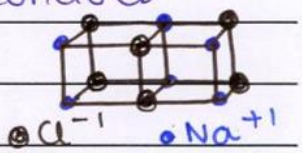
(0.A)
Q. No. 2 (i) **NaCl AS CONDUCTOR**

→ NaCl is an ionic solid. In solid state it's non-conductor.

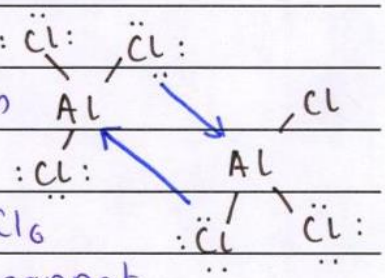
→ However in molten system, it dissociates into Na^+ and Cl^- ions which conduct electricity.



$AlCl_3$ AS NON-CONDUCTOR

→ $AlCl_3$ is a covalent solid.

→ In molten form it decomposes into simpler $AlCl_3$ from giant network of simpler Al_2Cl_6



→ $AlCl_3$ in covalent form cannot conduct because of unavailability of charges.

.....

Q. No. 2 (ii) (a) **BeO IS AMPHOTERIC**

REACTION WITH ACID

$$BeO + 2HCl \longrightarrow BeCl_2 + H_2O$$

REACTION WITH BASE

$$BeO + 2NaOH \longrightarrow Na_2BeO_2 + H_2O$$

Reaction with both acid and base shows its amphoteric oxide

(b) BeO HAS COVALENT NATURE BUT HIGH M.P

→ The size of Be^{+2} and O^{-2} are non-comparable due to which it's a covalent solid, i.e, according to **Fajaan's rule.**

→ It has high M.P because of its stable

Q. No. 2 (iii)

Q. No. 2 (iv) **OXIDATION OF $[Cr(H_2O)_6]^{+3}$ INTO CrO_4^{-2}**

1# When NaOH (a base) is added to the ion, it converts from green solution into green ppt.

$$[Cr(H_2O)_6]^{+3} + 3\,\bar{O}H \xrightarrow{NaOH} [Cr(H_2O)_3(OH)_3] + 3H_2O$$

Hexaaquacopper (III) — Triaquatrihydroxo copper (III)

2# On addition of more base, it produces hexahydroxo copper (III) ions

$$[Cr(H_2O)_3(OH)_3] + 3\,\bar{O}H \xrightarrow{NaOH} [Cr(OH)_6]^{-3} + 3H_2O$$

Hexahydroxocopper (III)

3# When this ion is treated with H_2O_2, it oxidizes into CrO_4^{-2}

$$2[Cr(OH)_6]^{-3} + 3H_2O_2 \longrightarrow 2CrO_4^{-2} + 3H_2O + [O]$$

Q. No. 2 (v)

$$S_2O_8^{-2} + 2I^{-1} \longrightarrow 2SO_4^{-2} + I_2$$

→ In this redox reaction, Fe^{+2} acts as catalyst.

→ In this first step, it ~~oxid~~ acts as reducing agent while reducing $S_2O_8^{-2}$ and oxidizen itself.

→ In second step, it oxidizen iodide ions.

MECHANISM

1# $S_2O_8^{-2} + 2Fe^{+2} \rightleftharpoons 2SO_4^{-2} + 2Fe^{+3}$

$S_2O_8^{-2}$ undergoes reduction by Fe^{+2}

2# $2I^{-1} + 2Fe^{+3} \rightleftharpoons I_2^{\circ} + 2Fe^{+2}$

I^{-1} undergoes oxidation via Fe^{+3} ions.

.....

Q. No. 2 (vi)

FUNCTIONAL GROUP

"An atom or a group of atoms that gives a compound its characteristic chemical properties is functional group."

→ Functional groups are **important** because:

- They help in **nomenclature** of organic compounds.
- They classify organic compounds into **families / classes** making study of millions of compounds easier.
- They are the **chemically active site** of a compound.

