

Bangalore University, Bengaluru -560001
B.Sc. V Semester, chemistry – V (Organic chemistry)
Blue print of model question paper – II

Name of the topic	No. of hours	No. of short Answer questions (2 Marks)			No. of long Answer questions (4 Marks)	Total marks
		Part-A	Part -B	Total		
Stereochemistry	8	3	3	6	2	20
Amines	5	1	2	3	2	14
Heterocyclic compounds	4	1	2	3	1	10
Chemistry of natural products	10	2	3	5	4	26
Spectroscopy of Organic compounds	8	3	2	5	2	18
Industrial Organic chemistry	5	2	1	3	2	14
Total	40	12	13	25	13	102

PART – A

(12 x 2 =24)

1. Stereochemistry
2. Stereochemistry
3. Stereochemistry
4. Amines
5. Heterocyclic compounds
6. Chemistry of natural products
7. Chemistry of natural products
8. Spectroscopy of organic compounds
9. Spectroscopy of organic compounds
10. Spectroscopy of organic compounds
11. Industrial Organic chemistry
12. Industrial Organic chemistry

PART – B

(13 x 6 = 78)

13. a) Stereochemistry

- b) Amines
 - 14. a) Stereochemistry
 - b) Heterocyclic compounds
 - 15. a) amines
 - b) Chemistry of natural products
 - 16. a) Amines
 - b) Spectroscopy of organic compounds
 - 17. a) Heterocyclic compounds
 - b) Chemistry of natural products
 - 18. a) Chemistry of natural products
 - b) Stereochemistry
 - 19. a) Chemistry of natural products
 - b) Amines
 - 20. a) Chemistry of natural products
 - b) Heterocyclic compounds
 - 21. a) Chemistry of natural products
 - b) Spectroscopy of organic compounds
 - 22. a) Spectroscopy of organic compounds
 - b) Stereochemistry
 - 23. a) Spectroscopy of organic compounds
 - b) Industrial Organic chemistry
 - 24. a) Industrial Organic chemistry
 - b) Stereochemistry
 - 25. a) Industrial Organic chemistry
 - b) Chemistry of natural products
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B.Sc. V Semester, chemistry – V (Organic chemistry)
Model question paper – II

Time: 3 Hours

Max. Marks: 70

PART – A

Answer **any eight** of the following questions. Each question carries **two** marks. (8 x 2 = 16)

1. Identify optically active compounds among the following
i) 2-chloropropane ii) 2-bromobutane iii) 6,6'-dinitrodiphenic acid
2. What are diastereomers? Give example
3. What are achiral molecules? Give example
4. N-methyl aniline is more basic than aniline. Give reason.
5. How pyrrole is prepared from acetylene?
6. Write Haworth structure of maltose
7. Write the structure of cocaine
8. Mention the number of signals and multiplicity of Cl_2CHCHO in the NMR spectrum
9. What is fingerprint region in IR spectroscopy?
10. What is blue shift? Give example
11. What are antibiotics? Give an example
12. Write the structure of ranitidine.

PART – B

Answer **any nine** of the following questions. Each question carries **six** marks. (9 x 6 = 54)

13. a) Write R and S configuration of i) Bromochloro acetic acid ii) Lactic acid
b) How ethyl amine is prepared by Gabriel phthalimide synthesis? (4 + 2)
14. a) Explain cyclization reaction to show that maleic acid is the cis isomer and fumaric acid is the trans isomer
b) Write the nitration reaction of indole (4 + 2)
15. a) Write any two synthetic applications of BDC which involve evolution of nitrogen gas
b) Write the structure of Vitamin-A (4 + 2)
16. a) Explain the basicity of alkyl amines on the bases of inductive effect and solvation effect
b) Mention the types of electronic transitions possible in acetaldehyde (4 + 2)
17. a) Describe Skraup's synthesis of quinoline.
b) What are anomers? Give examples (4 + 2)
18. a) Describe the synthesis of α -citrol from methylheptenone
b) Write syn and anti forms of benzaldoxime (4 + 2)
19. a) Write the structure of morphine and caffeine
b) Write the IUPAC name of i) $\text{C}_6\text{H}_5\text{-NH-CH}_3$ ii) $\text{CH}_3\text{-NH-CH}_3$ (4 + 2)
20. a) How zingiberene is prepared from methylheptenone and p-methoxyphenyl magnesium bromide?
b) Show that thiopene is an aromatic compound (4 + 2)
21. a) How terpenoids are classified based on cyclic system? Give an example for each class
b) Define equivalent and non-equivalent protons (4 + 2)
22. a) Explain the effect of conjugation on the UV spectra of organic compounds with examples

- b) Write cis and trans configuration norbornane (4 + 2)
23. a) Explain the NMR spectrum of 1,1,2-trichloroethane indicating the multiplicity of various peaks
- b) What are direct dyes? Give an example (4 + 2)
24. a) Describe the synthesis of cango red from benzidine
- b) Write the structure of D – glyceraldehydes and L- lactic acid (4 + 2)
25. a) Describe the synthesis of ibuprofen using principles of green chemistry
- b) What is mutarotation? (4 + 2)
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B.Sc. V Semester, chemistry – V (Organic chemistry)
Answer of model question paper – II

