**Quadrant IV- Assessment (Module-wise)**

**Programme: Bachelor of Science**

**Subject: Chemistry**

**Paper Code: CHC 107**

**Paper Title: Organic Chemistry**

**Unit: Aromaticity, Aromatic Hydrocarbons & Reactivity**

**Module Name: Mechanism of Friedel-Crafts Alkylation & Acylation.**

**Module No: 05**

**Name of the presenter: Dr. B. L. Malik.**

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**MCQ:**

1. The benzonium ion is a stable…….. a) allylic carbocation b) Vinylic carbocation c) Benzylic carbocation.
2. The rate determining step in electrophilic aromatic substitution is……

a) Formation of intermediate arenium cation b) elimination of $H^+$ c) Restoration of aromatic character.

3. In Friedel-Crafts alkylation …….a) only $1^0$ alkyl halides are used b) only $2^0$ & $3^0$ alkyl halides are used c) $1^0$, $2^0$ & $3^0$ alkyl halides are used.
4. Alkyl benzenes are ……..a) less reactive than benzene b) more reactive than benzene c) As reactive as benzene.
5. Alcohols on reaction with Lewis Acid gives…… a) Carbocation b) Carbanion c) Carbene.

**Completion type (fill in the blanks):**

1. In Friedel- Crafts acylation introduction of ……. Group takes place in benzene.
2. Reaction of benzene with cyclohexanol in presence of $BF_3$ gives ……..
3. Acyl benzene is …….. reactive than benzene.
4. Benzene reacts with isopropyl chloride in presence of $AlCl_3$ to give …….
5. The electrophile in Friedel-Crafts acylation is…….

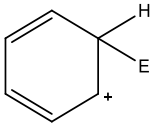
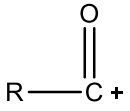
**Short Answer –I (short notes-20 to 50 words):**

1. Write equation for preparation of Acyl halides.
2. Show resonating structures for Acylium cation.
3. Give structure of complex formed when aromatic ketone reacts with $AlCl_3$.
4. Benzene reacts with propene to give isopropyl benzene. Write mechanism for this reaction.

**Short Answer-II (extended- 50 to 100):**

1. Give resonating structures of Arenium ion formed when alkyl cation reacts with benzene.
2. With examples explain rearrangement of Alkyl carbocation from $1^0$ to $2^0$ and from $2^0$ to $3^0$ for greater stability.
3. Explain with examples drawbacks of Friedel-Crafts alkylation.
4. Differentiate between Friedel-Crafts Alkylation & Acylation.

**Matching type:**

| Name of the species | structure |
|---|---|
| 1. Alkyl cation | 1. $AlCl_4^-$ |
| 2. Lewis Acid | 2.   |
| 3. Acylium cation | 3. $BF_3$ |
| 4. Arenium ion | 4. $R^+$ |
| 5. Tetrachloro Aluminate | 5.   |

**Numerical/Problems to Solve:**

1. Write a mechanism for synthesis of isopropylbenzene from benzene & propene in presence of HF.
2. Outline synthesis of Isobutylbenzene using Friedel-Crafts reaction.
3. Write products in the following reactions.

a) benzene + isobutyl chloride + $AlCl_3$ ----------

b) b) toluene + 1-butanol + $BF_3$ ----------

c) Nitrobenzene + 2-chloropropane + $AlCl_3$ ----------

**d)** Benzene + 3,3-dimethyl-1-butene + HF ----------

**Self reflection:**

1. How will you convert Benzoic acid to Ethyl benzene.
2. Write the steps involved in conversion of Benzaldehyde to Acetophenone.
3. Outline the synthesis of isopropyl benzene from Aniline.
4. By using Friedel-Crafts acylation reaction method explain how you will synthesize Benzophenone from Benzoic acid.

**Create something new (higher order cognition):**

1. Outline the synthesis of p-nitro-t-butylbenzene from benzene.
2. Give the products of Benzene with Ethylene oxide / $AlCl_3$.