acetophenone

(d) ethanol

15. The geometrical isomerism is shown by ***[2004]***

(a)  (b) 

(c)  (d) 

16. Among the following, the strongest nucleophile is : ***[2005]***

(a) C_2H_5SH (b) CH_3COO^-

(c) CH_3NH_2 (d) $NCCH_2^-$

17. Among the following the most stable compound is : ***[2005]***

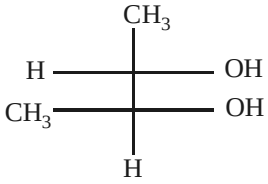
(a) *cis*-1, 2-cyclohexanediol

(b) *trans*-1, 2-cyclohexanediol

(c) *cis*-1,3-cyclohexanediol

(d) *trans*-1, 3-cyclohexanediol

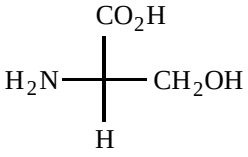
18. Correct configuration of the following is ***[2005]***

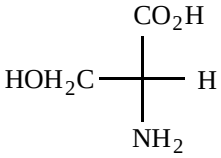


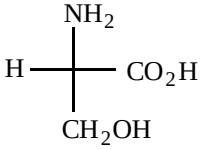
(a) 1S, 2S (b) 1S, 2R

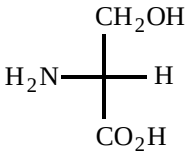
(c) 1R, 2R (d) 1R, 2S

19. Among the following, L-serine is : ***[2006]***

(a) 

(b) 

(c) 

(d) 

20. Methyl-α- D-glucoside and methyl-β-D-glucoside are: ***[2006]***

(a) Epimers

(b) Anomers

(c) Enantiomers

(d) Conformational diastereomers

21. Chain transfer reagent is ***[2007]***

(a) CCl_4 (b) CH_4

(c) O_2 (d) H_2.

22. The correct structure of 4-bromo-3-methylbut-1-ene is ***[2008]***

(a) $Br–CH=C(CH_3)_2$

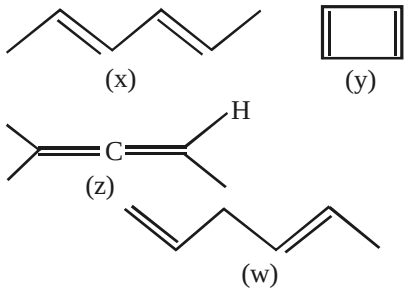
(b) $CH_2=CH-CH(CH_3)-CH_2Br$

(c) $CH_2=C(CH_3)CH_2CH_2Br$

(d) $CH_3-C(CH_3)=CHCH_2-Br$

23. Spin isomerism is shown by ***[2008]***
(a) dichlorobenzene (b) hydrogen
(c) dibasic acid (d) *n*-butane

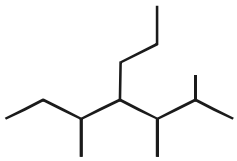
24. The correct stability order of following species is – ***[2009]***



(a) x > y > w > z (b) y > x > w > z
(c) x > w > z > y (d) z > x > y > w

25. Which one of the following compounds is resistant to nucleophilic attack by hydroxyl ions? ***[2010]***
(a) Methyl acetate (b) Acetonitrile
(c) Diethyl ether (d) Acetamide

26. The correct IUPAC name for ***[2011]***



(a) 5-methyl -4-(1'-2'-demethylpropyl) heptane
(b) 3-methyl-4-(1',2'-dimethylpropyl) heptane
(c) 2,3,5-trimethyl-4-propylheptane
(d) 4-propyl-2,3,5-trimethylpeptane

27. Which of the cations in more stable ? ***[2011]***

(a) $R'-\overset{H}{\overset{|}{C}}{}^{+}-OR$

(b) $R'-\overset{H}{\overset{|}{C}}=\overset{+}{O}R$

(c) both equal
(d) both are unstable

28. The Lassaigne's extract is boiled with dil. HNO_3 before testing for halogens because ***[2012]***
(a) Silver halides are soluble in HNO_3
(b) Na_2S and NaCN are decomposed by HNO_3
(c) Ag_2S is soluble in HNO_3
(d) AgCN is soluble is HNO_3