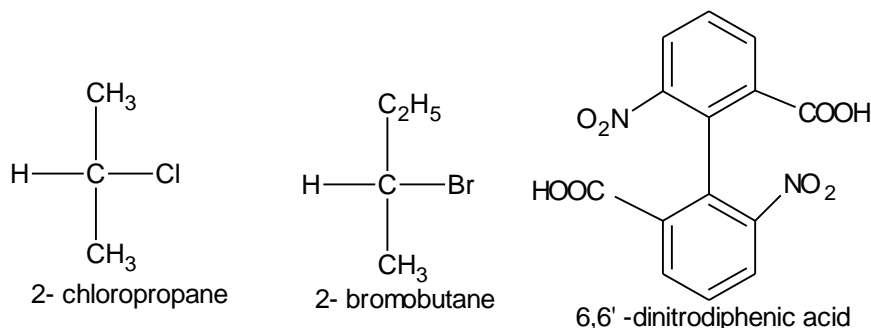
Time: 3 Hours

Max. Marks: 70

PART – A

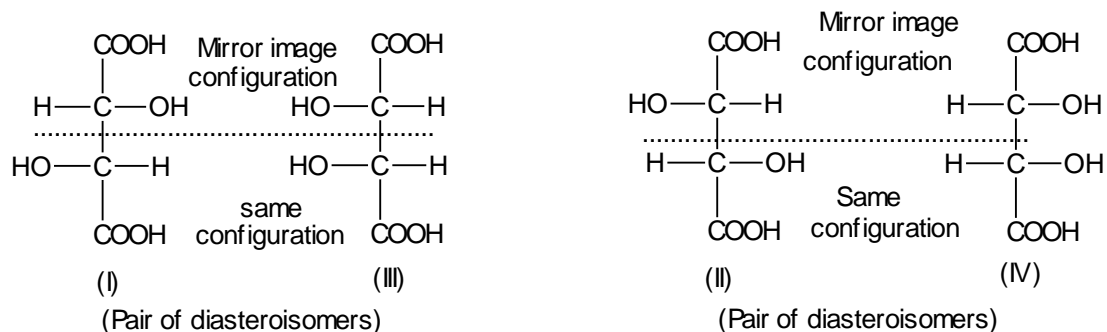
Answer **any eight** of the following questions. Each question carries **two** marks. (8 x 2 = 16)

Ans: 1)



2- bromobutane and 6,6'-diphenic acid are optically active due absence of element of symmetry where as 2-chloropropane is optically inactive due to presence of plane of symmetry.

Ans: 2) The pair of molecules or compounds with two or more different chiral carbon atoms or stereogenic centres which are neither identical nor non- super impossible mirror images of each other called diastereoisomers. For example,



Ans: 3) Those compounds which has an elements of symmetry and their mirror image is super imposible with each other and they do not contain chiral carbon atom called achiral or symmetric compounds and compounds are optically inactive.

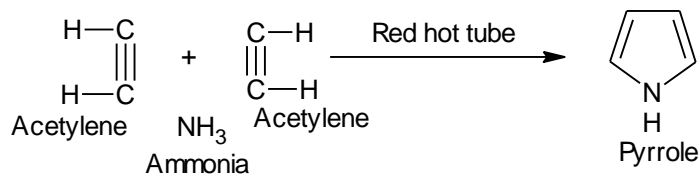
OR

The molecules whose mirror images are superimposable with each other are called achiral molecules

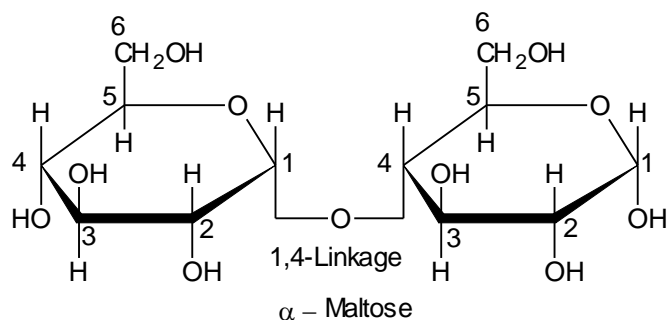
For example: 2-chloropropane

Ans: 4) In case of N-methyl aniline, methyl group is an electron releasing group, which increases electron density on nitrogen atom and also its K_b value is higher whereas in case of aniline there is no such group present on nitrogen and also its K_b value is low. Hence N-methyl aniline is more basic than aniline.

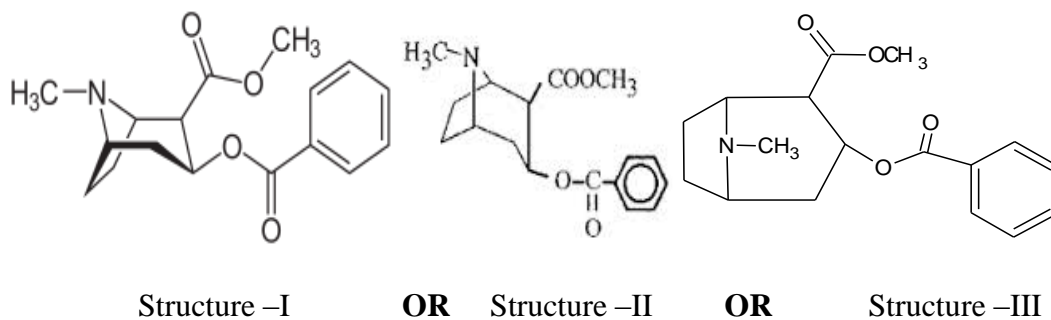
Ans: 5) Pyrrole can be prepared by passing a mixture of acetylene and ammonia through a red hot tube.



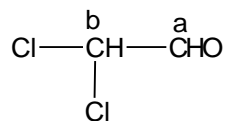
Ans: 6) Haworth structure of maltose



Ans: 7) Structure of cocaine is given below



Ans: 8)

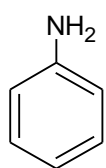


Two signals are observed, one for H_a and another for H_b protons.
 Multiplicity of each proton = 2 (doublet)

Ans: 9) Absorption bands in the region 1600 cm⁻¹ to 650 cm⁻¹ is called fingerprint region, because each compound gives a unique pattern in this region which doesn't match with the IR spectrum of any other compound.

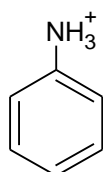
Ans: 10) A shift of λ_{max} absorption to a lower (short) wavelength in presence or absence of auxochrome group called hypsochromic shift or blue shift.

For example, addition of a proton to aniline decreases its λ_{max} (blue shift).



aniline

λ_{max} = 280 nm



anilinium

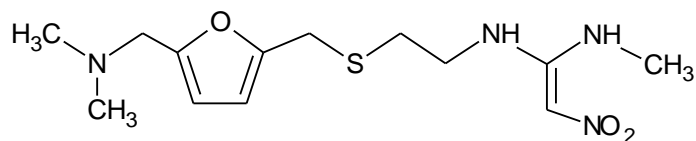
λ_{max} = 250 nm

Ans: 11) Antibiotics drugs are obtained(extracted) from the useful microorganisms and used to kill the harmful microorganisms.

These drugs are useful against typhoid, pneumonia, meningitis, etc.

Example – Penicillin, streptomycin, chloromycetin, aureomycin, terramycin, etc.

