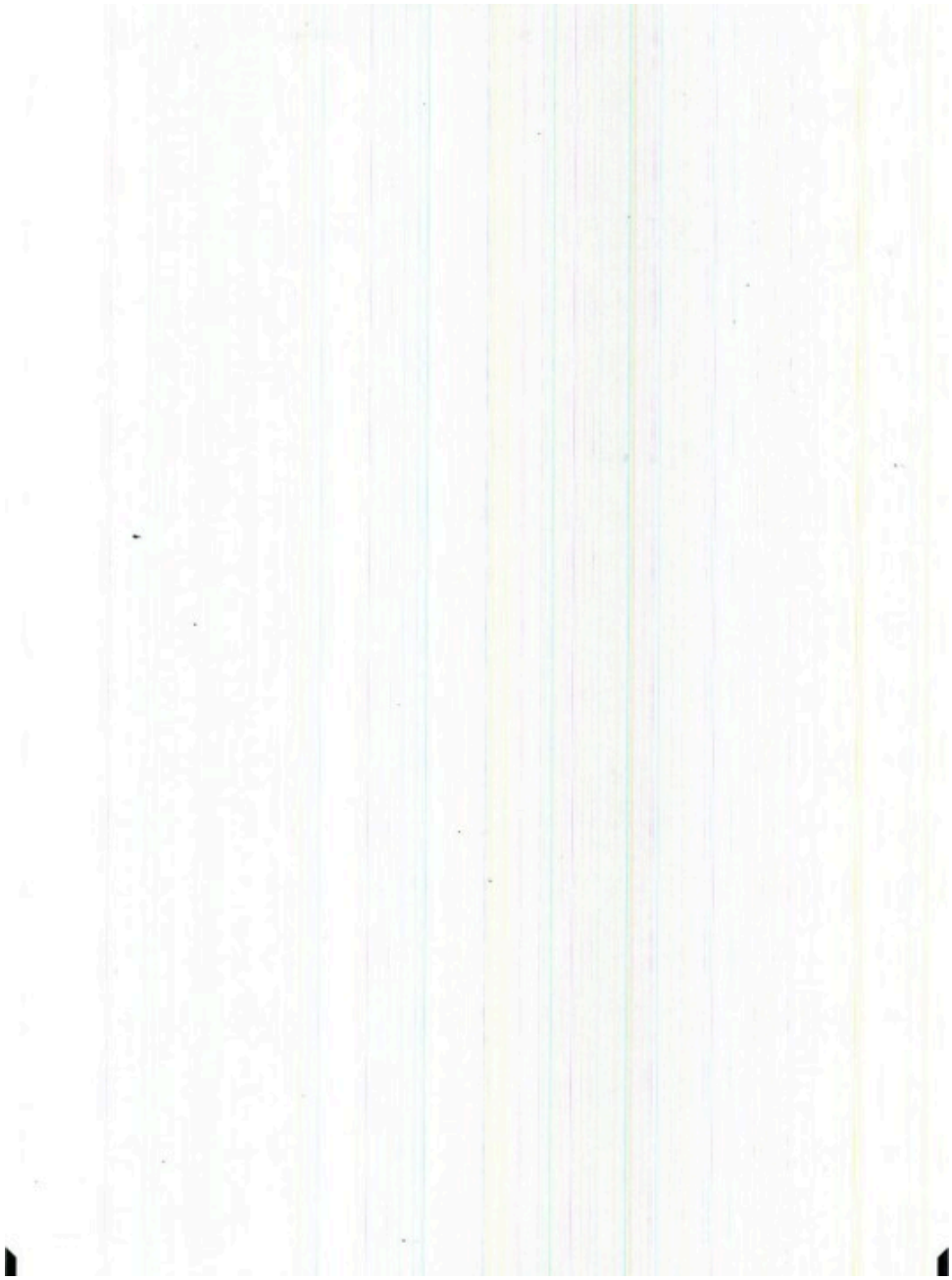
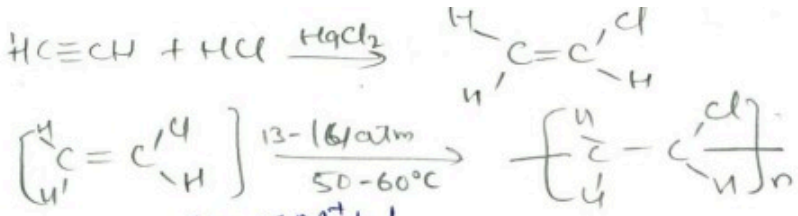
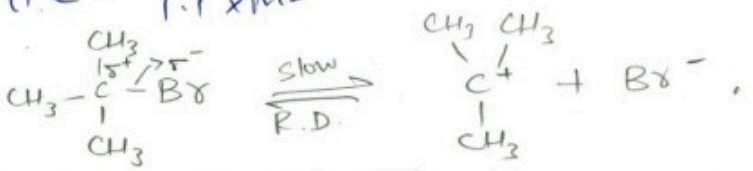








