

Duration: 3 Hours

Total Marks: 75

- N.B. : 1. All questions are compulsory**
2. Figures to right indicate full marks

Q. 1 Choose appropriate option for following multiple choice based questions. 20

- 1 The product obtained when toluene is first oxidised and then made to undergo halogenation is:
 - a 2-Chlorobenzoic acid
 - b Benzoyl choride
 - c 3-Chlorobenzoic acid
 - d 2,4,6-Trichlorobenzoic acid

- 2 Identify the compound with the highest ring strain?
 - a Cyclohexane
 - b Cyclopentane
 - c Cyclobutane
 - d Cyclopropane

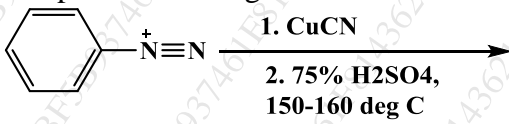
- 3 What is common in the groups mentioned:
 -CN, -CF₃, -NO₂, -N⁺(CH₃)₃
 - a They activate the ring towards electrophilic aromatic substitution
 - b They deactivate the ring towards electrophilic aromatic substitution
 - c They activate the aromatic ring by resonance effect and deactivate by inductive effect
 - d They deactivate the aromatic ring by resonance effect and activate by inductive effect

- 4 [4+2] Cycloaddition reaction method can be utilized for the synthesis of _____
 - a Naphthalene
 - b Anthracene
 - c Phenanthrene
 - d Benzene

- 5 Fats and oils are
 - a Monoesters of glycerol
 - b Diesters of glycerol
 - c Triesters of glycerol
 - d Diesters of glycol

- 6 Which of these electrophiles is a resonance stabilised structure?
 - a SO₃
 - b CH₃CO⁺
 - c Cl⁺
 - d CH₃CH₂⁺

- 7 The number of OH groups in fatty acids can be expressed as
 - a Saponification number
 - b Reichet-Meissl number
 - c Acetyl number
 - d Iodine number

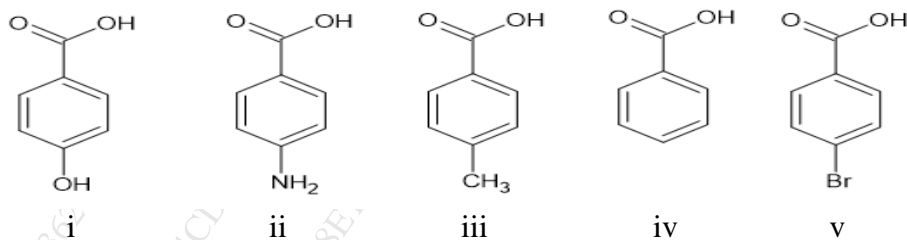
- 8 Which of the following reaction is a reversible reaction:
- Nitration of benzene
 - Friedel Crafts acylation
 - Halogenation of benzene
 - Sulphonation of benzene
- 9 Alkaline hydrolysis of oils (or fats) is called
- Saponification
 - Rancidification
 - Fermentation
 - Hardening
- 10 Identify the correct statement for Sachse-Mohr Theory
- Higher cycloalkanes are non-planar, exist in nature and are unstable
 - Higher cycloalkanes are non-planar, puckered, exist in nature and are stable
 - Higher cycloalkanes are non-planar and do not exist in nature
 - Higher cycloalkanes are co-planar and exist in nature
- 11 In electrophilic aromatic substitution, the rate determining step is the
- Generation of electrophile
 - Attack of the electrophile on the aromatic ring to form an intermediate carbocation
 - Abstraction of a proton by a base from the intermediate formed
 - All steps involved in electrophilic aromatic substitution are rate determining steps
- 12 Exposure to one of the following will lead to drying of oils
- Oxygen
 - Moisture
 - Microbes
 - Plastic container
- 13 The product of the given reaction is:
- 
- Phthalic acid
 - Benzene nitrile
 - Benzoic acid
 - Benzyl amine
- 14 _____ cannot be oxidized by O_2/V_2O_5
- Naphthalene
 - Anthracene
 - Phenanthrene
 - Biphenyl
- 15 *para* fluoro benzoic acid is less acidic than *para* chloro benzoic acid because—
- +R-effect dominates the -I effect in p-fluorobenzoic acid,
 - I effect dominates the +R effect in p-fluorobenzoic acid,
 - +R-effect dominates the -I effect in p-chlorobenzoic acid,
 - R-effect dominates the -I effect in p-chlorobenzoic acid,