Ans: 12)

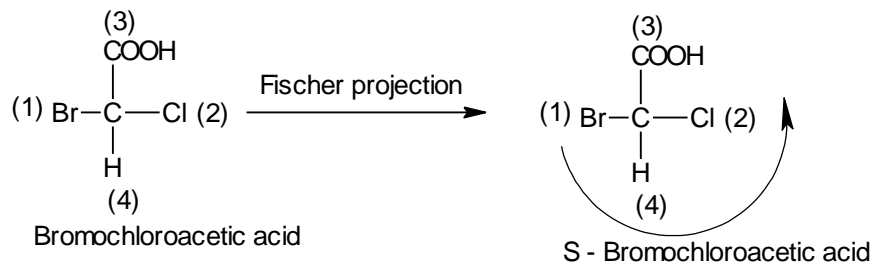
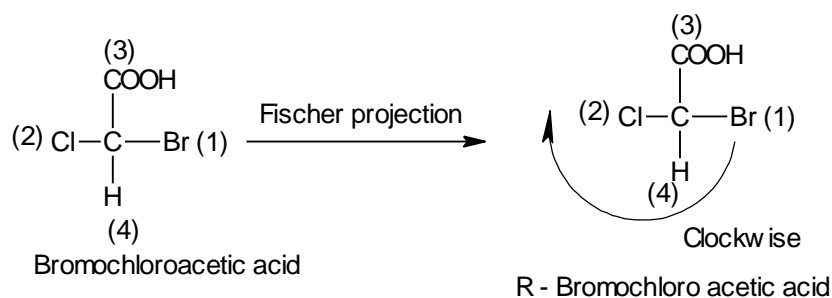


Structure of ranitidine

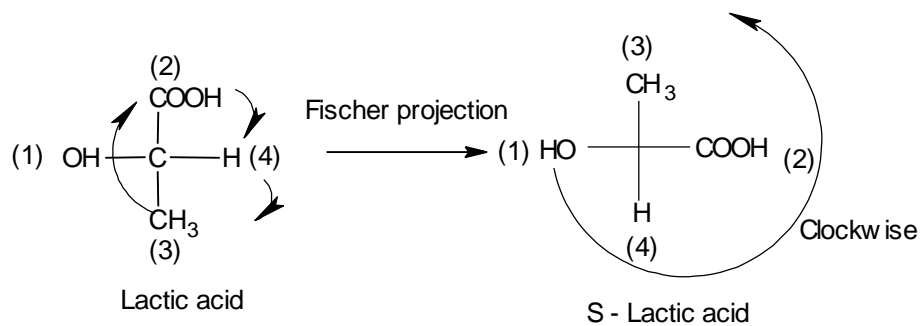
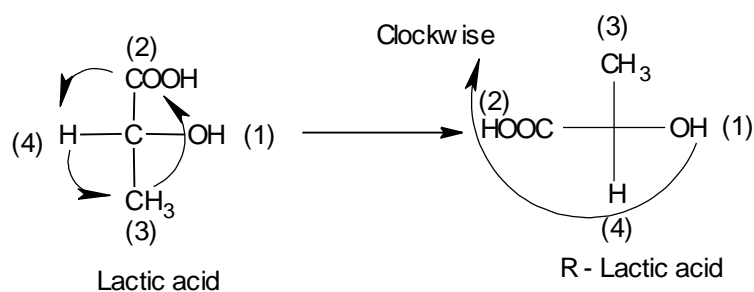
PART – B

Answer **any nine** of the following questions. Each question carries **six** marks. (9 x 6 = 54)

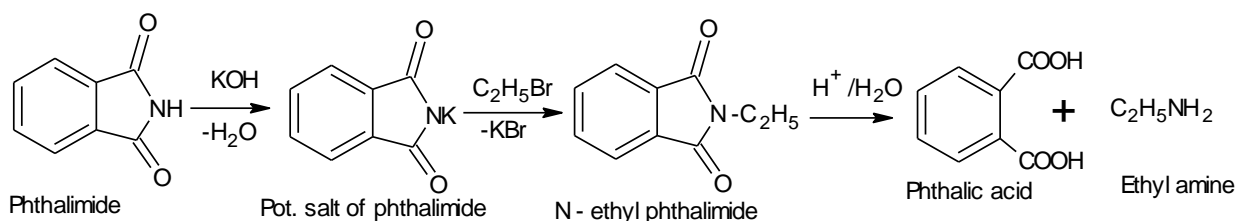
Ans: 13. a) i) R and S configuration of bromochloro acetic acid



ii) R and S configuration of lactic acid



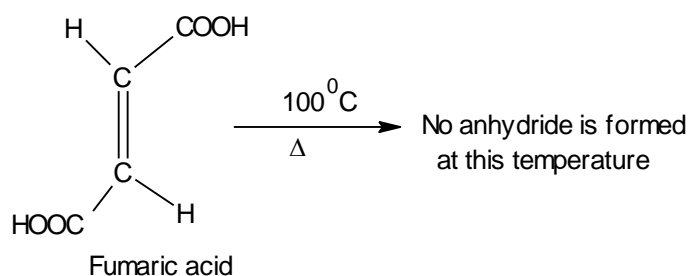
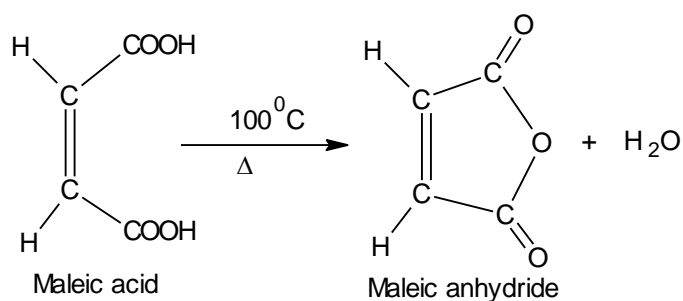
Ans: 13. b) Phthalimide is treated with alcoholic solution of KOH to get potassium salt which on treating with ethyl bromide followed by hydrolysis to form ethyl amine



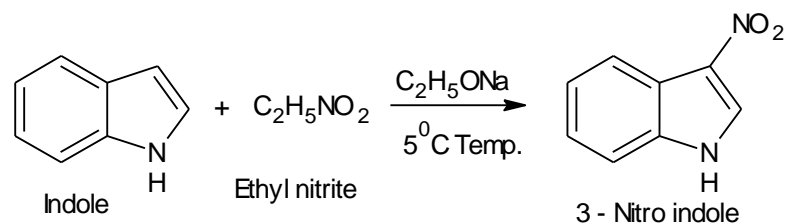
Ans: 14. a) The formation of a cyclic molecule from an open chain molecule takes place easily only when the reacting groups are close to each other. This fact has been most useful in assigning configuration to cis- trans isomers in which double bonded carbon carbon atoms carry groups that are capable of reacting with each other.

