

Short answer type questions (Carrying 1 mark each)

A. Choose True/False statement from the following :

1. Inductive effect is temporary.
2. The electronegative atom in a carbon compound produces -I effect.
3. The shape of $\overset{\oplus}{\text{C}}\text{H}_3$ is pyramidal.
4. t - alkylhalides follow SN^1 reaction.
5. Monochloro acetic acid is a weaker acid than monofluoro acetic acid.
6. Free radicals are neutral species.
7. Addition reaction can take place across C - C bond.
8. Nucleophile must be rich in electrons.
9. Resonance decreases the stability of a molecule.
10. $\text{CH}_2=\text{CH}-\overset{\oplus}{\text{C}}\text{H}_2$ is less stable than $\text{CH}_3-\overset{\oplus}{\text{C}}\text{H}-\text{CH}_3$.
11. CH_3-COOH is a weaker acid than HCOOH .

B. Fill in the blanks :

1. The homolytic bond fission produces ———.
2. Inductive effect is permanent and ———.
3. The presence of +I group in carboxylic acids — their acid strength.
4. The delocalisation involving π bonds is known as ———.
5. When there is +ve charge upon the carbon of an organic group it is called ———.
6. The -vely charged carbon in Carbanion is — hybridised.
7. Dehydrohalogenation of alkyl halide is an example of — reaction.
8. The chlorination of benzene is an example of — reaction.
9. Aniline is less basic than ammonia. It is due to —
10. In phenol, the C_6H_5- group is ——— in nature.

C. Answer the following :

1. Define inductive effect.
2. Write any two characteristic properties of inductive effect.

3. What do you mean by the term bond polarisation.
4. Define resonance.
5. Draw the resonating structure of vinyl chloride.
6. Write a group which causes +I effect.
7. What is the necessary condition for hyperconjugation.
8. Which among the following is an electrophile. BF_3 , H_2O , NH_3 .
9. Which among the following is a nucleophile
 NH_3 , CH_3 , H^+
10. What is homolytic bond fission.
11. What is the shape of a carbocation.
12. What is the shape of a carboanion.
13. How free radicals are formed.
14. Steric effect is due to the presence of — groups.
15. What is a reactive intermediate ?

D. Multiple choice questions

Q.1. Which of the following statement is correct about inductive effect ?

- | | |
|---|----------------------|
| (a) It takes place only in σ -bond | (b) It is permanent |
| (c) It is irreversible in nature | (d) All of the above |

Q.2. Which among the following is a strongest acid ?

- | | |
|-----------------------|----------------------|
| (a) Nitroacetic acid | (b) Bromoacetic acid |
| (c) Chloroacetic acid | (d) Cyanoacetic acid |

Q.3. Arrange the following in increasing order of acidity ?

- | | |
|---|--|
| (i) $\text{Cl} - \text{CH}_2 - \text{CH}_2 - \text{OH}$ | (ii) $\text{Cl}_2 - \text{CH} - \text{CH}_2 - \text{OH}$ |
| (iii) $\text{Cl} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{OH}$ | (iv) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH}$ |
| (a) $\text{IV} < \text{III} < \text{I} < \text{II}$ | (b) $\text{I} < \text{II} < \text{III} < \text{IV}$ |
| (c) $\text{II} < \text{III} < \text{IV} < \text{I}$ | (d) $\text{III} < \text{IV} < \text{II} < \text{I}$ |

Q.4. Arrange the following compounds in decreasing order of acidity ?

- | | |
|---|---|
| (i) $\text{Cl} - \text{CH}_2 - \text{CH}_2 - \text{SH}$ | (ii) $\text{Cl}_2\text{CH} - \text{CH}_2 - \text{SH}$ |
| (iii) $\text{Cl} - \text{CH}_2 - \text{CH}_2 - \text{OH}$ | (iv) $\text{CH}_3 - \text{CH}_2 - \text{OH}$ |
| (a) $\text{II} > \text{I} > \text{III} > \text{IV}$ | (b) $\text{I} > \text{II} > \text{III} > \text{IV}$ |
| (c) $\text{IV} > \text{I} > \text{III} > \text{II}$ | (d) $\text{III} > \text{II} > \text{I} > \text{IV}$ |

Hints : It is because $\text{Cl}_2\text{CH} - \text{CH}_2 - \overset{\ominus}{\text{S}}$ is more stable than $\text{Cl}_2 - \text{CH} - \text{CH}_2 - \overset{\ominus}{\text{O}}$. In the former the -ve charge is delocalised by vacant d-orbitals of sulphur.

