

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

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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Model question paper – I

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. Mention two conditions for optical activity
2. What are enantiomers? Give example
3. Define stereogenic center. Give an example
4. Write the reaction for conversion of nitrobenzene to aniline
5. Explain Chichibabin reaction.
6. Write Haworth structure of lactose
7. Mention two uses of menthol
8. What is TMS? Write its structure
9. What is spin – spin coupling?
10. What is red shift? Give example
11. What are antimalarials? Give example
12. Write the structure of diclofenac and mention one use of it.

PART – B

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

13. a) Explain the resolution of tartaric acid by chemical method
b) Write the reaction for the preparation of ethyl amine from acetaldehyde by reductive amination method (4 + 2)
14. a) Explain the optical activity due to restricted rotation taking 6, 6'-dinitrodiphenic acid
b) How furan is prepared from furfural? (4 + 2)
15. a) How benzene diazonium chloride is converted to i) p- hydroxyl azobenzene ii) phenol
b) State isoprene rule (4 + 2)
16. a) How amines are distinguished using Hinsberg reagent? Write equations.
b) What is chemical shift? (4 + 2)
17. a) Explain the general mechanism of electrophilic substitution reaction of five membered heterocyclic compounds.
b) What are epimers? Give examples (4 + 2)
18. a) Explain how ring size of glucose is determined by HIO₄ oxidation method.
b) Mention two disadvantages of biochemical method of resolution (4 + 2)
19. a) Describe the synthesis of nicotine.
b) Write the IUPAC name of isopropyl amine and ethyl amine (4 + 2)
20. a) How glucose is converted into fructose?
b) State Huckel's rule of aromaticity (4 + 2)
21. a) Write any four general characteristic properties of alkaloids
b) Mention any two applications of fingerprint region. (4 + 2)
22. a) Explain shielding and deshielding of proton in NMR spectroscopy
b) Write E and Z configuration 2-chloro 2- butene (4 + 2)
23. a) Explain spin-spin splitting and spin-spin coupling using CH₃CH₂Cl.
b) Mention any two principles of green chemistry (4 + 2)

24. a) Describe the synthesis of malachite green from benzaldehyde
b) Write the cis and trans form of decalin (4 + 2)
25. a) Describe the synthesis of paracetamol from phenol
b) Write the structure of β -carotene (4 + 2)
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Answer of model question paper – I

Time: 3 Hours

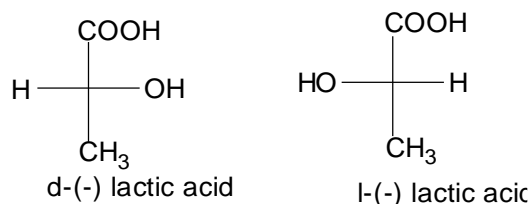
Max. Marks: 70

PART – A

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

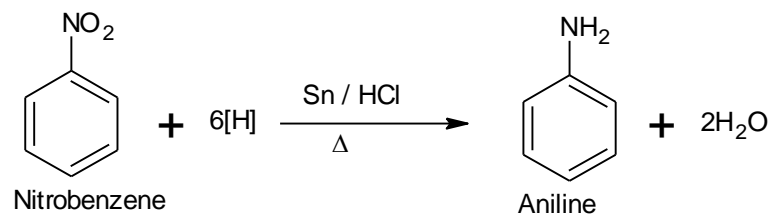
Ans: 1) Two conditions for optically active compounds: a) Compound should contain an asymmetric carbon or a stereogenic center or chiral carbon atom b) Compound should (dissymmetric) not have any plane of symmetry.

Ans: 2) Those isomers which have same molecular formula and able to rotate plane polarized light in either direction and their mirror images are not super imposable to each other called enantiomers. For example,

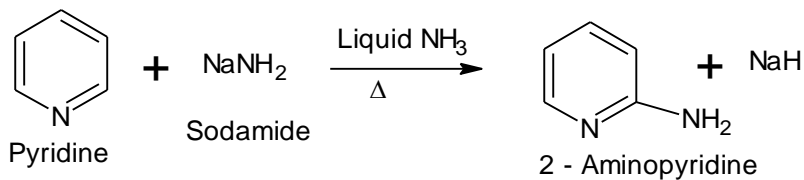


Ans: 3) The compounds which contain one or more chiral centre (a carbon atom surrounded by four different groups or atoms) and may be symmetric or dissymmetric in nature is called stereogenic centre. It is represented as *. For example, lactic acid ($\text{CH}_3\text{C}^*\text{HOHCOOH}$)

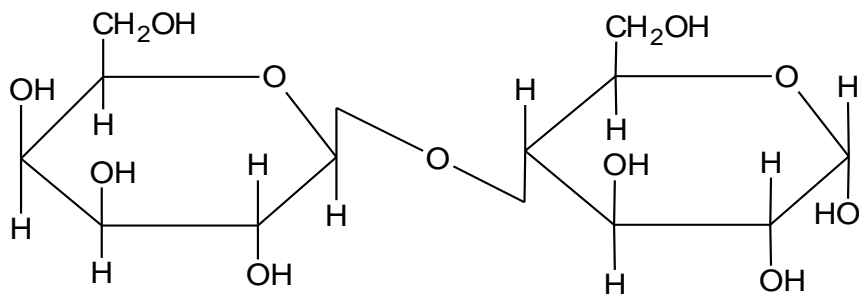
Ans: 4) Nitrobenzene on reduction using tin in dilute hydrochloric acid in hot condition form aniline.