$$\%C = \frac{100 \times M^1 + 1}{1.1 \times M_2}$$



Conj base accept $H^+$

Stability after accepting.

**(Section B)**

**Q. No. 2 Part (I)** Ans: $Fe + Pb^{2+} \rightarrow Fe^{2+} + Pb$.

Given: $E_o$ of Fe: -0.44V, $E_o$ of Pb = -0.13V

To find: a) Reduction potential = ? OR

Cell Potential $E_o$ = ? • cathode: Pb, anode: Fe.

$E_o = E_{cathode} - E_{Anode}$

Pb → cathode: -0.13V, Fe = Anode: -0.44V

~~• Fe → cathode and Pb = Anode.~~

$E_o$ = ~~-0.44V - (-0.13V)~~ $-0.13V - (-0.44V)$

$= +0.31\ V$

As, $E_o$ is in ~~negetive~~ positive value so reaction is ~~not~~ feasible.

~~• Reaction is not feasible.~~

**• Reaction can occurs and is feasible and spontaneous.**

Reason. $E_o > 0$ (in positive values).

---

**Q. No. 2 Part (II)** Ans: Reaction: $NH_3 \rightarrow NO_2$.

Given: H = +1 and O = -2.

so, substituting oxidation number values

$\overset{-3}{N}\overset{+3}{(H)_3} \rightarrow \overset{+4}{N}\overset{-4}{(O)_2}$

$NH_3 \rightarrow NO_2$

• As oxidation state of N increases from -3 → +4 (by 8 numbers) so, oxidation occurs on nitrogen.

~~• As oxidation state of O~~

• In this specific conversion. As there is - loss of H, - Gain of Oxygen and increase in oxidation state so as a whole oxidation occured in it.

(Section B)

**Q. No. 2 Part (iii)** Ans: Products of reaction:

Cathode: (reduction) occurs → $Na^{2+}$ gains electrons to form sodium metal.

$Na^{2+} + e^- \longrightarrow Na$

Anode: (oxidation) occurs → chloride ion lose electrons to form chlorine gas.

$2Cl \longrightarrow Cl_2 + 2e^-$.

- Hence in this reaction with rxn with molten NaCl.

> reduction occurs at cathode Na ~~metal~~ ions formed.

> oxidation occurs at anode ~~Cl~~. $Cl_2$ gas formed.

.....

**Q. No. 2 Part (iv)** Ans: Gp II elements are:

Be, Mg, Ca, Sr, Ba, Ra.

- Radium is radioactive so it is least studied.
- As in group two, they have valence electron is s-subshell so they lose 2 electrons to form (+2) cations.
- According to size of cation in Gp-II

$Be^{2+} < Mg^{2+} < Ca^{2+} < Sr^{2+} < Ba^{2+}$ (inc in Gp).

- As compared to Gp-I (Alkali) they are less reactive. because:
- Ionization energy of Gp-II decreases down group. and Gp-I have more I.E then Gp. II.
- Gp-I is reducing in nature.
- Due to these factors Gp I more reactive than Gp II.

(Section B)

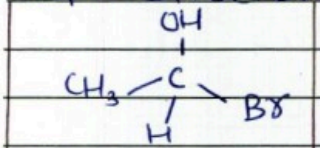
**Q. No. 2 Part (v)** Ans: Transition elements are present in middle of periodic table.