29. The incorrect IUPAC name is ***[2012]***

(a) $CH_3-\overset{\overset{O}{\|}}{C}-\overset{\overset{CH_3}{|}}{CH}-CH_3$

2-methyl-3-butanone

(b) $CH_3-\underset{\underset{CH_3}{|}}{CH}-\underset{\underset{CH_2CH_3}{|}}{CH}-CH_3$

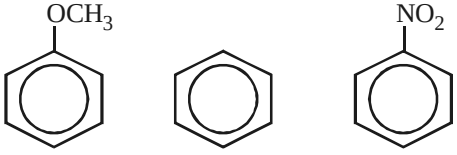
2, 3 -dimethylpentane

(c) $CH_3-C\equiv CCH(CH_3)_2$
4-methyl-2-pentyne

(d) $CH_3-\underset{\underset{Cl}{|}}{CH}-\underset{\underset{Br}{|}}{CH}-CH_3$

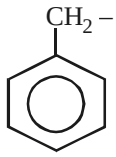
3-chloro-2-bromobutane

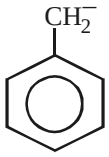
30. Among the following compounds (I-III), the correct order of reactivity towards electrophilic substitution reaction is ***[2012]***

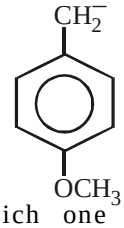


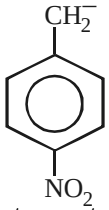
(a) II > III > I (b) III < I < II
(c) I > II > III (d) I = II > III

31. The most stable carbanion among the following is ***[2012, 2013]***

(a) 

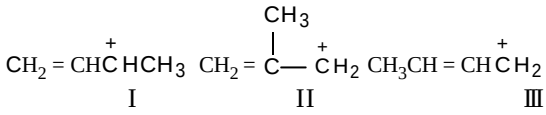
(b) 

(c) 

(d) 

32. Which one of the statements about $HOH_2CCH(OH)CHO$ is not correct ? It ***[2013]***
(a) is an isomer of 1, 3-dihydroxypropanone
(b) contains a tertiary alcoholic group
(c) has the same empirical formula as glucose
(d) can show optical isomerism

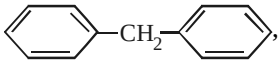
33. Which is the correct order of stability of the following three carbonium ions ? ***[2014]***



I II III

(a) I > II > III
(b) II > I > III
(c) I ≈ III > II
(d) All are equally stable

34. The molecular formula of diphenyl methane,



, is $C_{13}H_{12}$.

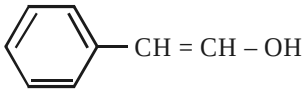
How many structural isomers are possible when one of the hydrogens is replaced by a chlorine atom? ***[2014]***

(a) 6 (b) 4
(c) 8 (d) 7

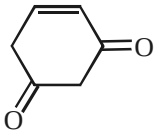
35. The compound CHCl ═ CHCHOHCOOH with molecular formula $C_4H_5O_3Cl$ can exhibit ***[2014]***

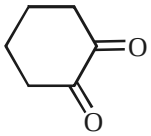
(a) geometric, optical position and functional isomerism
(b) geometric, optical and functional isomerism only
(c) position and functional isomerism only
(d) geometric and optical isomerism only

36. Tautomerism is exhibited by – ***[2015]***

(1) 

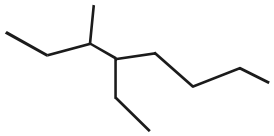
(2) 

(3) 

(4) 

(a) (1), (3) and (4) (b) (2), (3), and (4)
(c) All of these (d) None of these

37. Name of the compound given below is



(a) 3- methyl -4- ethyloctane ***[2013, 2015]***
(b) 2, 3- diethylheptane
(c) 5- ethyl - 6- methyloctane
(d) 4- ethyl- 3- methyloctane

38. Which of the following represents the given mode of hybridisation sp^2–sp^2 – *sp* – *sp* from left to right? ***[2015]***

(a) $H_2C = CH - C \equiv N$
(b) $CH \equiv C - C \equiv CH$
(c) $H_2C = C = C = CH_2$
(d) 

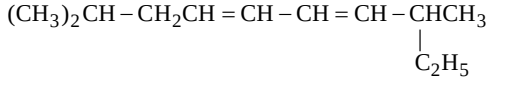
39. In Lassaigne's test for the detection of halogens, the sodium fusion extract is first boiled with concentrated nitric acid. This is ***[2016]***