Ans: 5) Pyridine reacts with sodamide in liquid ammonia at about 100°C to form 2-aminopyridine. This reaction is called Chichibabin reaction.



Ans: 6) Haworth structure of lactose

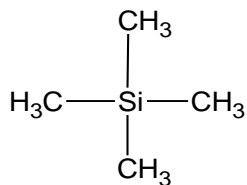


Howarth structure of lactose

Ans: 7) Menthol is used (i) In mouth washes and nasal sprays (ii) In local anaesthetic

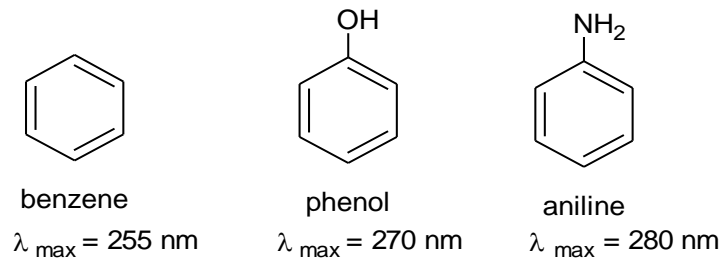
Ans: 8) TMS is tetra-methylsilane. It is used as standard in NMR spectroscopy.

Its structure is



Ans: 9) A single signal is split into number of peaks due to shielding of a given set of equivalent protons by protons of adjacent carbon atoms called spin-spin splitting or multiplets

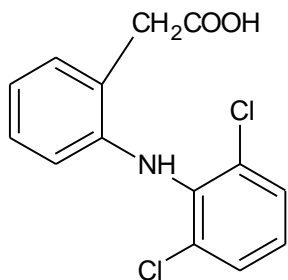
Ans: 10) A shift of λ_{max} absorption to a longer wavelength in presence of auxochrome group called bathochromic shift or red shift.



Ans: 11) The drugs which are used in the treatment of malaria caused by protozoa are called anti-malarials

Examples - Quinine, plasmoquin, atebirin, chloroquine, paludrine, etc.

Ans: 12)



{2-[(2,6-dichlorophenyl)amino]phenyl}acetic acid
(Diclofenac)

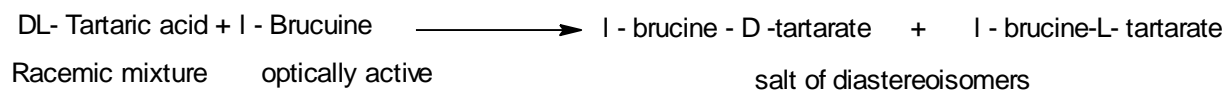
It is used in the treatment of rheumatoid arthritis, spondylitis, gout and acute musculoskeletal disorders.

PART – B

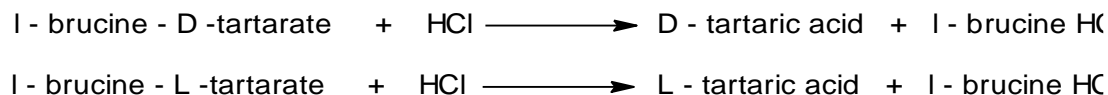
Answer **any nine** of the following questions. Each question carries **six** marks. (9 x 6 = 54)

Ans: 13. a) This method is considered to be best method of resolution of racemic mixture. It consists of converting the racemic mixture into diastereoisomers. The racemic mixture is treated with an optically active substance, when diastereoisomers result. The diastereoisomers differ in their physical properties and hence can be separated by optically active bases and vice-versa.

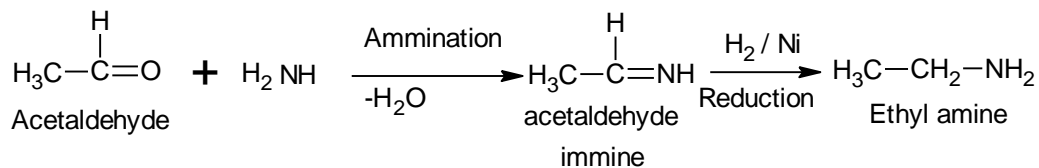
Consider the separation of a racemic mixture of tartaric acid. The racemic mixture of tartaric acid is treated with l –brucine (a base) to form salts, called diastereoisomers.



The two tartarate (diastereoisomers) are then separated by fractional crystallization and then each is separately treated with HCl to get the two enantiomers of tartaric acid.