- Usually most transition elements are coloured compounds but in some cases like with '$d^{10}$' they are colourless. Example includes 'Zinc'. At no. 30. configuration [Ar] $3d^{10} 4s^2$.
- Transition elements with full 'd' sub-shell are colourless because they don't have empty orbital to accept electron pair and form a bond. As they are unable to accept pair of $e^-$ so, they are colourless compounds. and this is an exception case as observed in 'Zinc'. As d-d splitting doesn't occur so it doesn't form coloured compounds. with conf $d^{10}$.

.....

**Q. No. 2 Part (vi)** Ans: Compound: $CH_3-CH(OH)-Br$

Open structure of this compound:



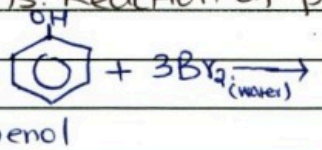

- Yes this compound is optically active as it possess a chiral carbon or centre.

Justification: For a compound to classify criteria of optically active, ~~being~~ having a chiral centre or having at least 1 chiral carbon is the condition, A chiral-C is carbon having 4 different atoms attached to it. As this carbon have 4 different atoms attached directly to it so it is classified in optically active compound. Hence, this is justification provided.

(Section B)

**Q. No. 2 Part (vii)** Ans: Reaction of phenol and bromine water:

Reaction:-




phenol

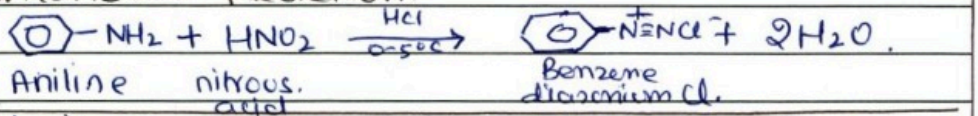
2,4,6 tribromophenol

- phenol reacts with bromine water, the red colour of bromine discharges and white ppt of 2,4,6 tribromophenol.
- As in phenol (-OH) group is electron donating it donate e⁻ density to C atom making it more exposed to reaction. for this reason reaction occurs at room temprature.

Hence, (-OH) ~~increase~~ activates ~~e⁻ d~~ ring making rxn at room temprature possible.

---

**Q. No. 2 Part (viii)** Ans: Formation of benzene-diazonium chloride:- Reaction:




Aniline nitrous acid Benzene diazonium Cl.

- In its formation Aniline (phenyl amine) react with nitrous acid at temprature not rising above 5°c. because, above 5°c the product: benzene diazonium chloride decompose give's phenol. To avoid that (T) is strictly checked hence only adding cold solutions.
- Benzen diazonium chloride is unstable, and decomposes above 5°c so, Temprature is managed below 1°c.

(Section B)

**Q. No. 2 Part (ix)** Ans: Polymerization of Vinyl chloride:

Formation of Vinyl chloride:

$HC \equiv CH + HCl \xrightarrow{HgCl_2}$ $H_2C=CHCl$

Alkyle — vinyl chloride.

Type of polymerization: Addition type of polymerization occurs. No elimination of molecules. Temprature managed at 50°-60°C

polymerization reaction:

$$\left[H_2C=CHCl\right] \xrightarrow[50°C-60°C]{13-14\ atm} \left[-H_2C-CHCl-\right]_n$$

- Addition polymerization occurs.
- No elimination of simple molecules.
- In some cases catalyst also used.

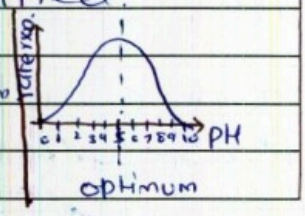
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**Q. No. 2 Part (x)** Ans: Factors affecting enzyme activity:

**1: Temprature:** Enzymes are highly affected by temprature, They work best at optimum Temp, 37°C for human enzyme. If T rise from optimum → Enzyme is denatured. If T is less then optimum → Enzyme deactivate.

**2. Substrate Concentration:** Adding substrate increase product formation, but until some limit, if excess substrate is added, all active sites are filled no product can be formed.

**3. pH:** Enzyme is highly affected by pH rate. They work best at optimum pH. If pH as above optimum, enzyme can be denatured.



(Section B)

**Q. No. 2 Part (xi)** Ans: Molecular ion peak: In a mass spectrum molecular ion peak tells actual m/z of any compound. It is the actual mass of compound excluding radioactive compounds.

Symbols – It is denoted by $[M^{+\cdot}]$ present in it. sign.