(a) to remove silver halides
(b) to decompose Na_2S and NaCN, if present
(c) to dissolve Ag_2S
(d) to dissolve AgCN, if formed

40. Which one among the following cannot exhibit enantiomerism? ***[2016]***

(a) Diphenyl methanol
(b) 1-Bromo-2-chlorobutane
(c) 2-Butanol
(d) Tartaric acid

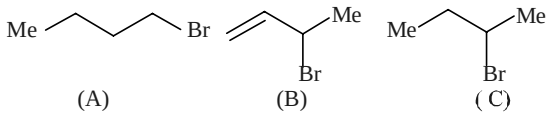
41. The IUPAC name of the following compound is



[2016]

(a) 1,1,7,7-tetramethyl-2,5-octadiene
(b) 2,8-dimethyl-3,6-decadiene
(c) 1,5-di-iso-propyl-1,4-hexadiene
(d) 2,8-dimethyl-4,6-decadiene

42. Consider the following bromides :



(A) (B) (C)

The correct order of S_N1 reactivity is ***[2016]***

(a) B > C > A (b) B > A > C
(c) C > B > A (d) A > B > C

43. The strongest ortho - para and strongest meta - directing groups respectively are ***[2017]***

(a) $-NO_2$ and $-NH_2$
(b) $-CONH_2$ and $-NH_2$
(c) $-NH_2$ and $-CONH_2$
(d) $-NH_2$ and $-NO_2$

44. Hybridisation states of C in CH_3^+ and CH_4 are ***[2017]***

(a) sp^2 & sp^3 (b) sp^3 & sp^2
(c) sp^2 & sp^2 (d) sp^3 & sp^3

45. The increasing order of stability of the following free radicals is ***[2017]***

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

TYPE B : ASSERTION REASON QUESTIONS

Directions for (Qs.46-48) : Each of these questions contains an Assertion followed by Reason. Read them carefully and answer the question on the basis of following options. You have to select the one that best describes the two statements.

(a) If both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are correct, but Reason is not the correct explanation of Assertion.
(c) If Assertion is correct but Reason is incorrect.
(d) If both the Assertion and Reason are incorrect.

46. **Assertion :** In the third group of qualitative analysis, NH_4Cl is added to NH_4OH medium.
Reason : This is to convert the ions of group into their respective chlorides. ***[2014]***

47. **Assertion :** Carbanions like ammonia have pyramidal shape. ***[2015]***
Reason : The carbon atom carrying negative charge has an octet of electrons.

48. **Assertion :** NF_3 is a weaker ligand than $N(CH_3)_3$. ***[2017]***
Reason : NF_3 ionizes to give F^- ions in aqueous solution.

HINTS & SOLUTIONS

Type A : Multiple Choice Questions

1. (a) $\overset{5}{C}H_3-\overset{4}{C}H(CH_3)-\overset{3}{C}H(CH_3)-\overset{2}{C}H(\overset{1}{C}HO)-CH_2CH_3$

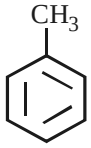
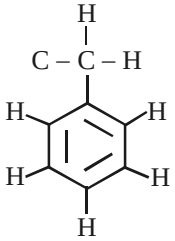
2. (c) No. of asymmetric carbon = 2
No. of enantiomers = $2^2 = 4$.

3. (a) Pyrolysis is the process of decomposition of organic compound by the application of heat.

4. (a) Turpentine oil is volatile and is insoluble in water. Therefore, it can be purified by steam distillation.

5. (a) Molecular formula of $CH_3COOH = C_2H_4O_2$
Both the compounds given have same empirical formula that is CH_2O. So, percentage of carbon in both of them will be same.

6. (a) Tertiary carbonium ion has highest stability followed by secondary and then primary carbonium ion. So, option (a) is correct.

7. (d)  or 

There are 15σ bonds in toluene, so 30 σ-electrons.