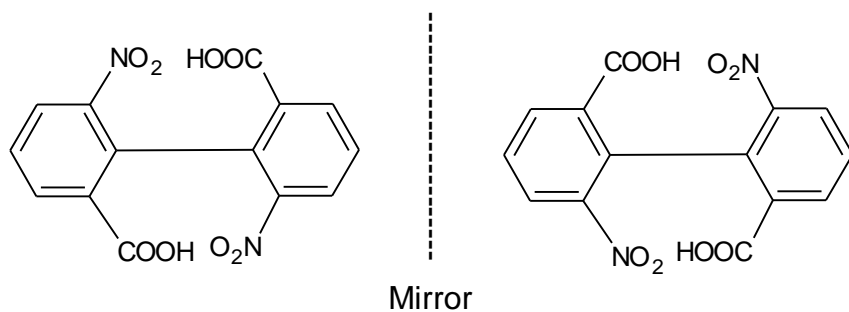
Ans: 13. b) Acetaldehyde reacts with ammonia to form immine which on reduction using hydrogen and nickel form ethyl amine



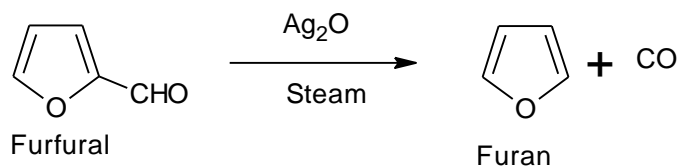
Ans: 14. a) Stereoisomerism of the compounds having restricted rotation about a σ sigma bonds specifically known as atropisomerism or conformational chirality.

A number of appropriately substituted biphenyls can have a chiral axis when steric (van der waals repulsive) interactions between the ortho substituents are sufficient to prevent rotation of aromatic rings relative to each other about the sigma bond joining them.

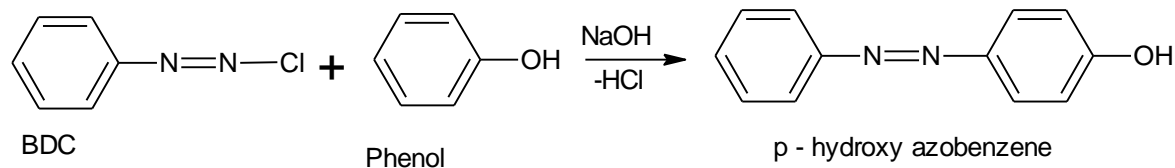
For example, consider 6,6'-dinitrodiphenic acid, in which the benzene rings lie in different planes which are vertical to each other. Their mirror images are non- super impossible on each other. Hence, such molecules exhibit optical activity.



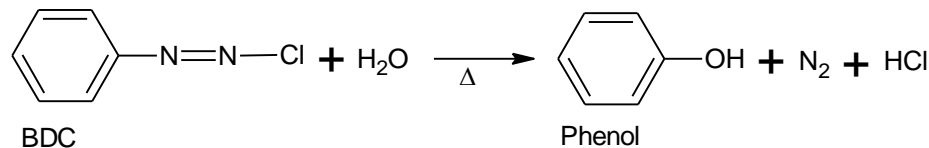
Ans: 14. b) Furan is prepared by decarbonylation of furfural in steam in presence of silver oxide catalyst



Ans: 15. a) i) When benzene diazonium chloride coupled with phenol in basic medium to form p-hydroxyazobenzene



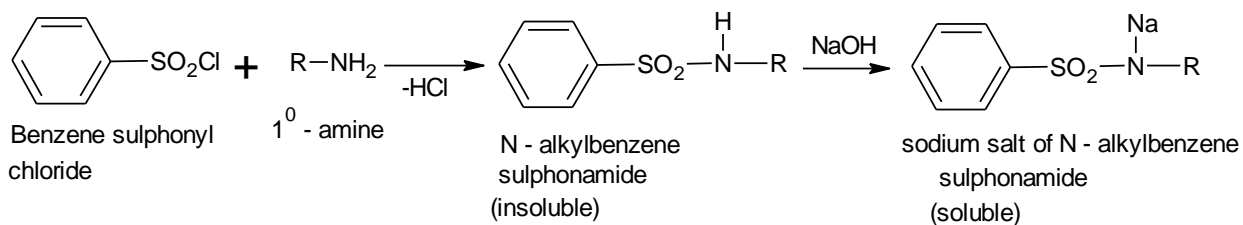
ii) When benzene diazonium chloride undergo hydrolysis in hot condition to form phenol with liberation of nitrogen gas.