- 16 Triphenyl methane is not present in which of the following indicator?
 a Phenolphthalein
 b Methyl red
 c Crystal violet
 d Phenol red
- 17 When phenol is treated with excess of bromine water, it gives
 a m-bromophenol
 b o- and p-bromophenol
 c 2,4-dibromophenol
 d 2,4,6-tribromophenol
- 18 The relative order of stability for some common cycloalkanes proposed by Baeyer, is
 a Cyclopentane > Cyclohexane > Cyclobutane > Cyclopropane
 b Cycloheptane > Cyclohexane > Cyclobutane > Cyclopropane
 c Cyclohexane > Cyclopentane > Cyclobutane > Cyclopropane
 d Cyclopentane > Cyclobutane > Cyclohexane > Cyclopropane
- 19 Which of the following gives benzoic acid on oxidation?
 a Chlorophenol
 b Chlorotoluene
 c Chlorobenzene
 d Benzyl chloride
- 20 The middle ring of anthracene and phenanthrene is most reactive towards electrophilic substitution reaction because of _____
 a High pi electron density on the middle ring
 b Less aromaticity compared to the terminal rings
 c More resonance energy in the middle ring
 d More resonance energy in the terminal ring

Q.2 Answer any TWO questions **20**

1. a) Depict the mechanism of electrophilic aromatic substitution reaction in benzene. Give limitations of Friedel Crafts Alkylation Reaction. **10**
 b) Discuss the stabilities of cycloalkanes on the basis of Baeyer's strain theory.
2. a) Justify the order of reactivity among benzene, naphthalene, anthracene and phenanthrene towards electrophilic aromatic substitution reactions. Explain Pschorr synthesis of phenanthrene. **10**

b)



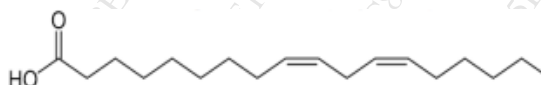
For the above given five molecules,

- a. Arrange the above molecules in increasing order of acidity. Justify the order

- b. Use molecule number iv as a starting material and synthesize benzophenone. Give the reactants and reaction conditions.
3. a) Comment on the orientation and reactivity of the -Cl and -OH group towards electrophilic aromatic substitution. **10**
 b) Define Saponification Value, Acid Value and Iodine Value. Explain the principle and significance of determination of these values.

Q. 3 Answer any SEVEN questions **35**

1. How will you differentiate cyclobutane from cyclopropane on the basis of their structures and reactivity? Draw the conformations of cyclobutane and comment on their stabilities. **5**
2. What is rancidity of oil? Write the structure and important medicinal uses of naphthols. **5**
3. With the help of chemical reactions, give an account of the distinguishing test for primary, secondary and tertiary aromatic amines. Arrange them in ascending order of basicity and justify the same. **5**

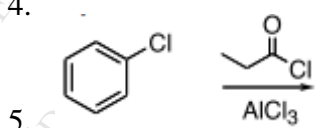
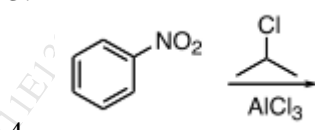
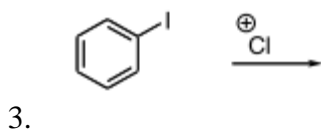
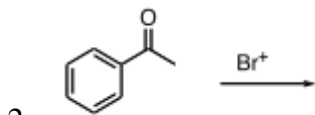
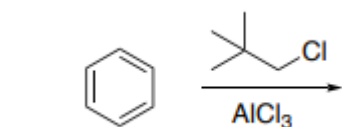
4.  **5**

Identify the above structure. Give the products of the reaction with the above structure with the following reagents. i. H_2/Ni ii. $NaOH$ iii. Ethanol iv. Iodine

5. Explain, using suitable examples, the steric inhibition of resonance (ortho) effect. Compare the acidity of phenol versus benzoic acid. Depict the mechanism of Kolbe synthesis. **5**
6. State and explain the significance of the various analytical values used to control the quality of oils. **5**
7. Attempt the following conversions (**ANY TWO**): **5**
- Benzene to benzene nitrile
 - Toluene to 3-amino benzoic acid
 - Benzene to 3-bromo toluene

With the help of resonance structures, explain why *p*-nitrobenzoic acid is stronger acid than benzoic acid but weaker than *o*-nitrobenzoic acid.

8. Predict the product/s of the following reaction. 5



9. Write the structure and uses of β -naphthol. Predict the product/s of the following reaction:

i) Phenanthrene + $\text{HNO}_3/\text{H}_2\text{SO}_4$

ii) Phenanthrene + $\text{H}_2\text{SO}_4/120^\circ\text{C}$

iii) Phenanthrene + $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$