→ For example in alcohol R – OH ; OH is

Q. No. 2 (vii)

.....

Q. No. 2 (viii) (a) Br_2 / CCl_4

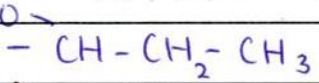
$H_2C = CH - H_2C - CH_3 + Br_2 \xrightarrow{CCl_4} CH_2(Br) - CH(Br) - CH_2 - CH_3$

1,2 - Dibromo butane

(c) $C_6H_5 - \overset{O}{\overset{\|}{C}} - O - OH$

$C_6H_5 - \overset{O}{\overset{\|}{C}} - O - OH + CH_2 = CH - CH_2 - CH_3$

$\downarrow$

$C_6H_5 - \overset{O}{\overset{\|}{C}} - OH +$ 

Benzoic acid 1,2 Epoxy butane

(b) $Cl_2 + H_2O$ $\quad Cl_2 + H_2O \rightarrow HCl + HOCl$

$H_2C = CH - CH_2 - CH_3 + HCl \rightarrow CH_3 - CH(Cl) - CH_2 - CH_3$

Q. No. 2 (ix) → The trend of halide ions as reducing agents is: $I^{-1} > Br^{-1} > Cl^{-1} > F^{-1}$

→ The Iodide ion is larger in size, thus reduces other more efficiently by oxidizing itself.

→ It reduces H_2SO_4 as:

$$HI + H_2SO_4 \longrightarrow H_2S + I_2 + H_2O$$

→ The oxidation state of S changes from **+6 in H_2SO_4 to -2 in H_2S.**

→ Bromide ion can reduce as:

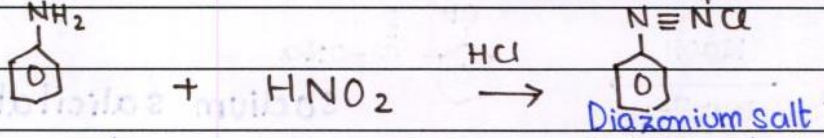
$$HBr + H_2SO_4 \longrightarrow SO_2 + Br_2 + H_2O$$

→ Oxidation state of S changes from **+6 to +4.**

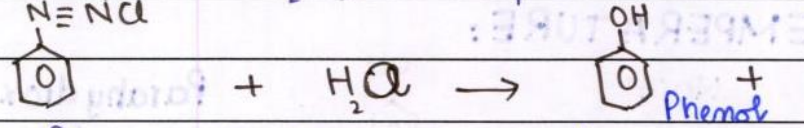
→ These reactions show that HI (I^{-1}) is strongest reducing agent.

Q. No. 2 (x) **DIAZONIUM SALTS** "A salt containing N≡N is diazonium salt."

→ It can be prepared by treatment of aniline with **Nitrous acid.**



→ When diazonium salt is heated above 10°C with H_2O, it produces **Phenol**



→ Benzene diazonium salts are more stable than aliphatic ones.

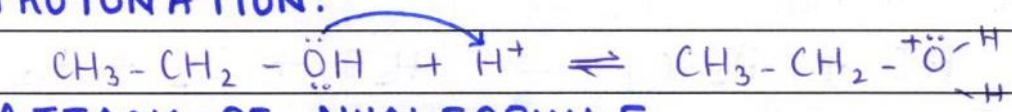
Q. No. 2 (xi) **DEHYDRATION OF ETHANOL**

$$CH_3-CH_2-OH + HO-CH_2-CH_3 \xrightarrow[140^\circ C]{\text{conc. } H_2SO_4} CH_3CH_2OCH_2CH_3 + H_2O$$