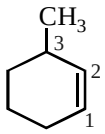
8. (c) Magnesium reacts only with H_2O to form insoluble $Mg(OH)_2$ and not with alcohol.

$$Mg + 2H_2O \rightarrow Mg(OH)_2 \downarrow + H_2$$

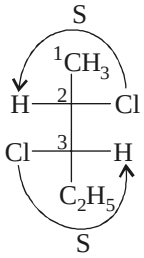
9. (b) 2, 4-Dimethylcyanopentane

$$\overset{5}{C}H_3-\overset{4}{C}H(\overset{5}{C}H_3)-\overset{3}{C}H_3-\overset{2}{C}H(\overset{1}{C}N)-CH_3$$

10. (a) The IUPAC name is 3-methylcyclohexene.



11. (d) The most reactive nulceophile will be $(CH_3)_3-CO^-$ due to +I effect of three $-CH_3$ groups.

12. (b) 

So compound is (2S, 3S)

13. (a) Among the carbonium ions formed by the cleavage of the C—H bond, the order of stability is :

$$C_6H_5\overset{+}{C}H_2 > (CH_3)_3\overset{+}{C}CH_2 > CH_3(CH_2)_3\overset{+}{C}H_2 > \overset{+}{C}_6H_5$$

As $C_6H_5\overset{+}{C}H_2$ is most stable so, in $C_6H_5CH_2-H$, C – H bond energy will be lowest.

14. (c) Dipole moment will be highest in case of acetophenone as it has strong electron withdrawing group.

15. (d) Geometrical isomerism is obseved when different groups are attached to each of the doubly bonded carbon atom.

16. (a) Strongest nucleophile is C_2H_5SH.
In this compound S is electron pair donor.
Since S is least electronegative, hence, its tendency to donate electron pair is highest.

17. (d) Among 1, 2- and 1, 3- configurations, 1, 3- is more stable due to less repulsion.
Further among *cis* and *trans* isomers, *trans* is more stable due to less crowding.

18. (a)

19. (c)

20. (b) In α-D glucoside $-OCH_3$ group at C_1 is towards right while in β-D glucose, it is towards left at C_1. Such pairs which differ around only C_1 in configuration are called *anomers*.

21. (a) Some molecules react with main growing chain to interrupt further growth of the original chain. This leads to lowering of average molecular mass of the polymer. Such reagents are called chain transfer agents. CCl_4 is the only chain transfer agent among the given options.

22. (b) $^{1}CH_2 = {}^{2}CH - {}^{3}\underset{\displaystyle CH_3}{\overset{\displaystyle H}{\underset{|}{\overset{|}{C}}}} - {}^{4}CH_2Br$

23. (b) Spin isomerism is shown by hydrogen. In *ortho-hydrogen*, the spin of nuclei of two atoms of the molecule are in same direction whereas in case of *para hydrogen*, the spin of nuclei of two atoms are in opposite direction.

24. (c) x is a conjugated diene system, w is an isolated diene system, z is a cumulated diene system, y is antiaromatic system.

25. (c) Diethyl ether $(CH_3CH_2)_2O$ is resistant to nucleophilic attack because it does not have an electron deficient carbon.

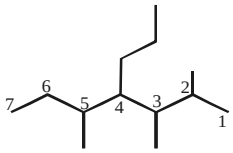
$C_2H_5 - O - C_2H_5$ Ether

$CH_3 - \overset{\displaystyle O}{\overset{\|}{C}} - OCH_3$ Methyl acetate

$CH_3 - C \equiv N$ Acetonitrile

$CH_3 - \overset{\displaystyle O}{\overset{\|}{C}} - NH_2$ Acetamide

26. (c) In case two or more chains are of equal length, then the chain with greater number of side chains is selected as the principal chain.



2, 3, 5-Trimethyl-4-propylheptane

27. (b) Although (b) has positive charge on O (an electronegative element), it is more stable because here every atom has octet of electrons.