For example, maleic acid readily forms cyclic anhydride whereas fumaric acid does not. This means that in maleic acid the two groups are nearer to each other than they are in fumaric acid.

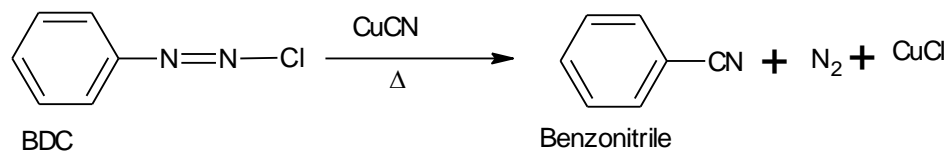
i. e. maleic acid is the cis form and fumaric acid the trans form.



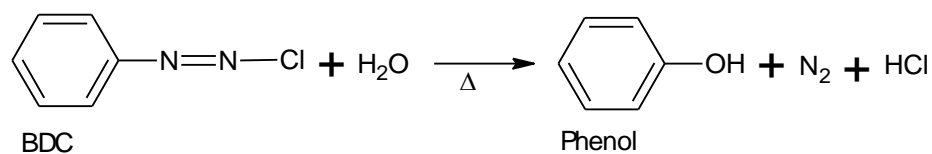
Ans: 14. b) Indole on nitration, using ethyl nitrite and sodium ethoxide as nitrating mixture forms 3-nitro indole



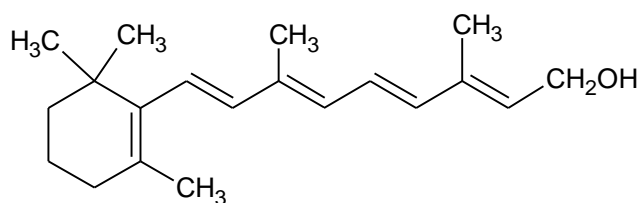
Ans: 15. a) i) When benzene diazonium chloride is heated cuprous cyanide by Sandmeyer's reaction given benzonitrile



ii) When benzene diazonium chloride undergo hydrolysis in hot condition to form phenol with liberation of nitrogen gas.



Ans: 15. b) Structure of vitamin – A



Vitamin - A₁ (Retinol)

Ans: 16. a) An alkyl amine has + I effect. It increases the electron density on the N –atom of amine. As a result, the basic character of the amine increases. A base donates its pair of electrons to the protons more easily, if the substituted ammonium ion formed from it is more stable. Hence an amine will be stronger base if the substituted ammonium ion formed from it is more stable. With increase in number of alkyl group, increase in basicity of amines.

So basicity of amines on the basis of inductive effect-

Tertiary amine > Secondary amine > Primary amine

But practically basicity changes due to steric hindrance

Secondary amine > Tertiary amine > Primary amine

When an amine is dissolved in water, the N –atom of amine forms hydrogen bond with H –atom of water. Thus the amine gets hydrated through hydrogen bonding. As a result of this, bonding energy called hydration energy, is released. Greater the extent of hydrogen bonding in protonated amine, greater will be the release of hydration energy and greater will be the stability of protonated amine and hence greater will be the basicity.

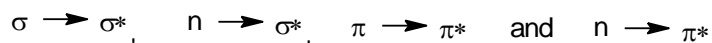
So basicity of amine on the basis of solvation effect-

Tertiary amine > Secondary amine > Primary amine

But practically basicity changes due to steric hindrance

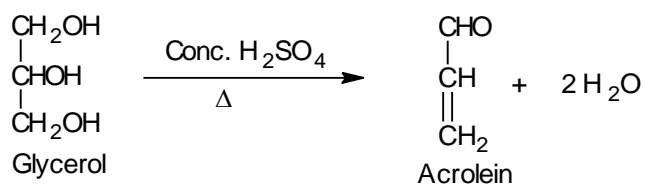
Secondary amine > Tertiary amine > Primary amine

Ans: 16. b) Four electronic transitions are possible in acetaldehyde namely

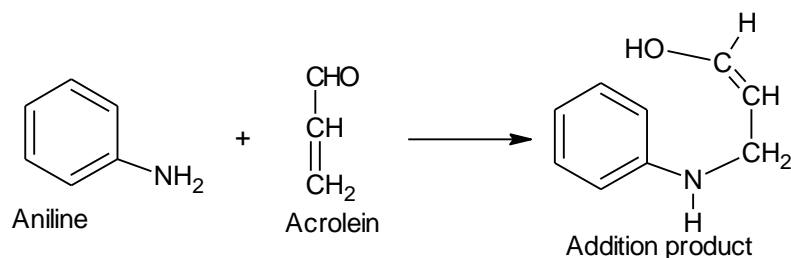


Ans: 17. a) Skraup's synthesis of quinoline involves following steps:

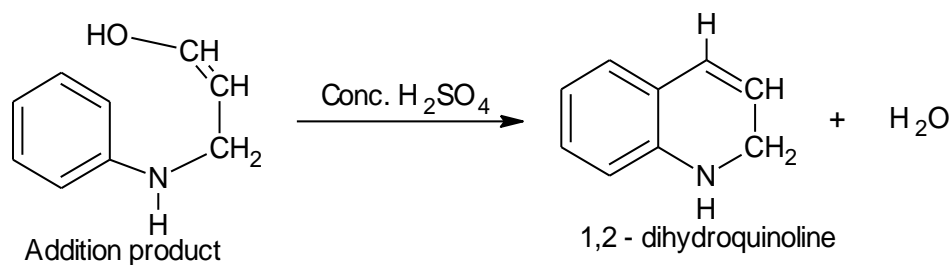
Step-1: Glycerol undergoes dehydration with sulphuric acid to give acrolein