Q.5. Among the following which is least basic.

- | | | | |
|---------------------------------|---|---|---|
| (a) $\text{CH}_3 - \text{NH}_2$ | (b) $\text{CH}_3 - \text{CH}_2 - \text{NH}_2$ | (c) $\text{CH}_2 = \text{CH} - \text{NH}_2$ | (d) $\text{CH} \equiv \text{C} - \text{NH}_2$ |
|---------------------------------|---|---|---|

Hints : Acidity $\propto \frac{1}{\text{E.N. of the C - atom attached to } -\text{NH}_2}$

Q.6. Which among the following is most basic in nature ?

- (a) $\text{CH}_3 - \text{CH}_2 - \text{NH}_2$ (b) $\text{C}_2\text{H}_5 - \text{NH} - \text{C}_2\text{H}_5$ (c) $\text{CH}_3 - \text{CH} = \text{NH}$ (d) $\text{CH}_3 - \text{C} \equiv \text{N}$

Q.7. Among the following which is most basic in nature.

- (a) $\text{C}_6\text{H}_5 - \text{NH}_2$ (b) $\text{C}_6\text{H}_5 - \text{NH} - \text{C}_6\text{H}_5$
(c) $\text{C}_6\text{H}_5 - \underset{\text{CH}_3}{\text{N}} - \text{C}_6\text{H}_5$ (d) $\text{CH}_3 - \text{CH}_2 - \text{NH}_2$

Hints : aliphatic amines are more basic than aromatic amines. In aromatic amines due to delocalisation of lone pair electron on N-atom, it is less available for protonation.

Q.8. Which of these species are electrophiles ?

- (a) AlCl_3 (b) SO_2 (c) CO_2 (d) All of these

Q.9. Which among the following is a nucleophile ?

- (a) NF_3 (b) PCl_3 (c) NH_2OH (d) OF_2

Q.10. Which among the following acts as a nucleophile ?

- (a) NF_3 (b) NH_3 (c) NH_2OH (d) None of these

Hints : N- is attached to 3 most electro -ve atom.

Q.11. Which among the following is an electrophile ?

- (a) $\overset{\ominus}{\text{C}}\text{H}_2$ (b) $\overset{\ominus}{\text{H}}$ (c) $\text{R} - \overset{\ominus}{\text{O}}$ (d) $\overset{\ominus}{\text{S}}\text{H}$

Q.12. Which among the following has maximum +R effect ?

- (a) $-\text{NH}_2$ (b) $-\text{OH}$ (c) $-\overset{\ominus}{\text{O}}$ (d) $-\text{NHCOCH}_3$

Q.13. Among the following which is the most stable free radical.

- (a) $\text{CH}_3 - \underset{\text{CH}_3}{\overset{\cdot}{\text{C}}} - \text{CH}_3$ (b) $\text{CH}_3 - \overset{\cdot}{\text{C}}\text{H} - \text{CH}_3$ (c) $\text{C}_6\text{H}_5 - \overset{\cdot}{\text{C}}\text{H}_2$ (d) $\text{CH}_2 = \text{CH} - \overset{\cdot}{\text{C}}\text{H}_2$

Q.14. Which among the following has lowest P^{H} value.

- (a) $\text{Cl}-\text{CH}_2\text{COOH}$ (b) CNCH_2COOH (c) $\text{O}_2\text{NCH}_2\text{COOH}$ (d) $\text{Br}-\text{CH}_2-\text{COOH}$

Q.15. Which among the following has lowest P^{H} value ?

- (a) Phenol (b) Formic acid (c) Acetic acid (d) Ethyl alcohol

Q.16. Which among the following is the most stable carboniumion ?