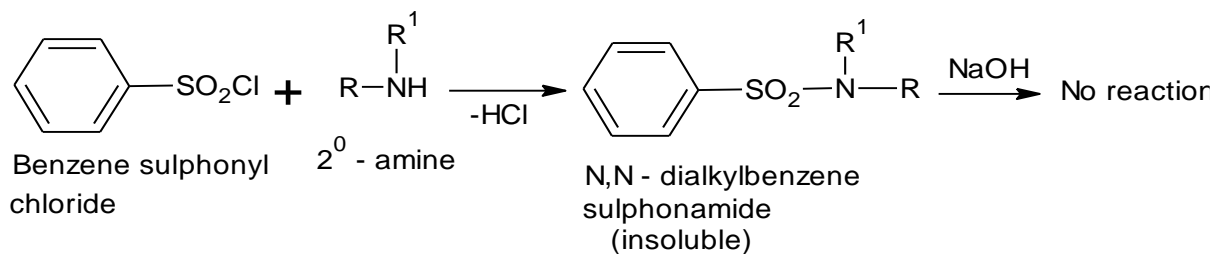
Ans: 15. b) Isoprene rule states that terpenoids are made up of a number of isoprene units. The isoprene units are held by head to tail linkage. The branched end of isoprene is considered as head.

Ans: 16. a) This involves the treatment of the mixture with benzenesulphonyl chloride (Hinsberg reagent). The solution is then made alkaline with aqueous NaOH

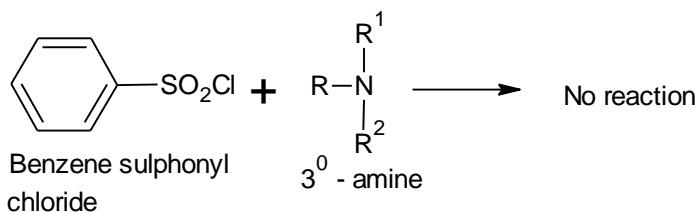
- i) The primary amine gives N-alkylbenzenesulphonamide. This forms salt with NaOH, which is soluble in water.



- ii) The secondary amine gives N,N-dialkyl benzenesulphonamide. This does not form salt with NaOH, and is insoluble in alkali solution.

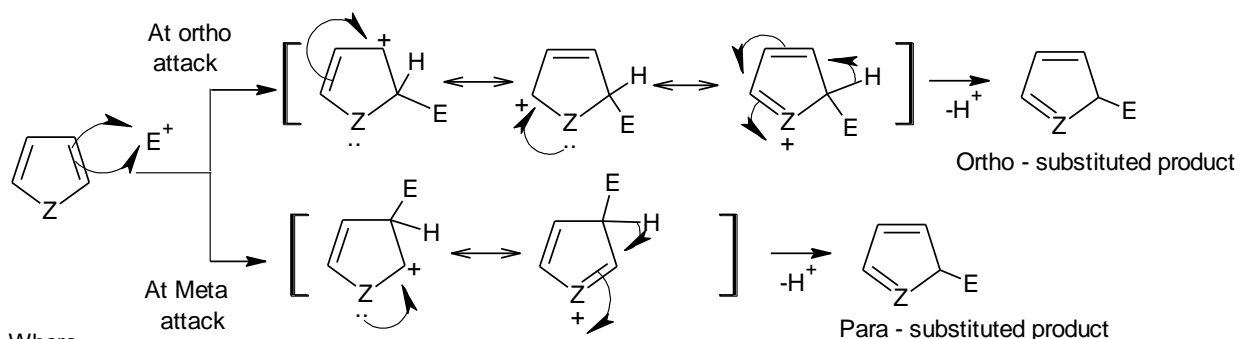


iii) The tertiary amine does not react.



Ans: 16. b) The separation between the peak of the reference standard (TMS) and any other peak in an NMR spectrum due to shielding and deshielding effects is called chemical shift.

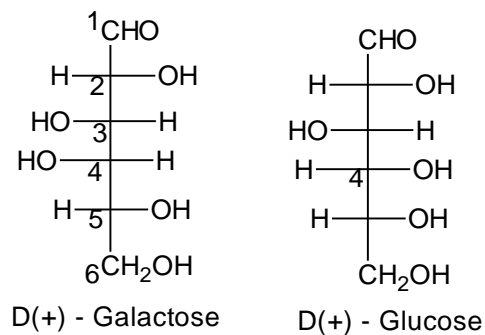
Ans: 17. a) Five membered heterocyclic compounds undergo electrophilic substitution reaction at ortho and meta positions. Ortho substituted products are more stable than Meta substituted products