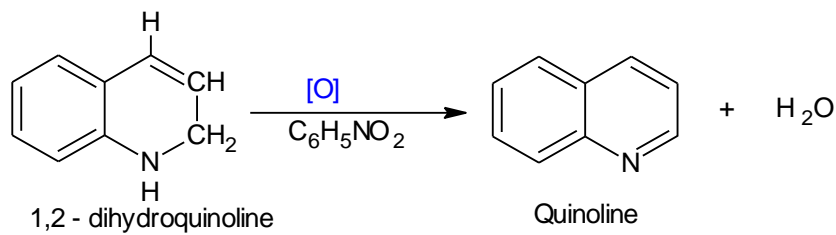
Step-2: Aniline adds to acrolein to give addition product



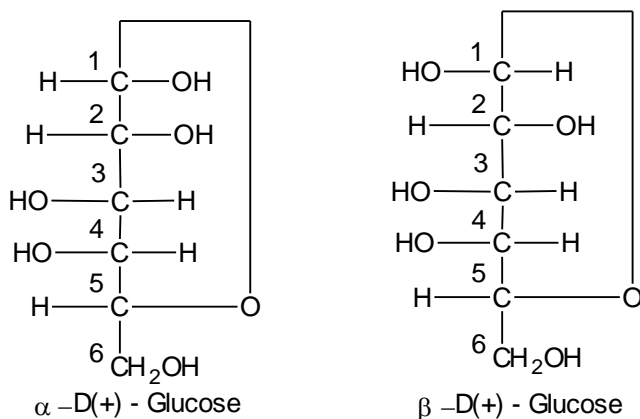
Step-3: Addition product undergoes ring closure in presence of sulphuric acid to form 1,2-dihydroquinoline.



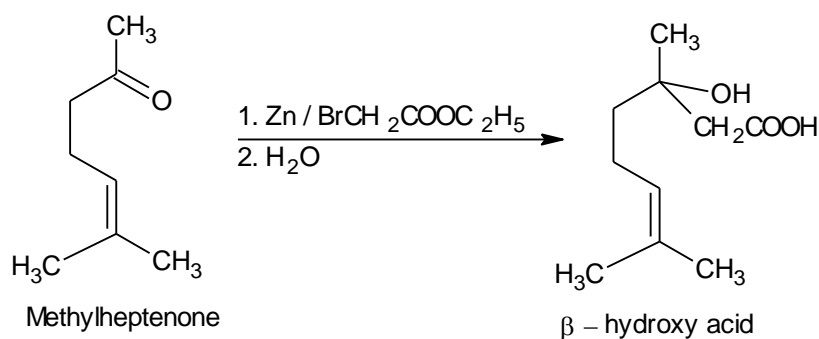
Step-4: 1, 2 – dihydroquinoline undergoes oxidation with nitrobenzene to finally yield quinoline.

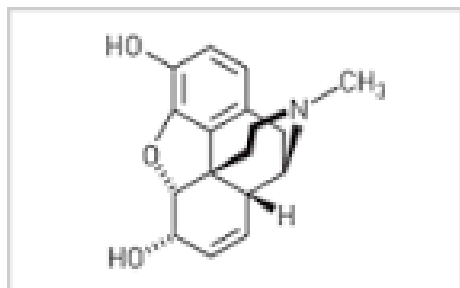


Ans: 17. b) A pair of diastereomers that differ in the configuration around C-1 are called epimers.

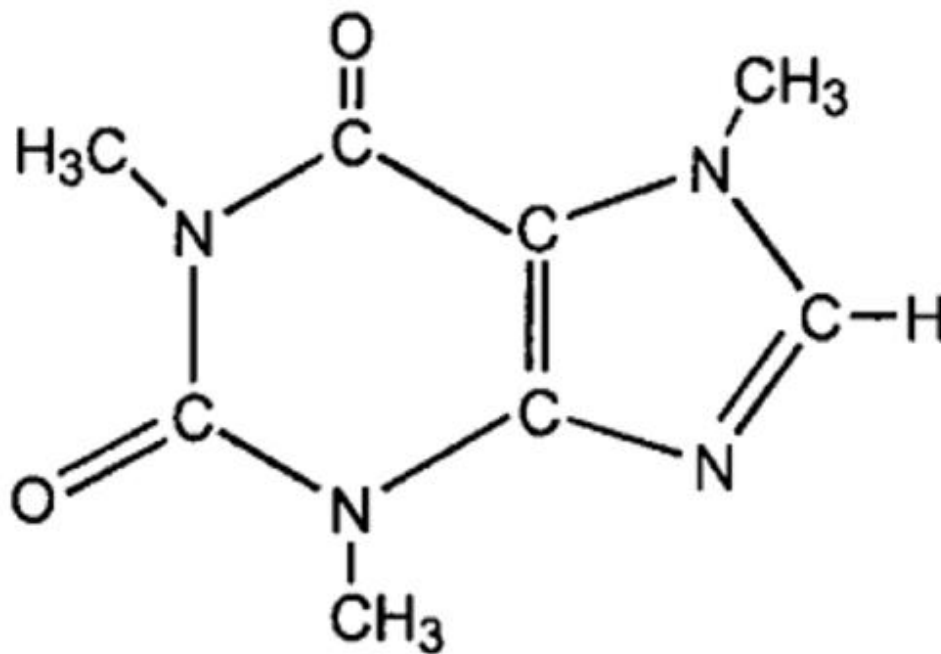
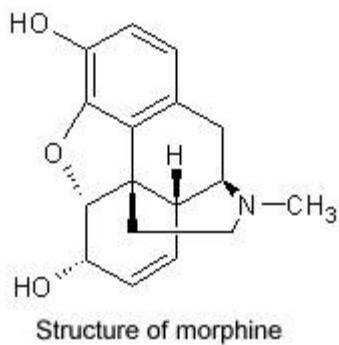


Ans: 18. a) **Step-I:** Methylheptenone is subjected to Reformatsky reaction and hydrolysis to give β – hydroxy acid.