28. (b) Na_2S and NaCN, formed during fusion with metallic sodium, must be removed before adding $AgNO_3$, otherwise black ppt. due to Na_2S or white precipitate due to AgCN will be formed and thus white precipitate of AgCl will not be identified easily.

$$Na_2S + 2AgNO_3 \longrightarrow 2NaNO_3 + \underset{\text{Black}}{Ag_2S}\downarrow$$

$$NaCN + AgNO_3 \longrightarrow NaNO_3 + \underset{\text{White}}{AgCN}\downarrow$$

$$NaCl + AgNO_3 \longrightarrow NaNO_3 + \underset{\text{white}}{AgCl}\downarrow$$

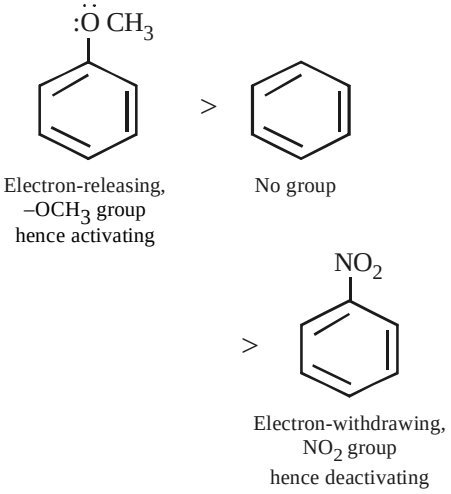
$$Na_2S + 2HNO_3 \xrightarrow{\text{boil}} 2NaNO_3 + H_2S\uparrow$$

$$NaCN + HNO_3 \xrightarrow{\text{boil}} NaNO_3 + HCN\uparrow$$

29. (a) $\overset{1}{CH_3} - \overset{2}{\overset{\displaystyle O}{\overset{\|}{C}}} - \overset{3}{\underset{\displaystyle CH_3}{\overset{|}{CH}}} - \overset{4}{CH_3}$

3-Methyl-2-butanone

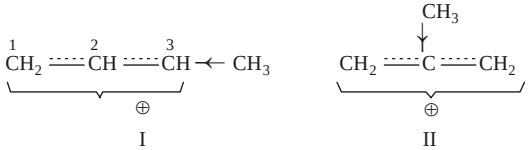
30. (c)

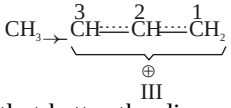


31. (d) $-NO_2$ group, being strong electron-withdrawing, disperses the negative charge, hence stabilizes the concerned carbanion.

32. (b) It has 1° and 2° alcoholic group, but not 3°

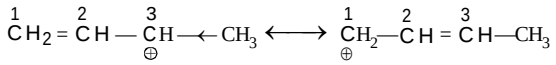
33. (c) Let us first write the resonance hybrid of the three allyl carboniun ions.





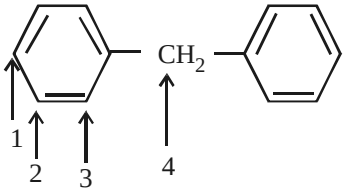
III

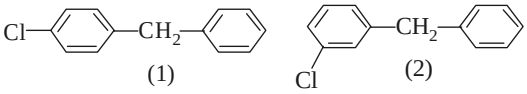
We know that better the dispersal of + charge, more will be the stability of the carbonium ion. Further, we know that C_1 and C_3 carry most of the positive charge which is



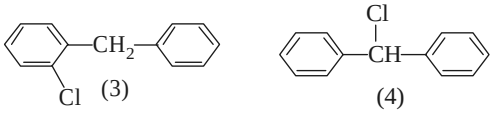
dispersed by the methyl group (+ I group) present on I and III, thus these two are more and equally stable than the II in which methyl group is present on C_2 which carry little of the positive charge.

34. (b) In diphenylmethane monochlorination at following positions will produce structured isomers



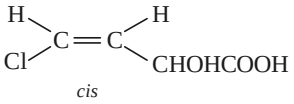


(1) (2)

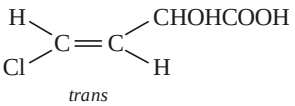


(3) (4)

35. (a)