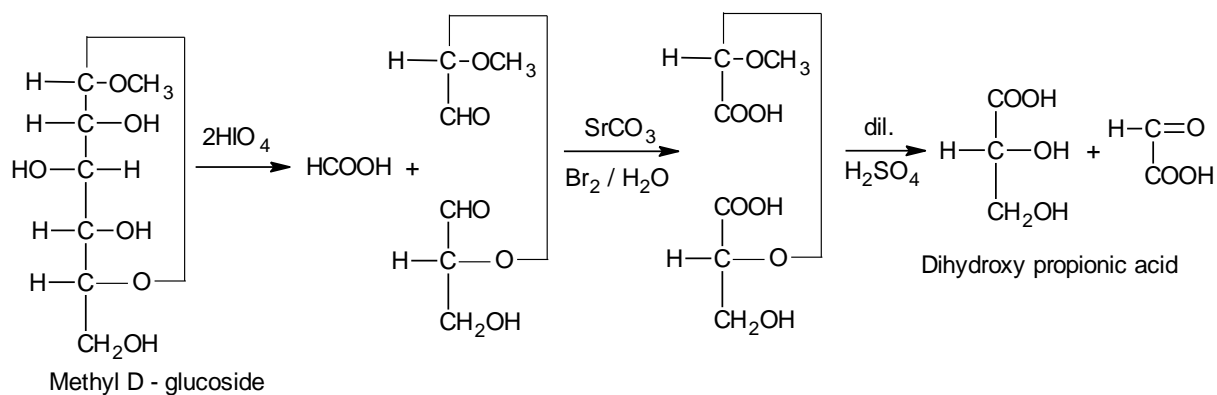
Where

When Z = NH, Pyrrole
 When Z = O, Furan
 When Z = S, Thiophene

Ans: 17. b) A pair of diastereomers that differ in the configuration about a single carbon atom other than first than first carbon are called epimers.



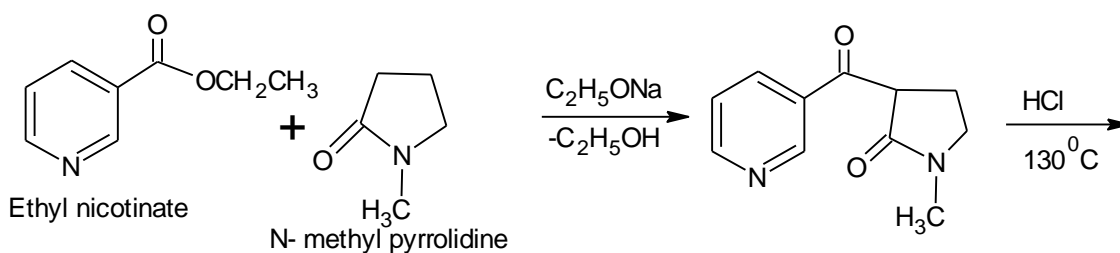
Ans: 18. a) The presence of six membered ring can be established by the following oxidation sequence using HIO_4 .

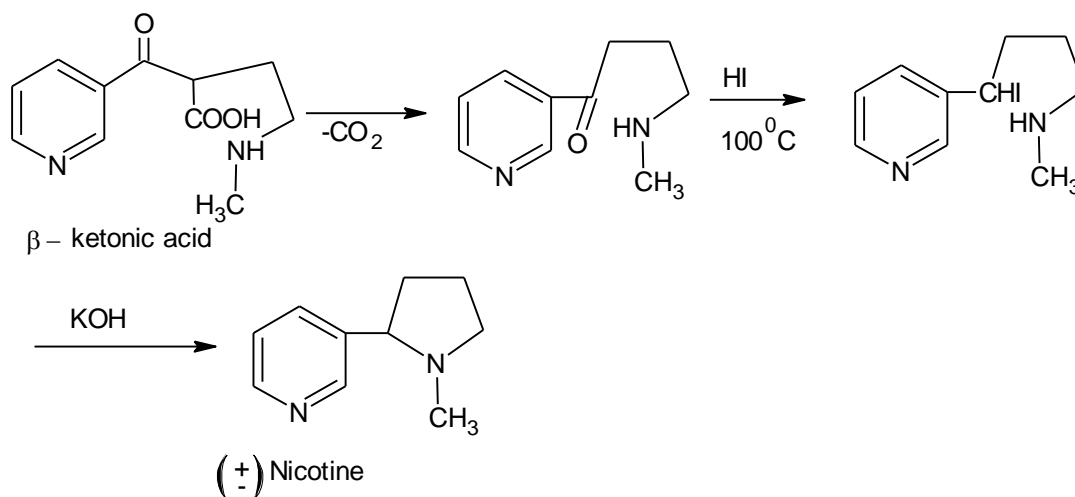


Ans: 18. b) Two disadvantages of biochemical method of resolution are

- One form of isomer is always destroyed.
- As dilute solutions are used, the amount of the second isomer left behind is very small.
- It is difficult to select a micro-organism which attacks only one of the enantiomers.