OR

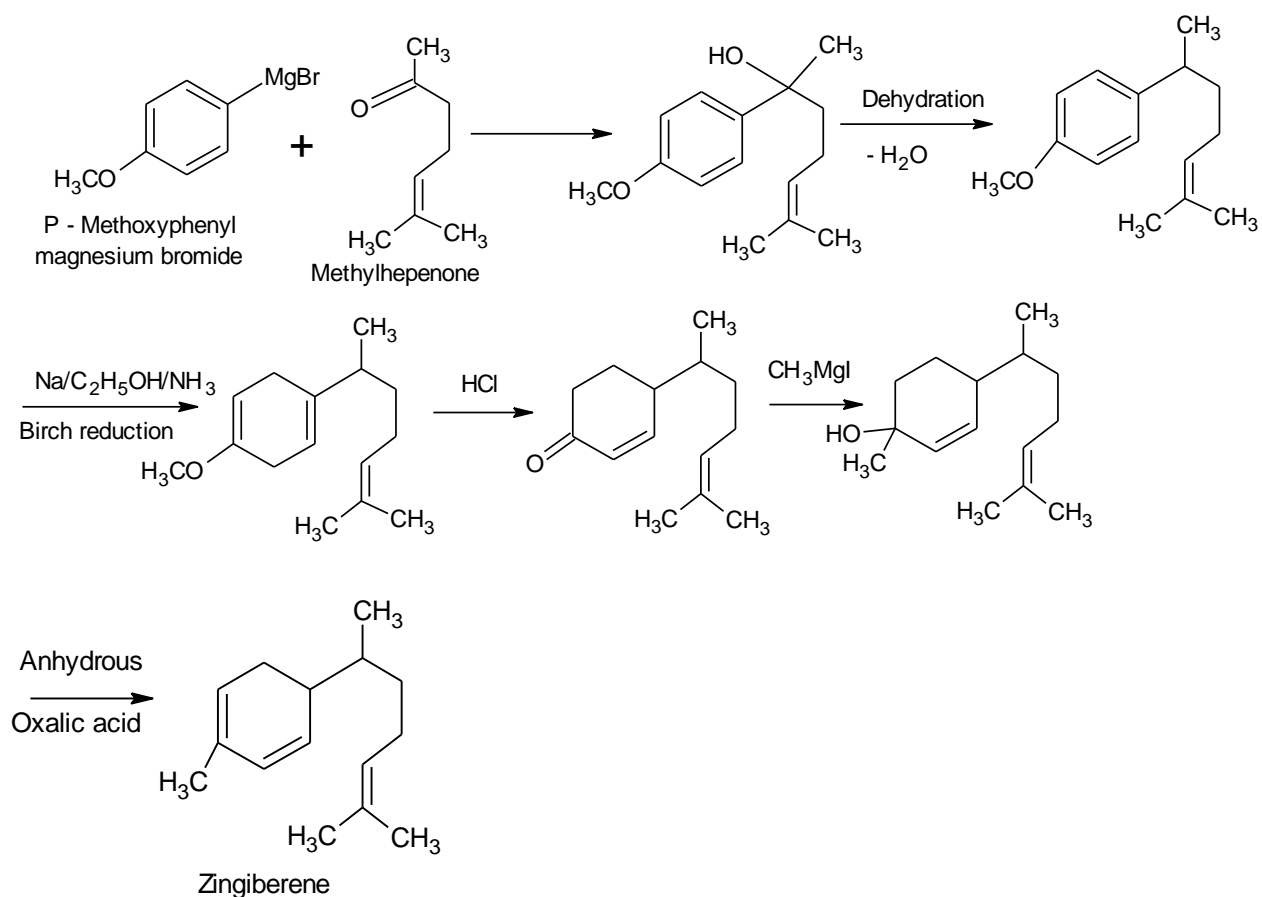


Caffeine

Ans: 19. b) IUPAC name of i) $C_6H_5-NH-CH_3$ is N-Phenylmethanamine

ii) $CH_3-NH-CH_3$ is N-Methylmethanamine

Ans: 20. a) Zingiberene can be prepared from p-methoxyphenyl magnesium bromide and methylketone as follow



Ans: 20. b) Thiophene is cyclic and planar compound, each ring atom of thiophene is sp^2 hybridized & continuous delocalization of electrons takes place and it contains $(4n + 2)\pi$ electrons. Also it undergoes electrophilic substitution reaction rather than addition reaction. Hence it is aromatic in nature.

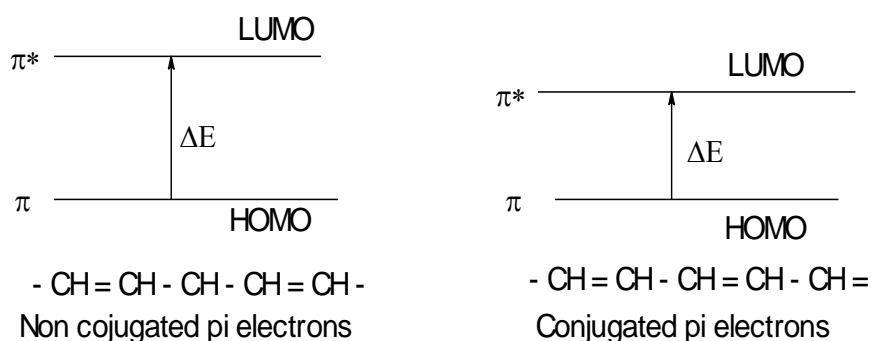
Ans: 21. a) Based on cyclic system present, terpenoids are classified into following types

- i) Monocyclic terpenoids: Example – α –Terpineol
- ii) Bicyclic terpenoids: Example – α –Pinene
- iii) Tricyclic terpenoids: Example – *Phytol*
- iv) Tetracyclic terpenoids: Example – *Gibberellic acid*
- v) Poly cyclic terpenoids: Example – Natural rubber

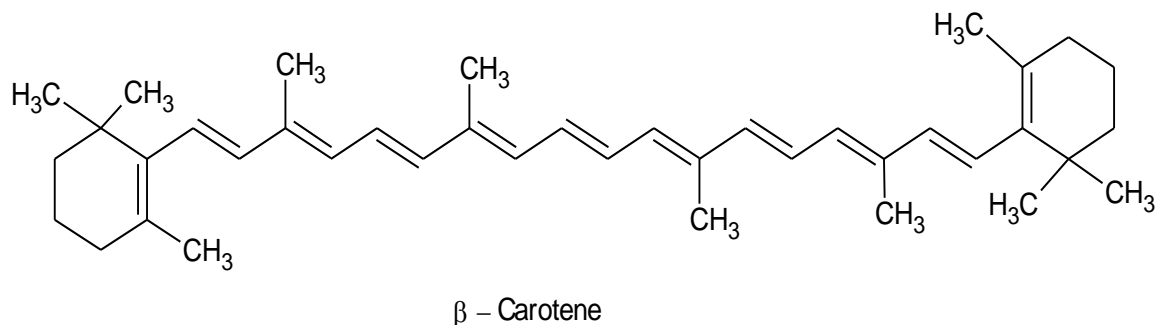
Ans: 21. b) A set of protons of identical environments are known as equivalent protons while the protons with different environment are known as non-equivalent protons. The number of signals in a

PMR spectrum tells us how many kinds of protons are present in a given molecule. Magnetically equivalent protons are also chemically equivalent.