Importance: $[M^{+\cdot}]$ peak tells about what actually compound is. It tells about its mass, and m/z ratio.

- It signifies tell with other properties of compound also.

E.g → for Ethene: $[M^{+\cdot}]$ is at 28 (m/z).

Molecular ion peak is basic component of mass spectrum.

.....

**Q. No. 2 Part (xii)** Ans: Given: $M^+$ peak = 100%

$(M^+ + 1)$ peak = 5.5%

To find: No. of carbon atoms.

Formula:

$$\text{no. of carbon atom} = \frac{100 \times (M^+ + 1)\text{ peak}}{1.1 \times M^+ \text{ peak}}$$

Calculation:

$$\#\text{ of C-atoms} = \frac{100 \times 5.5\%}{1.1 \times 100\%}$$

$$\#\text{ of C-atoms} = \frac{550}{110}$$

$$\#\text{ of C-atom} = 5.$$

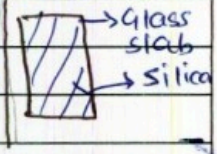
So, 5 - carbon atoms are present.

(Section B)

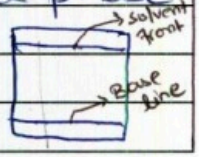
**Q. No. 2 Part (xiii)** Ans: Describtion of terms:

Following is detail: ↗ it can be solid or liquid.

a) Stationary phase: In chromatography stationary phase is area on which, mixture spot is applied. In TLC it is a glass slab, on which Alumina is applied, then dried. In paper, chromatography, cellulose paper is used. Stationary phase doesn't move while mobile phase move over it.




b) Solvent front: It is the final point on a stationary phase where the mobile phase reaches. It helps to identify. retention value as well. It is the final point on stationary phase.




.....

**Q. No. 2 Part (xiv)** Pesticides: These are compounds used to kill insects, fungi, weeds or rodents from plants that are proved harmful for plants. Some examples are: ~~In insecticide allegory~~ herbicide (organophosphates, 2,4 D and Dicamba etc) Although main use of pesticide is protection of plants but there are some negetive impacts also:

Negetive Impacts:

1) They are harmful for human as, they can have contact with it from fruits, vegetable. They contain carcinogens that are toxic.

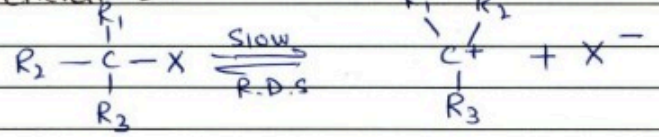
2) They can severely disrupt neutrient cycles and can also cause soil degenration.

(Section C)

**Q. No. 3 (Page 1)** Ans: **$SN_1$ Mechanism:**

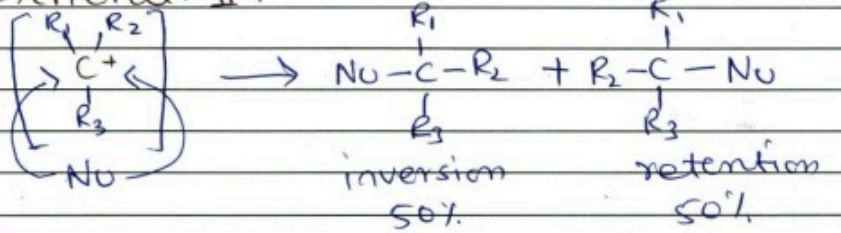
- It is unimolecular nucleophillic substitution.
- It's first step is slow step hence, rate determining step.
- The ~~carbocation~~ (R–X) ionizes reversibly forming ions: → [R+] and [X⁻] ions.

General: I.

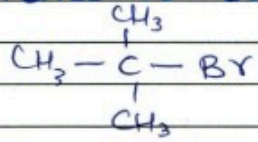



- Nu can attack, carbocation from site Nu was removed — Retention of R.
- Side opposite to it — inversion

General: II.