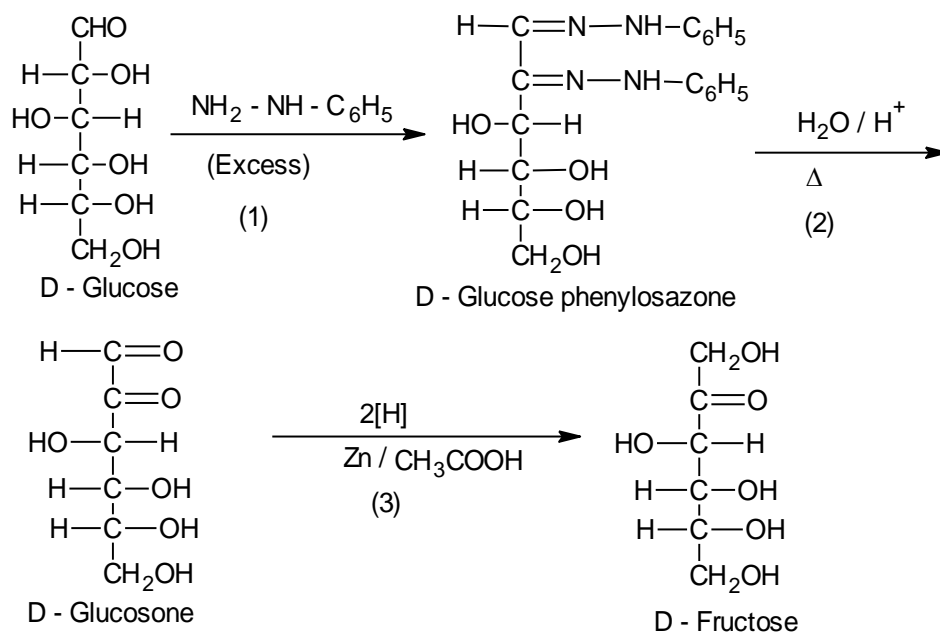
Ans: 19. a) Racemic mixture of nicotine is prepared by treatment of ethyl nicotinate with N – methyl pyrrolidine





Ans: 19. b) IUPAC name of isopropyl amine is 2 – propanamine, and ethyl amine is ethanamine.

Ans: 20. a) Fructose is prepared from glucose



Ans: 20. b) The property sp^2 hybridized heterocyclic compound which contain $(4n + 2)\pi$ electrons, where $n = 0,1,2, 3 \dots\dots$ called Huckel's rule for aromaticity.

Ans: 21. a) The general properties of alkaloids are

- i) They are colourless, crystalline, non-volatile solids, while a few of them (coniine, nicotine) are liquids.
- ii) Except the liquid alkaloids which are soluble in water, the rest are insoluble in water but dissolve readily in ethanol, ether, chloroform and benzene.
- iii) They are optically active, the majority being levorotatory.
- iv) They are basic (alkaline) with bitter taste, and dissolve in inorganic acids to form salts.

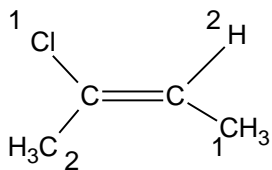
Ans: 21. b)

- i) It is used in the determination of hereditary genes
- ii) It is used in identification of suspected person who involved in crime

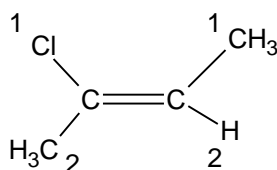
Ans: 22. a) For determining its NMR spectrum, a molecule is kept in a magnetic field. This causes the electrons of the molecule to circulate and in doing so they generate secondary magnetic fields called induced magnetic fields. The induced magnetic field may either oppose or reinforce the applied field. If the induced field opposes the applied field the effective field strength experienced by the proton decreases. This is known as shielding of the proton. Compared to a naked (bare) proton, a shielded proton needs a stronger magnetic field to produce an absorption signal or in other words it absorbs up field.

If the induced field reinforces the applied field, the effective field strength experienced by the proton increases. This deshielded proton naturally needs only a smaller applied field to give a signal i.e. it absorbs downfield.

Ans: 22. b) E and Z form of 2-chloro 2-butene can be written as below

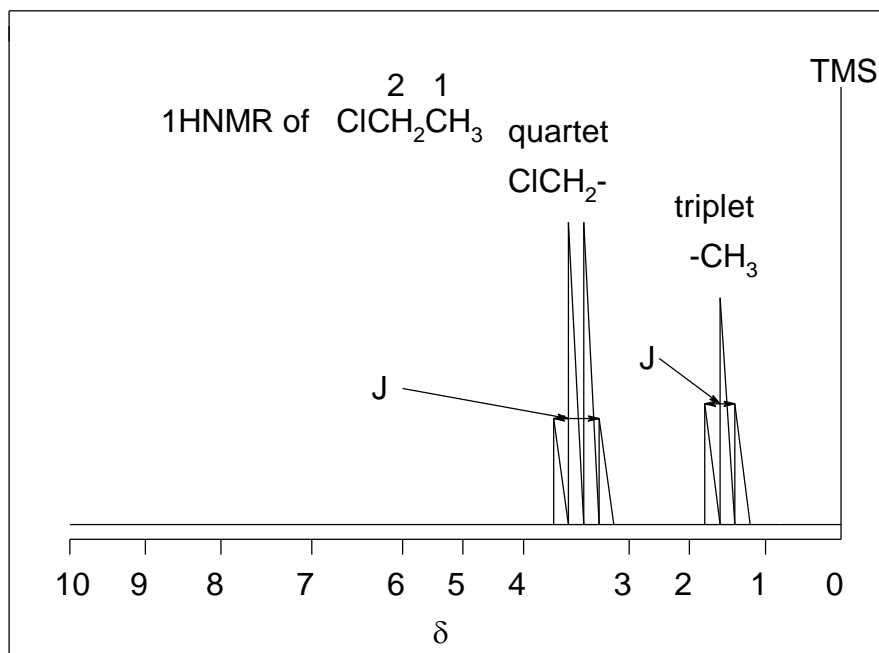


E - form of 2 - chloro 2 - butene



Z - form of 2 - chloro 2 - butene

Ans: 23. a) Spin – spin splitting and spin – spin coupling in chloroethane:



Chloroethane, ClCH_2CH_3 , has two non-equivalent hydrogen atoms namely H_1 and H_2 . We expect to see two signals, one at around δ 1.5 ppm and another at around δ 3.6 ppm. The field for the identical protons on C_1 is split into four (ratio 1:3:3:1) by the three protons on C_2 :

$\uparrow\uparrow\uparrow$
 $\uparrow\uparrow\downarrow, \uparrow\downarrow\downarrow, \uparrow\downarrow\uparrow$
 $\downarrow\uparrow\uparrow, \downarrow\uparrow\downarrow, \downarrow\downarrow\uparrow$
 $\downarrow\downarrow\downarrow$

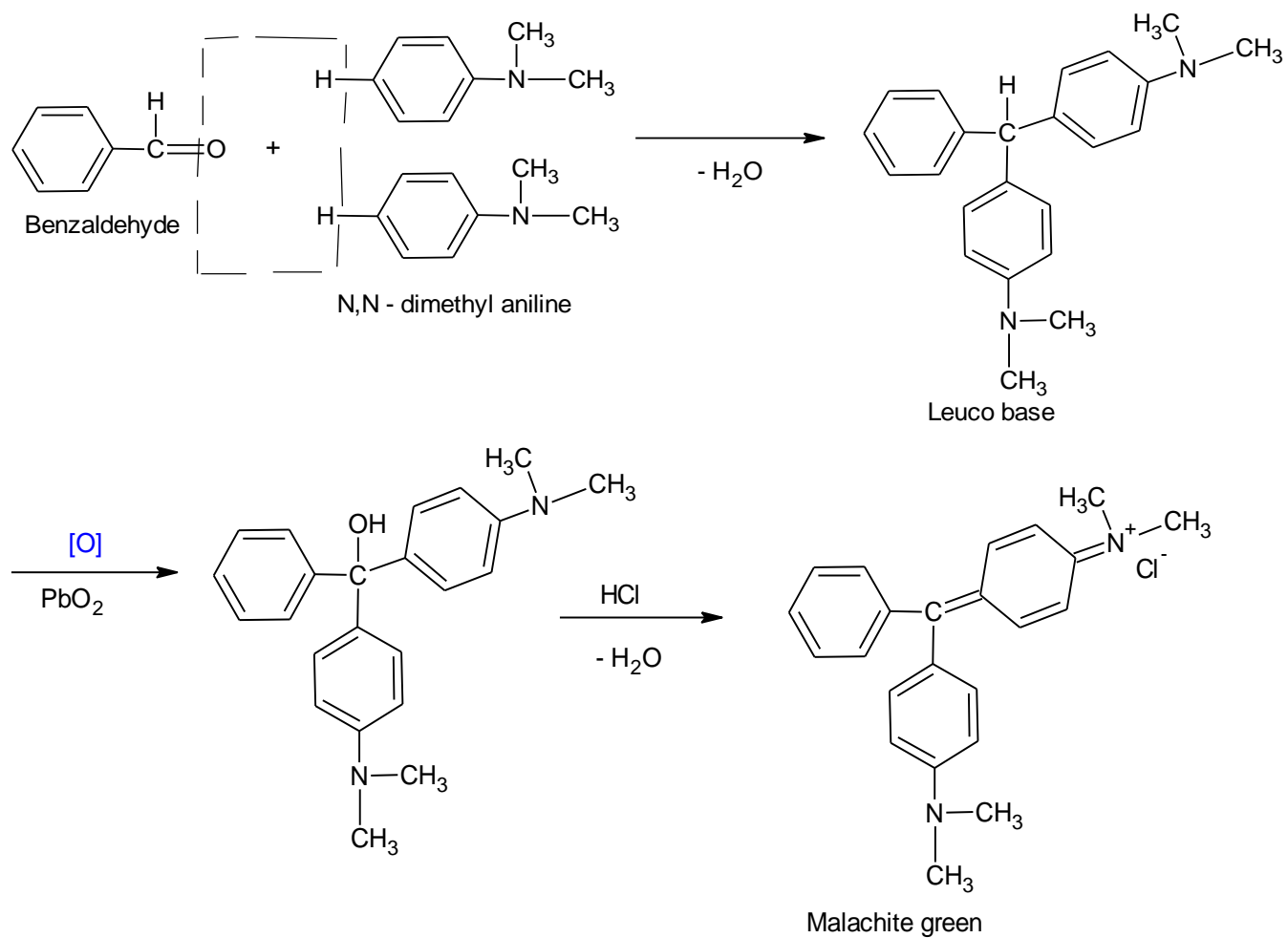
The three protons on C_2 are split into a triplet (1:2:1) by the two protons on C_1 . The quadruplet appears down field due to the proximity of the chlorine atom called spin-spin splitting.