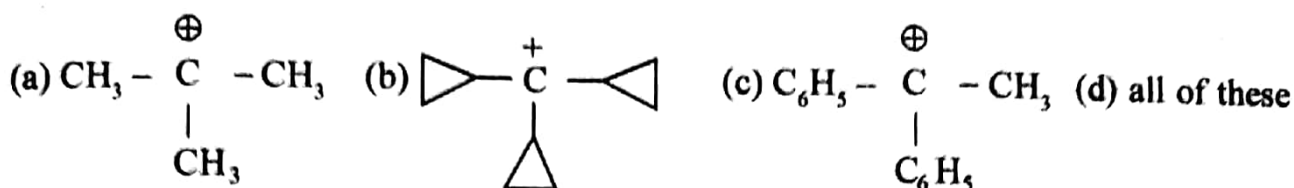
- (a) $\text{CH}_2 = \overset{\oplus}{\text{C}}\text{H}$ (b) $\text{CH}_2 = \text{CH} - \overset{\oplus}{\text{C}}\text{H}_2$
(c) $\text{CH}_3 - \text{CH} = \text{CH} - \overset{\oplus}{\text{C}}\text{H}_2$ (d) $\text{CH}_3 - \text{CH} = \text{CH} - \overset{\oplus}{\text{C}} - \text{CH}_3$
|
 CH_3

Hints : (d) C^+ is stabilised by resonance as well as by + I group ($-\text{CH}_3$ group)

Q.17. Which among the following has maximum -R power ?

- (a) -CHO (b) -COOH (c) -SO₃H (d) -NO₂

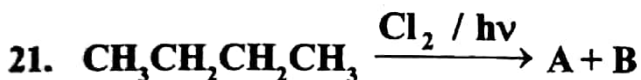
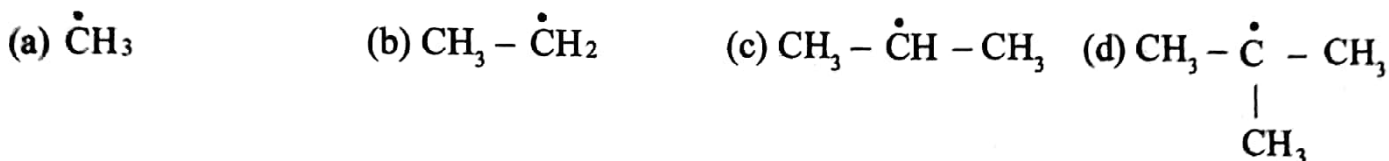
Q.18. Which one of the following carbonium ion is most stable ?



Q.19. Which among the following has maximum -I power ?

- (a) -OH (b) -NO₂ (c) F (d) Cl

Q.20. Which among the following is the most stable free radical ?



The approximate ratio of percentage of A and B formed in the above reaction is :

- (a) 45 : 55 (b) 28 : 72 (c) 60 : 40 (d) 50 : 50

Questions carrying 2 marks each

1. Why monochloro acetic acid is a stronger acid than acetic acid.
2. Explain the acidic properties of phenol.
3. Why aniline is less basic than ammonia.
4. Why alkyl amines are stronger bases than ammonia.
5. What is heterolytic bond cleavage. Explain with one example.
6. Carbon carbon bond distance in benzene is intermediate between C - C and C = C. Explain.
7. In acylium ion, the structure $\text{R} - \text{C} \equiv \overset{\oplus}{\text{O}}$ is more stable than $\text{R} - \overset{\oplus}{\text{C}} = \text{O}$. Explain.
8. What are free radicals ? How are they formed ?
9. Between Cl₂ and bromine which is more selective for halogenation ? Give reason.
10. Can we get isobutane by Wurtz reaction ? Give reason.

Long answer type questions

1. What is inductive effect. Write any four characteristic properties of inductive effect. Explain, why methyl chloride has some dipole moment & methane has zero dipole moment.
2. State and explain resonance. What are the necessary conditions of resonance. Explain with examples.
3. Write notes on.
(a) Hyperconjugation (b) Electromeric effect.