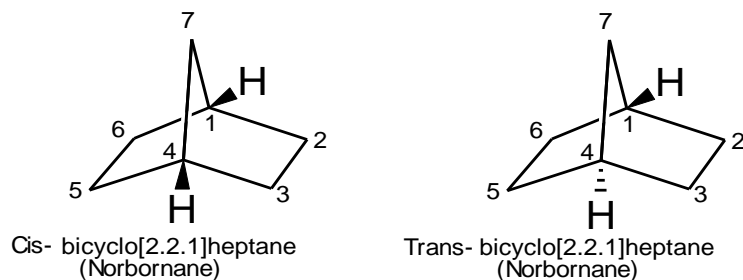
Ans: 22. a) Conjugation of double bonds lowers the energy required for the transition. The reason is that in conjugated systems, the difference in energy between the highest occupied molecular orbital (HOMO) and the lowest vacant anti bonding molecular orbital (LUMO) becomes smaller.



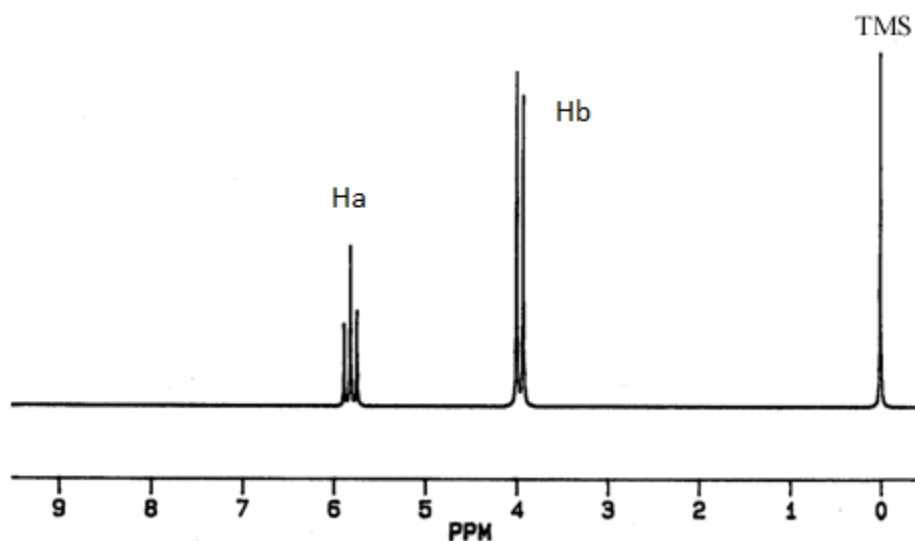
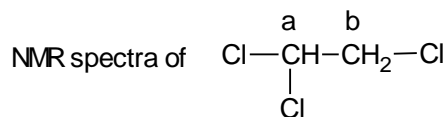
As a result $\text{>CH=CH-CH=C}<$ and >CH=CH-C=O exhibit $\pi \rightarrow \pi^*$ absorption bands within the ordinary ultraviolet range. For instance, 1,3-butadiene ($-\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2-$) in hexane solution shows λ_{max} 217 nm. As the number of double bonds in conjugation increases, the absorption moves to longer wavelengths. Thus spectrum of 1,3,5,7-octatetraene ($-\text{CH}_2=\text{CH}-\text{CH}=\text{CH}-\text{CH}=\text{CH}-\text{CH}=\text{CH}_2-$) in hexane exhibits λ_{max} 296 nm. If there are enough double bonds in conjugation absorption will ultimately move into the visible region and the compound will be coloured. For example, β -carotene, a naturally occurring yellow pigment containing 11 double bonds in conjugation owes its colour to absorption in the visible part of light λ_{max} is 451 nm.



Ans: 22. b) Cis and trans form of norbornane -

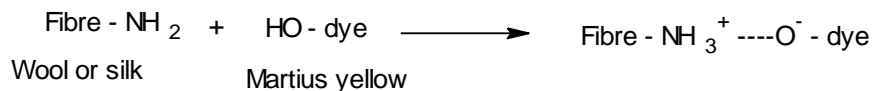


Ans: 23. a) In 1, 1, 2- trichloroethane contain two types of protons present namely Ha and Hb therefore two types of signals are observed. Signal of Ha proton undergo splitting into triplet (1+2=3) due to presence of two neighboring protons Hb. Two chlorine groups which are more elctrogtative than carbon are attached to the same carbon atom which is attached by Ha proton hence this signal is observed at downfield around 5.8- 5.9 ppm. Similarly signal of Hb proton undergo splitting into doublet (1+1=2) due to presence of one neighboring proton Ha. Only one chlorine groups which is more elctrogtative than carbon is attached to the same carbon atom which is attached by Hb proton hence this signal is observed at up field around 3.8- 4.1 ppm in NMR spectrum .