The interaction between the nuclei of chemically non-equivalent neighboring protons C_1 and C_2 is called as spin-spin coupling. The interaction takes place through intervening covalent bond.

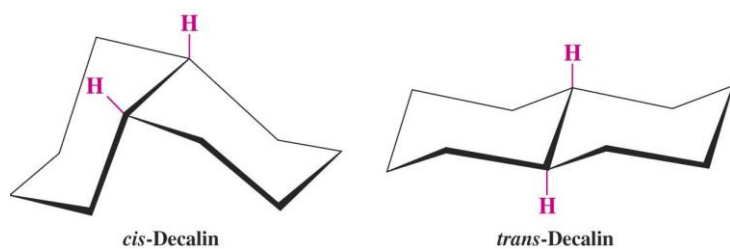
Therefore the strength of the interaction depends on the number of intervening bonds. Greater the number of intervening bonds, lesser the interaction. Measuring the distance between the centre of two peaks gives the coupling constant. It is denoted by a letter J.

Ans: 23. b) Two principles of green chemistry are i) Prevention (ii) Atom Economy (iii) Less Hazardous Chemical Syntheses (iv) Designing Safer Chemicals (v) Use of safer Solvents and Auxiliaries (vi) Design for Energy Efficiency (vii) Use of Renewable Feed stocks (viii) Reduce Derivatives (ix) Use of Catalysis (x) Design for Degradation (xi) Real-time analysis for Pollution Prevention and (xii) Inherently Safer Chemistry for Accident Prevention.

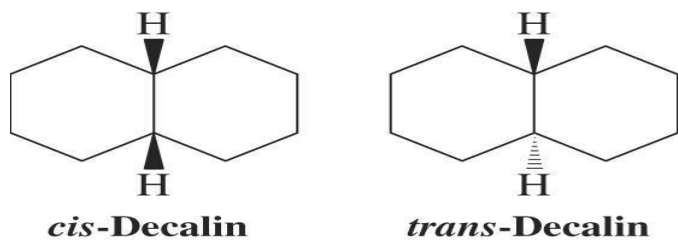
Ans: 24. a)



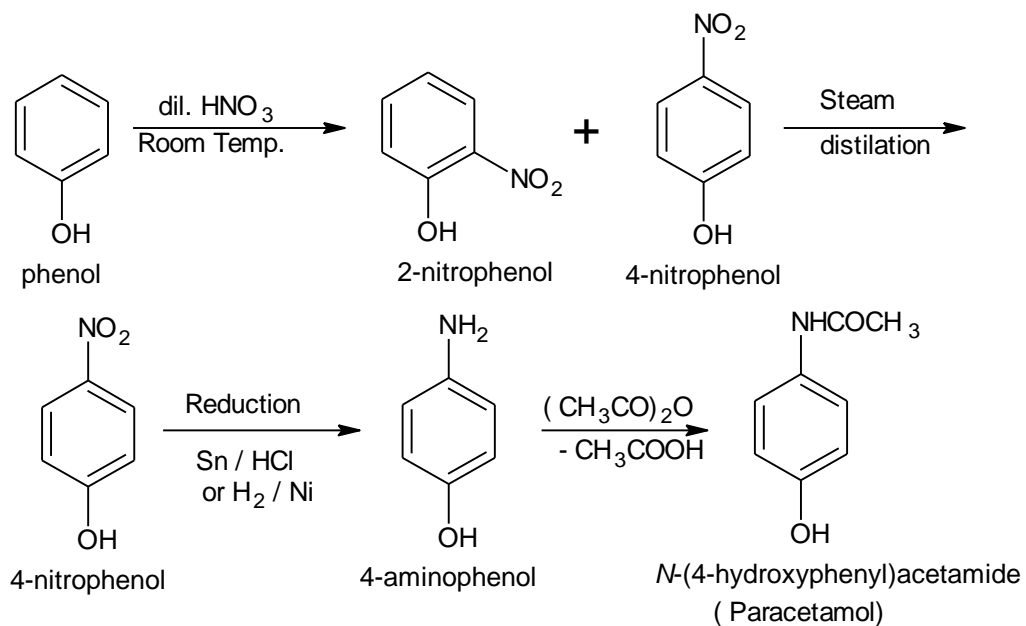
Ans: 24. b) Cis and trans form of decalin can be written as



OR



Ans: 25. a) paracetamol is a anti -pyretics drug which is prepared from phenol as follow



Ans: 25. b) Structure of β - carotene given below