4. What is carbonium ion. Explain its structure and stabilities.
5. What is carbanions. Explain its structure and stabilities.
6. Define free radical. Explain its structure and stability.
7. Write notes on :
(a) Wurtz reaction (b) Wurtz fittig reaction
8. Describe substitution reaction of alkanes with halogens.
9. Why alkanes show free radical substitution reaction ?
10. Explain the % of different chloroalkanes when chlorine react with butane.
11. Explain why chlorine react more than bromine but latter is more selective for free radical substitution reaction with alkanes.

Short answer type questions (Carrying 1 mark each)

A. Choose True/False statement from the following :

1. Cis-isomer of $\text{HOOCCH}=\text{CHCOOH}$ forms anhydride when heated.
2. A racemic mixture contains equal masses of the two diastereoisomers.
3. Meso Tartaric acid is optically inactive.
4. m- Chlorobromo benzene is an isomer of m- Bromochloro benzene.
5. The compounds having $\text{C}=\text{O}$ does not show geometrical isomerism.
6. Ethane show geometrical isomerism.
7. Eclipsed form is less stable than straggered form.

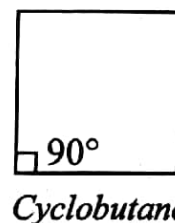
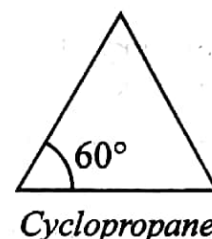
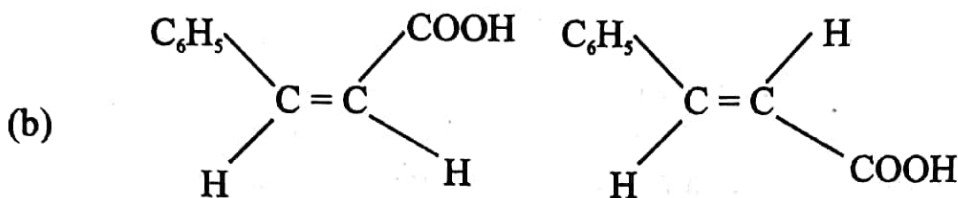
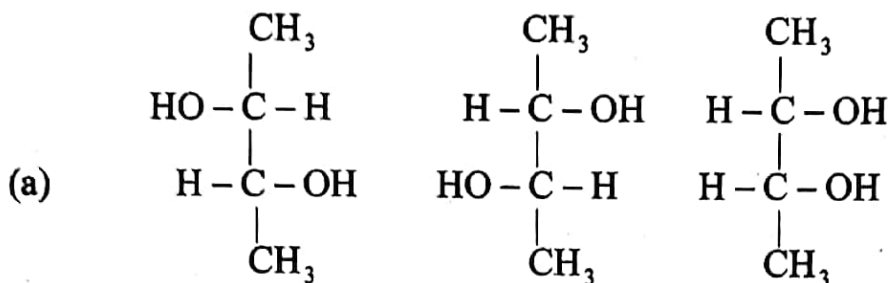
B. Fill in the blanks :

1. The cis-isomer has ——— dipolemoment than trans- isomer.
2. The optical isomers that are not mirror images are called ———.
3. The process of mixing an equimolar proportion of d and l forms of a compounds is called——
4. The process of separation of two d and l forms, from their mixtures is known as ——
5. When a carbon atom is joined to four other different atoms or groups the carbon atom conta are —— centre.
6. A meso compound is made up of —— molecules that contains —— centres.

Questions carrying 2 marks each .

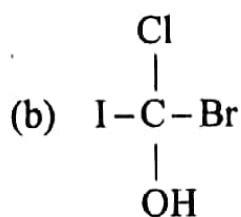
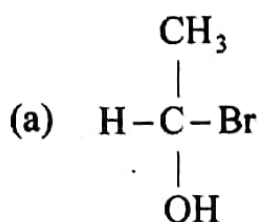
1. Define optical isomerism. What are the necessary conditions for optical isomerism.
2. Write down the structures of stereoisomers of the following.
 - (a) 2, 3- dihydroxy butane
 - (b) 3-phenyl-2- propenoic acid.

Ans.