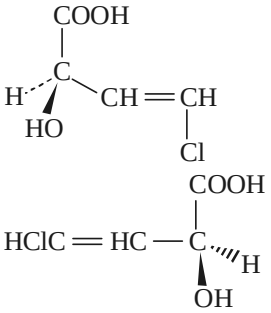


cis

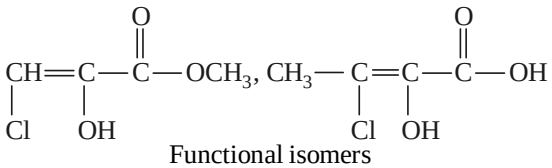


trans

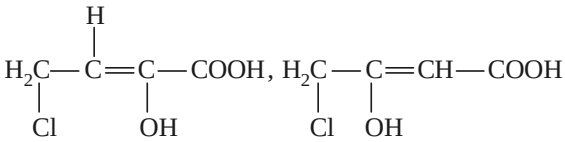
Geometric isomers



Optical isomers



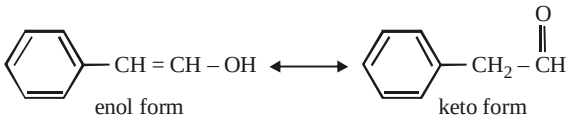
Functional isomers



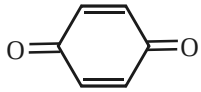
Position isomers

36. (a)

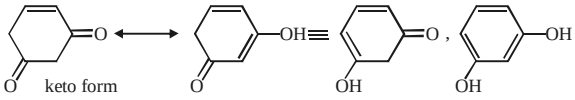
(a)



enol form keto form

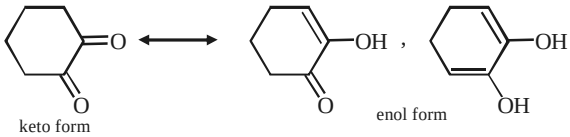
(b)  cannot tautomerise

(c)



keto form enol form

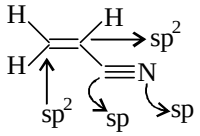
(d)



keto form enol form

37. (d)

38. (a)



39. (b) If the organic compound also contains nitrogen or sulphur, the Lassaigne's extract on boiling with dil. HNO_3 decomposes sodium cyanide or sodium sulphide formed during fusion.

$$NaCN + HNO_3 \longrightarrow NaNO_3 + HCN\uparrow$$

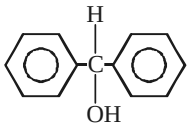
$$Na_2S + 2HNO_3 \longrightarrow 2NaNO_3 + H_2S\uparrow$$

If cyanide and sulphide ions are not decomposed, they will react with silver nitrate and hence will interfere with the test.

$$NaCN + AgNO_3 \longrightarrow \underset{\text{Silver cyanide (White ppt.)}}{AgCN} + NaNO_3$$

$$Na_2S + 2AgNO_3 \longrightarrow \underset{\text{Silver sulphide (Black ppt.)}}{Ag_2S} + 2NaNO_3$$

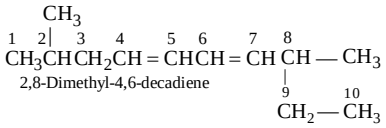
40. (a)



(Diphenyl methanol)

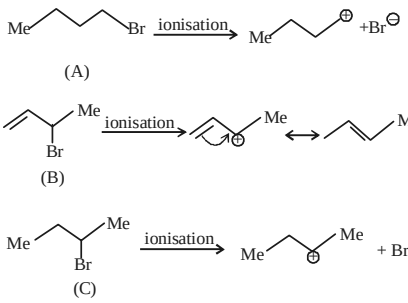
It does not contain any chiral carbon atom.

41. (d)



2,8-Dimethyl-4,6-decadiene

42. (a)



(A)

(B)

(C)

Since S_N1 reactions involve the formation of carbocation as intermediate in the rate determining step, more is the stability of carbocation higher will be the reactivity of alkyl halides towards S_N1 route. Now we know that stability of carbocations follows the order : 3° > 2° > 1°, so S_N1 reactivity should also follow the same order.

3° > 2° > 1° > Methyl **(S_N1 reactivity)**

43. (d)

44. (a) Hybridisation of carbon in CH_3^+ is sp^2 and in CH_4 its hybridisation is sp^3

45. (b) The order of stability of free radicals

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

The stabilisation of first two is due to resonance and last two is due to inductive effect.

Type B : Assertion Reason Questions

46. (c) Assertion is true but reason is false. NH_4Cl suppresses the ionisation of NH_4OH due to common ion effect and so ions of third group get precipitated as their hydroxides.

47. (b)

48. (c) It is correct statement that NF_3 is a weaker ligand than $N(CH_3)_3$, the reason is that fluorine is highly electronegative therefore, it with draw electrons from nitrogen atom. Hence, the lone pair of nitrogen atom cannot be ligated. While $N(CH_3)_3$ is a strong ligand because CH_3 is electron releasing group.