**– With refrence to tert-butyl bromide**



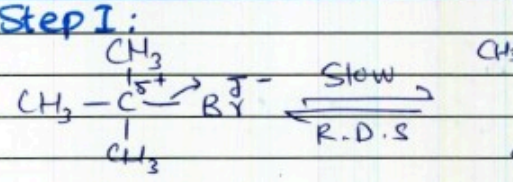

- It favours $SN_1$ because it is tertiary alkyl halide.
- Due to steric hindrance 2 steps are required

(Section C)

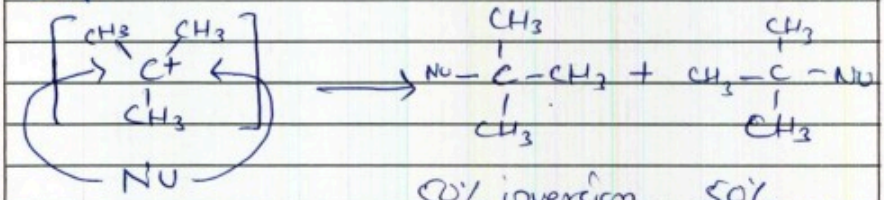
**Q. No. 3 (Page 2)** for it attack on it.

**Carbocation Formation:**

**Step I:**




**Step II:**




- As final outcome is mixture of compounds or racemic mixture.
- Cause is the racemization.
- The alkyl groups stabalizes carbocation by increasing steric hindrance - As they are bulky groups so, they offer resistence to incoming Nu. and they are reletively stable. order is: 3° > 2° > 1° > methyl for carbocations stability.

- Stereochemical evidence suggest that rate of $SN_1$ rxn depends on concentration of alkyl halide only.
- Increase or decrease in conc. of Nu does not affect reaction.

(Section C)

**Q. No. 3 (Page 3)**

Rate of given reaction:

Rate = $K[R-X]$

So, Rate = $K[(CH_3)_3C\,Br]$

- Overall reaction rate is first order.
- $SN_1$ reaction is favoured by polar protic solvents ~~and~~ as it stabalizes the carbocation.
- Intremediate is formed in this type of reaction.
- Carbocation is formed as carbocation

(Section C)

**Q. No. 4 (Page 1)** Ans: **Bascicity of Amines:-**

There are 2 basic factors upon which the basicity of Amines depends:
Factors are given below:-

1: Ability of ~~conjugate base~~ Amine to accept $H^+$.
2: Stability of compound formed after accepting the proton. ~~conjugate base~~

- These are 2 important factors upon which basicity of a compound depends.

As order of increasing $pk_b$ value is
Phenylamine > Ammonia > Ethylamine.
So, greater the $Pk_b$ value → weaker is base:

**Explonation:**

~~$C_6H_5NH_2 \Longrightarrow C_6H_5$~~

| | | $Pk_b$ value. |
|---|---|---|
| $C_6H_5NH_2$ | (Phenylamine) | $Pk_b = 9.36$ |
| $NH_3$ | (Ammonia) | $Pk_b = 4.75$ |
| $CH_3CH_2NH_2$ | (Ethylammine) | $P_{kb} = 3.27$ |

- In case of **phenylammine**, $NH_2$ is attached to a phenyl ring that is a benzene / aryl ring.
It is resonance stabalized. so chances are very difficult to accept proton.
For that reason it has high $Pk_b$ value ultimately weaker strength to form ammine.

(Section C)

**Q. No. 4 (Page 2)** • In case of **ammonia**, As it can donate proton and has a lone pair of electron so, it is more basic than ~~amine~~ phenylamine but less basic than ethylamine. So ammonia has $pK_b = 4.75$. less than phenylamine that signifies its ability to donate proton.

• In case of **Ethylamine** there is a alkyl group [$CH_3CH_2 - NH_2$], that ~~simply~~ is a electron donating group. Due to this reason in increases electron density of N atom. As nitrogen's e⁻ density increases ultimately it can donate a proton at a greater extent hence forms a stronger base. $pK_b$ of ethylamine is 3.27.

So, in conclusion, the basicity increases in this order:

Phenylamine < Amonia < Ethylamine

while, $pK_b$ value increases in order

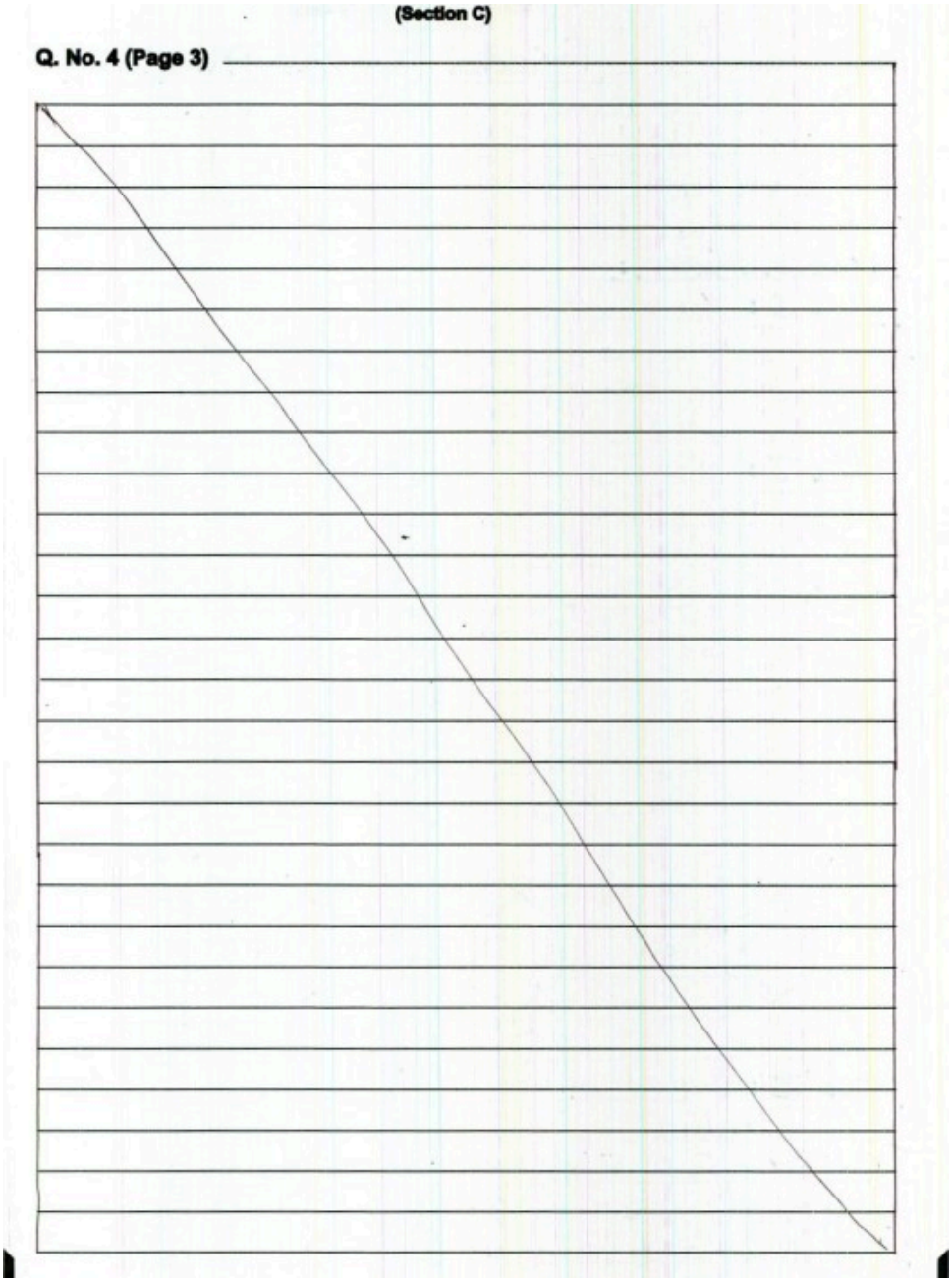
Phenylamine > Ammonia > Ethylamine

Hence, basicity increase:

phenylammine < Ammonia < Ethylamine.

(Section C)

Q. No. 4 (Page 3)



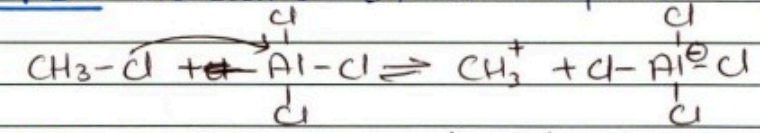
(Section C)

**Q. No. 5 (Page 1)** Ans: **Friedel- Crafts Alkylation:**

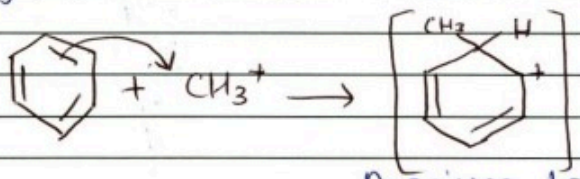
- It is such a reaction in which lewis acid reacts with benzene ring in presence of catalyst $AlCl_3$ to form product of methyl benzene or alkyl benzene.