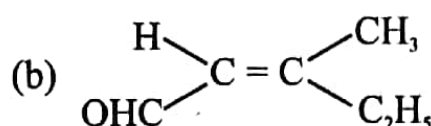
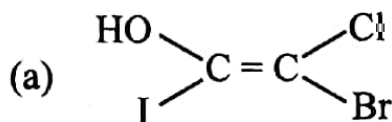


3. Explain why 2- Butene forms geometrical isomerism while 1 - Butene does not, ?
 4. What kind of structural isomerism exists between 2-methyl pentane and 3-methyl pentane.
 5. How many conformations are possible for butane.
- Hints.** Infinite
6. Staggered conformation is more stable than eclipsed. Explain.
 7. Write down the structure of all the isomers of dichloroethene. Which have zero dipole moment ?
 8. It is difficult to convert one geometrical isomer into other. Explain.
 9. Why alkynes do not exhibit geometrical isomerism although they contain π -bonds.
 10. Optically active 2-iodobutane on treatment with NaI in acetone gives a product which does not show optical activity. Explain.
 11. Briefly describe the possible isomers of 2, 3-pentadiene.
 12. Write down the structure of stereoisomers formed when cis-2- Butene is reacted with Br_2 .
 13. What is racemisation ?
 14. What is resolution ?
 15. What are the necessary conditions to get optical isomerism and geometrical isomerism ?
 16. Name the optically active alkane with lowest number of C - atoms.
 17. State and explain diastereomerism.
 18. Explain the term chirality.
 19. What is fischer projection formula ? Explain with one example ?

20. Give R, S configuration of the followings :



21. Give E, Z nomenclature of the following :



Long answer type questions

1. Define isomerism. Write notes on geometrical isomerism.
2. Write note on :
 - (a) CIP Rules
 - (b) Optical isomerism.
3. What type of isomerism is exhibited by maleic acid and fumaric acid ? Why they differ in their physical properties.
4. What is cis-trans isomerism ? Explain with Examples. How cis-and trans isomers differ in their physical properties ?
5. What is conformational isomerism ? Explain. conformational isomers of cyclohexane.
6. Write the possible conformational isomers of n-Butane. Give different formula to represent n-Butane.
7. Write notes on D, L-isomers with examples.
8. Write notes on :
 - (a) Enantiomerism
 - (b) Diastereomerism
 - (c) Mesocompounds
9. What is Bayer strain theory ? Explain stability of different cycle alkanes with the help of this theory.
10. Write notes on Fischer projection formula and how it helps to assign the configuration of an optically active compound.
11. Write notes on :
 - (a) E, Z system of nomenclature
 - (b) R, S system of nomenclature
 - (c) Specific rotation
 - (d) Erythro and Threo system of nomenclature

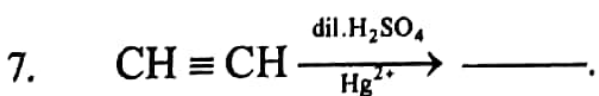
Short answer type questions (Carrying 1 mark each)

A. Choose True/False statement from the following :

1. Wurtz reaction is suitable for the synthesis of alkanes having odd number of C-atoms.
2. All alcohol react with conc. H_2SO_4 to produce alkene.
3. Peroxide effect is effective only in the addition of HBr and not HCl & HI.
4. Bayer's reagent is alkaline $KMnO_4$.
5. Markownikoff's rule is applicable both for symmetrical as well as unsymmetrical alkenes.
6. The acidic nature of three types of hydrocarbons are Alkene > Alkane > Alkyne.
7. 1-butyne can not be distinguished from 2-butyne with the help of Tollen's reagent.
8. 2-Butyne forms a red ppt. with ammoniacal Cuprous chloride solution.
9. Lindlar's reagent is used to check hydrogenation with alkyne.
10. All the addition reactions of Alkynes are electrophilic in nature.
11. Cis-isomer of $HOOCCH=CHCOOH$ forms anhydride when heated.
12. A racemic mixture contains equal masses of the two diastereoisomers.
13. Meso Tartaric acid is optically inactive.
14. The compounds having $C=O$ does not show geometrical isomerism.
15. Eclipsed form is less stable than straggered form.