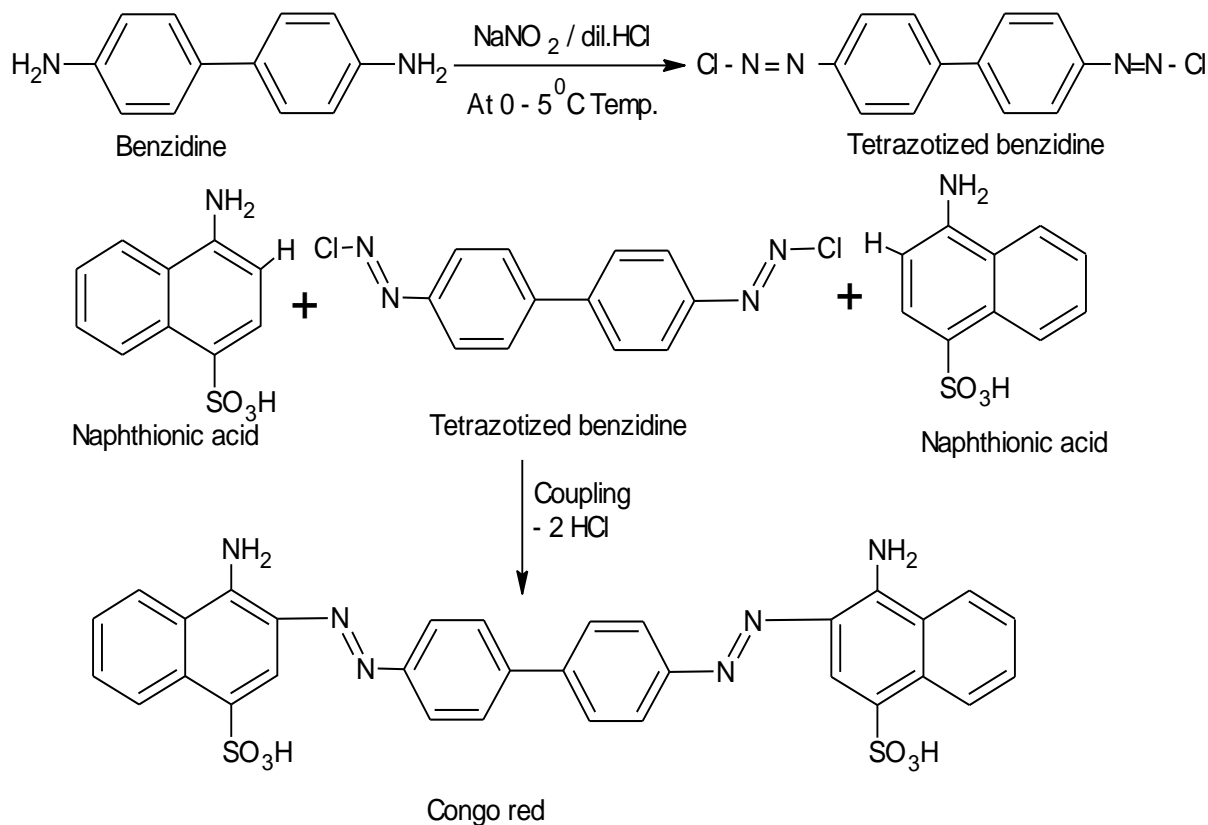


Ans: 23. b) These dyes can be applied to the fabric by direct immersion in a water solution of the dye. A direct dye contains acidic or basic auxochrome which combines with the opposite polar group present in the chemical structure of the fibres. Wool and silk are readily dyed by this method.

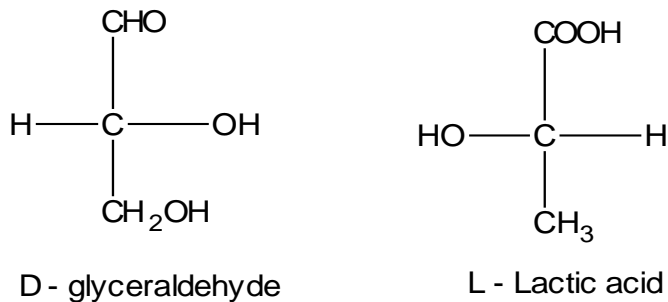
Example - Martius yellow



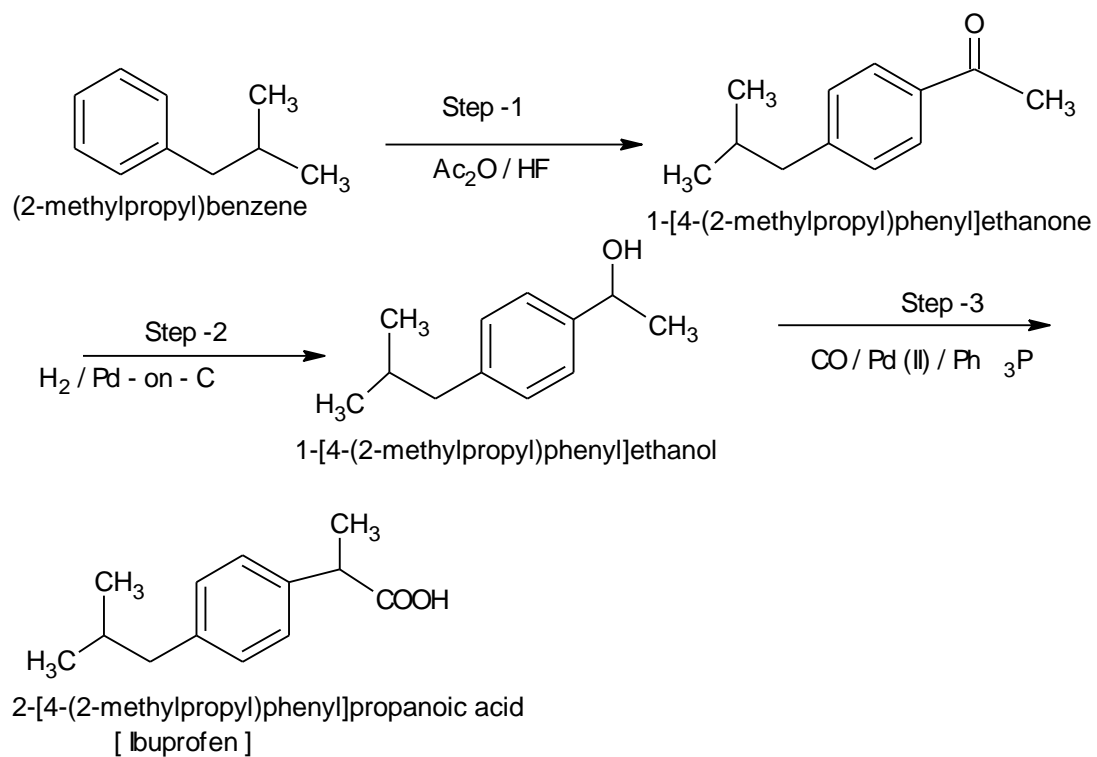
Ans: 24. a) Congo red can be prepared from naphthionic acid and tetrazotized bezidine



Ans: 24. b) Structure of D -glyceraldehyde and L-lactic acid can be written as



Ans: 25. a) Ibuprofen is prepared from 2-methylpropyl benzene using principles of green chemistry as follow



Ans: 25. b) The change in specific rotation of an optically active solution without any change in other properties is known as mutarotation.