**Mechanism:**

**Step I:** Generation of electrophile:

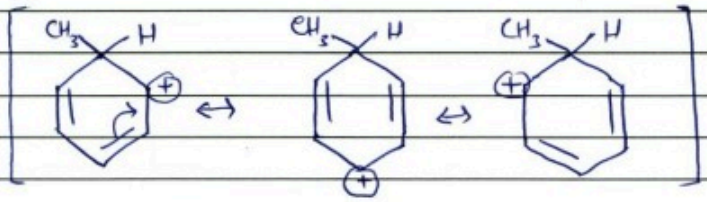


**Step II:** Attack of electrophile on benzene ring, formation of Arenium ion:



Arenium Ion.

As, benzene is resonance stabalized, so resonance structure are as follow.

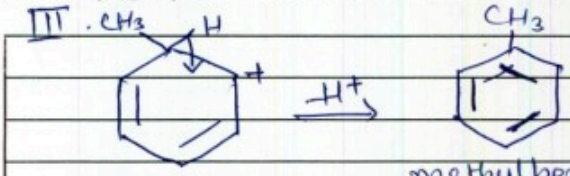


**Step III:** Deprotanation and reformation of catalyst.

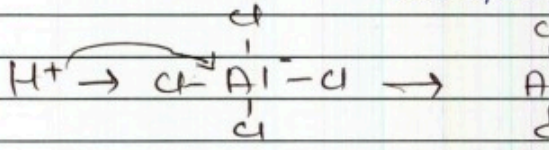
In last step → proton is lost forming alkyl benzene (methyl benzene) in this case and catalyst $AlCl_3$ is regenrated.

(Section C)

**Q. No. 5 (Page 2)**

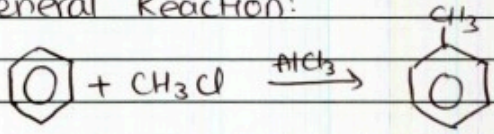
III. 


methyl benzene




• $AlCl_3$ also regenerated.

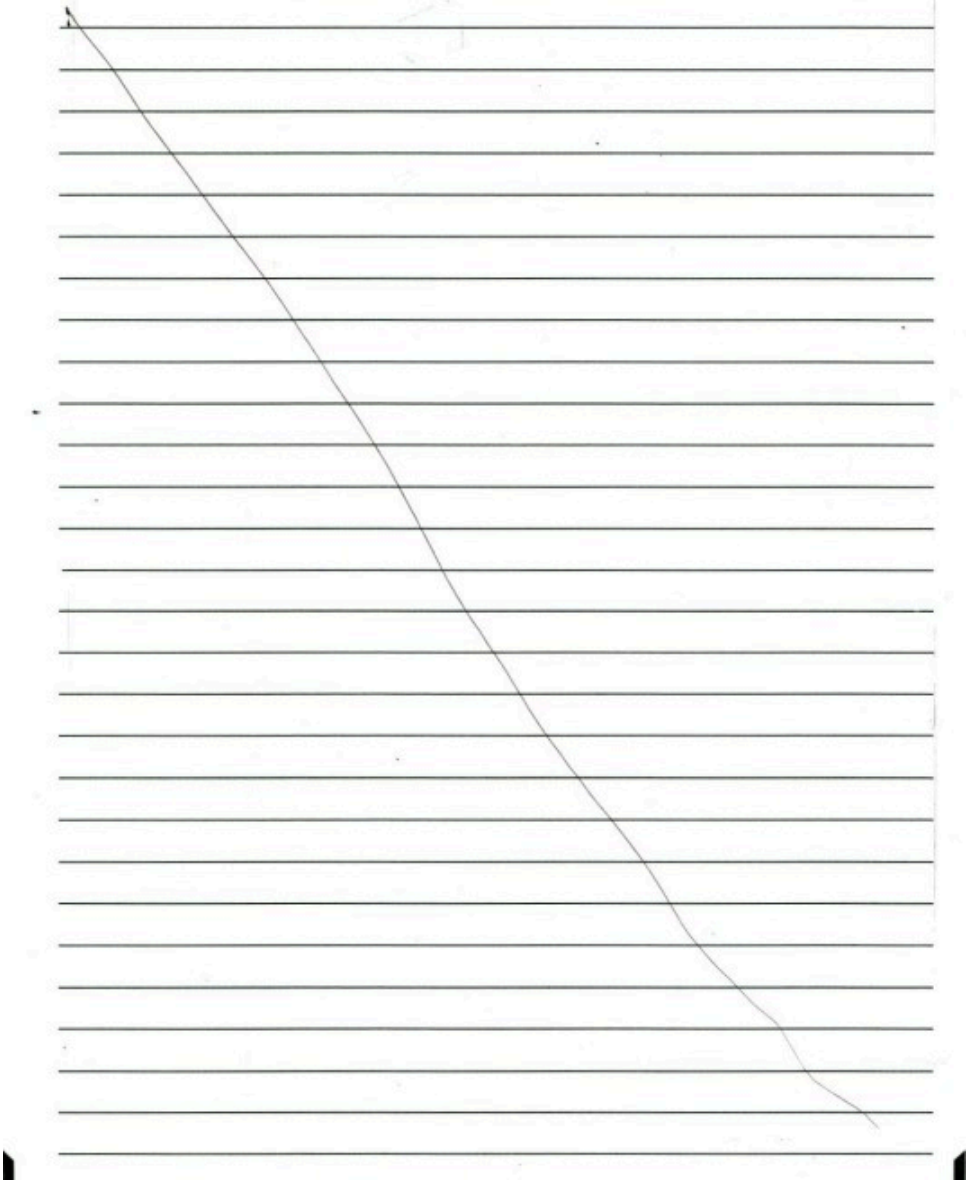
General Reaction:




methyl benzene.

(Section C)

**Q. No. 5 (Page 3)**



(Section C)

**Q. No. 6 (Page 1)** Ans: Order of ease of hydrolysis:

As given: Acyl chloride > Alkyl chlorid > Aryl chloride.

Justification:

- In Acyl chloride:

Formula: $CH_3-\overset{\overset{O}{\|}}{C}-Cl$. OR $R-\overset{\overset{O}{\|}}{C}-Cl$.

- As in this the carbon atom attached with halide is attached to 2 electronegetive atom 'O' and 'Cl'.
- They withdraw electrons from this carbon.
- As this carbon becomes less electronegetive it becomes easier for nucleophile to attack on it as most electron density is withdrawn from it. So it is easiest to hydrolize.

For these reasons acyl chloride is easily hydrolized.

- In Alkyl chloride:

Formula: $CH_3-\overset{\alpha}{CH_2}-Cl$ OR $R-Cl$.

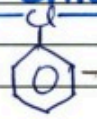
- As in this case alpha carbon atom is only attached to one electronegetive atom (Cl) so it is less exposed to hydrolysis then acyl chloride.
- ~~Carbon atom is tes~~
- Although Cl withdraws electron density from carbon atom but to less extent hence a stronger nucleophile

(Section C)

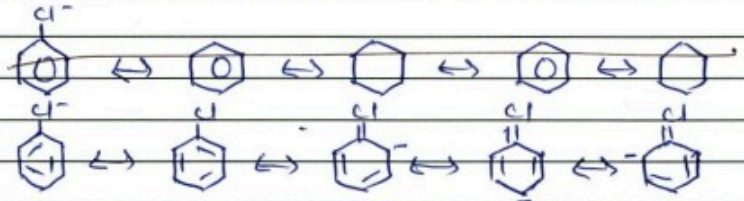
**Q. No. 6 (Page 2)** will be required ~~to from~~ for hydrolysis.

- For this reason alkyl halide has less ease of hydrolysis then acyl chloride.

**– In Aryl chloride:**

Formula:  → Aryl chloride.

Resonance structures:



- As it contains an aryl group which is resonance stabalized and the negetive charged is delocalized within ring, its hydrolysis is very difficult.
- Negetive charge is delocalized and ring is resonance stabalized, so, it is least exposed to hydrolysis.

Above, given is justification of ease in hydrolysis in order:

Acyl chloride > Alkyl chloride > Aryl chloride.

(Section C)

**Q. No. 6 (Page 3)**