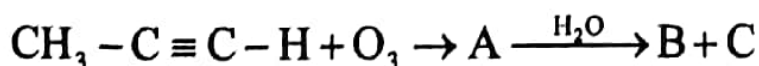
B. Fill in the blanks :

1. Ketoximes and amides are — isomers.
2. The process of mixing an equimolar proportion of d & l forms of a compounds is called —
3. The process of separation of two d & l forms, from their mixtures is known as —
4. Staggered form is — stable than eclipsed form.
5. A meso compound is made up of — molecules that contains — centres.
6. The hlogens which is most reactive in the hlogenation of alkane under sunlight is —
(chlorine, bromine, iodine)



Questions carrying 2 marks each

1. What is Electrophilic addition reaction ?
2. Write the name of the product obtained after ozonolysis of 1-butyne & then on hydrolysis.
3. Why acetylene is less reactive towards electrophile than ethylene ?
4. What happens when acetylene is treated with Na in liq. NH_3 & the product heated with H_2SO_4 ?
5. State and explain the restricted hydrogenation of alkyne.
6. Arrange the following in the increasing order of acidic strength. Propyne, 2-Butyne, acetylene
7. Identify A, B and C as the case may be

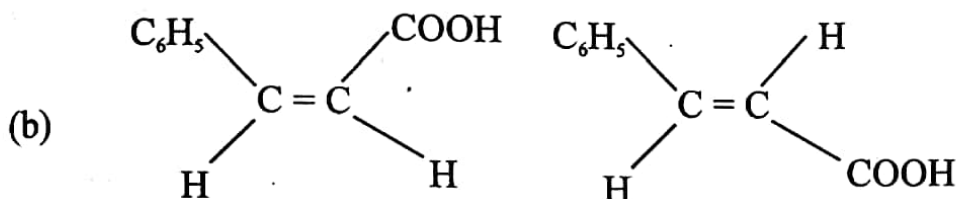
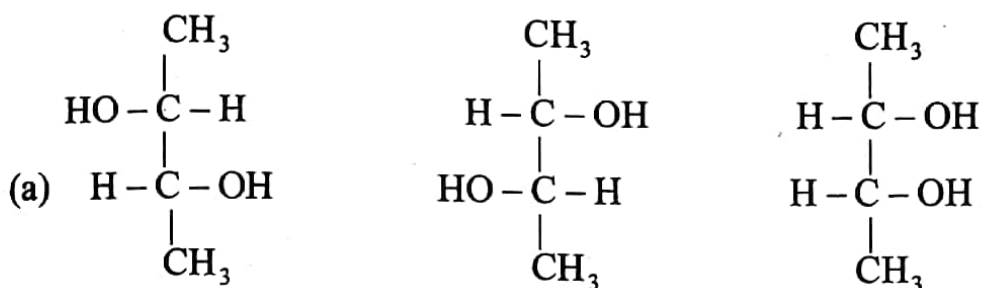


8. Write down the structures of stereoisomers of the following. (Roorkee- 1986)

(a) 2, 3- dihydroxy butane

(b) 3-phenyl-2- propenoic acid.

Ans.



- How many conformations are possible for butane. [*Hints.* Infinite]
- Staggered conformation is more stable than eclipsed. Explain.
- It is difficult to convert one geometrical isomer into other. Explain.
- Why alkynes do not exhibit geometrical isomerism although they contain π -bonds.
- Optically active 2-iodobutane on treatment with NaI in acetone gives a product which does not show optical activity. Explain.
- Briefly describe the possible isomers of 2, 3-pentadiene.
- Write down the structure of stereoisomers formed when cis-2- Butene is reacted with Br_2 .
- Neopentane forms only one mono substituted compound.
- What is racemisation ?
- What is resolution ?
- Name the optically active alkane with lowest number of C - atoms.
- State & explain diastereomerism.

Long answer type questions

- State and explain E_2 reaction with mechanism.
- What are the factors on which E_2 reaction depends.
- Write notes on stereochemistry, orientation of E_2 reaction.
- What is E_1 reaction Explain with mechanism.
- What are the factors on which E_1 reaction depends.
- Write rearrangement in E_1 reaction with mechanism.
- Write notes on stereochemistry and orientation of E_1 reaction.
- Write notes on $\text{E}_{1\text{cb}}$ reaction along with its kinetics.
- Compare E_1 , E_2 and $\text{E}_{1\text{cb}}$ reaction.
- Write notes on (a) Saytzeff elimination (b) Hoffmann elimination on.
- Write electrophilic addition reactions of alkenes along with mechanism.
- Write Hydroboration-oxidation reaction along with mechanism.

13. What is the hydroxylation reaction of alkenes. Explained by using (a) alkaline KMnO_4 (b) O_3 and (c) peroxy acid.
14. Write notes 1, 2 and 1, 4 addition reactions of dienes with mechanism.
15. Write Diels alder reaction with mechanism.
16. Explain allylic and Benzylic bromination with mechanism.
17. Write one example of nucleophilic addition reaction of alkyne with mechanism.
18. Explain the acidic character of acetylene and other terminal alkynes.
19. Write notes on Bayer strain theory.
20. Draw the Newmann projection formula and saw horse formula of (a) Ethane, (b) Butane
21. Write notes on conformations of cyclonexane.
22. Write notes on axial and equatorial bonds in cyclo hexane. What is 1, 3-diaxial interactions. Explain with example.

Short answer type questions (Carrying 1 mark each)

A. Choose True/False statement from the following :

1. Toluene when reacts with conc. HNO_3 and conc. H_2SO_4 can form m-nitrotoluene only.
2. m-Chlorobromobenzene is an isomer of m-bromochlorobenzene.
3. In benzene carbon uses all the three p-orbitals for hybridisation.
4. An electron donating substituent in benzene orients incoming electrophile to the ortho and para position.
5. Friedel-Craft's reaction cannot take place in the absence of a Lewis acid.
6. Toluene on oxidation with KMnO_4 produces benzoic acid.

B. Fill in the blanks :

1. Toluene is nitrated _____ than benzene.
2. It is _____ to carry out nitration of benzene in comparison to nitrobenzene.
3. The attacking species during nitration is _____ and during sulphonation is _____
4. _____ is the electrophile in the Friedel Craft's acylation reaction.
5. Benzene shows _____ substitution reactions.

Short Answer type Questions

1. What is the active species in the nitrating mixture ?
2. Between Toluenes and Benzene which is more reactive toward an electrophile ?
3. What is Friedel-Craft's alkylation ?
4. Classify the following groups as ortho, para or m-directing when present on the benzene ring—
(a) $-\text{NH}_2$ (b) $-\text{NO}_2$ (c) $-\text{OH}$ (d) $-\text{CN}$
5. What is Huckel's rule of aromaticity ?
6. Why benzene prefer electrophilic substitution reaction ?
7. Give the mechanism of halogenation reaction of Benzene ?
8. Give the mechanism of nitration reaction of benzene ?
9. How can you prepare Toluene from Benzene ?

10. How can you prepare Acetophenone from Benzene?
11. How Benzene reacts with chlorine in the presence of sunlight and in the presence of iron?
12. How can you prepare nitrobenzene from benzene?
13. What happens when benzene is heated with methyl chloride in the presence of anhydrous aluminium chloride?
14. What happens when benzene is heated with fuming nitric acid and fuming sulphuric acid?
15. Explain why $-OH$ group in benzene is o & p- directing.
16. Explain why $-NO_2$ group in benzene is m-directing.
17. Explain why chlorobenzene is less reactive as compared to ethylchloride.
18. Although benzene is highly unsaturated, it does not undergo addition reaction. Explain.
19. What is the role of $AlCl_3$ in the Friedelcraft's reaction?

Long answer type questions

1. What is Huckel's rule. Explain the aromatic character of arenes, cyclic carbocation and carbanion.
2. Give examples of heterocyclic compounds which show aromatic character and explain it as per Huckels rule.
3. Explain the halogenation of benzene with mechanism.
4. Explain nitration and sulphonation of benzene with mechanism.
5. Write notes on Friedel craft's reaction with mechanism.
6. Explain the directive influence of various groups in aromatic substitution.