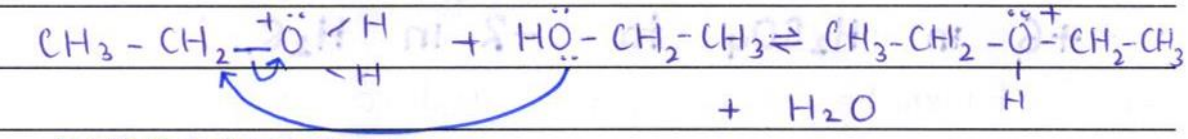
Ethanol — Diethyl ether

MECHANISM

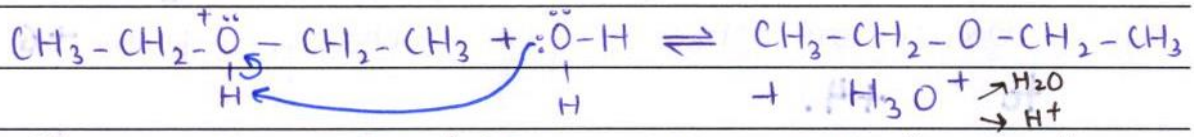
1# PROTONATION:



2# ATTACK OF NUCLEOPHILE



3# DEPROTONATION



→ The condensation / dehyduation in 140°C in the presence of mineral acid produces ETHER.

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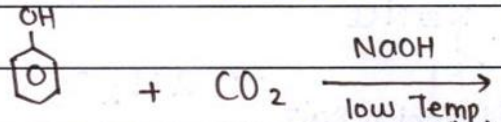
Q. No. 2 (xii) **KOLBE - SCHMITT REACTION**

→ It's the reaction of phenol with CO_2 in presence of NaOH.

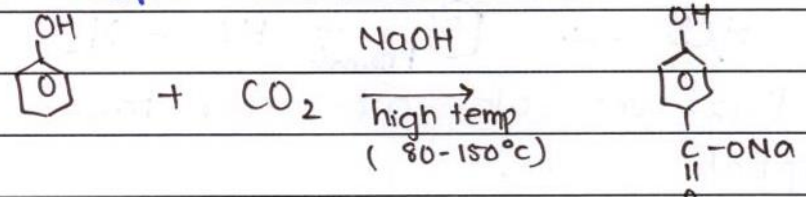
IN LOW TEMPERATURE:



Sodium salicilate

At low temperature, attachment is at ortho.

IN HIGH TEMPERATURE:



Parahydroxo Sodium benzoate

Q. No. 2 (xiii) → **Tollen's Test** is given by Aldehydes and not Ketones.

$$R-\underset{\underset{O}{\|}}{C}-H + AgNO_3 + NH_4OH \rightarrow R-\underset{\underset{O}{\|}}{C}-Ag + NH_4NO_3 + H_2O$$

→ **Iodoform Test** is given by Acetaldehyde and methyl ketones.

→ Aldehydes give positive **Fehling's and Benedict test** producing white ppt while ketones don't.

→ Ketones give positive test with **sodium prusside solution** with Brick red ppt. while aldehydes don't.

→ Formaldehyde (& aldehydes without α-hydrogen) give **Cannizaroes reaction** while ketones don't.

.....

Q. No. 2 (xiv) **(a) ACET AMIDE INTO ETHYL AMINE**

$$CH_3-\overset{\overset{O}{\|}}{C}-NH_2 + 4[H] \xrightarrow{LiAlH_4} CH_3-CH_2-NH_2 + H_2O$$

Acet amide — Ethyl amine

(b) ACETYL CHLORIDE INTO ACETIC ANHYDRIDE

$$CH_3-\overset{\overset{O}{\|}}{C}-Cl + HO-\overset{\overset{O}{\|}}{C}-CH_3 \rightarrow CH_3-\overset{\overset{O}{\|}}{C}-O-\overset{\overset{O}{\|}}{C}-CH_3 + HCl$$

Acetyl chloride — Acetic acid — Acetic anhydride

(c) CALCIUM ACETATE INTO ACETONE

$$CH_3-\overset{\overset{O}{\|}}{C}-O\diagdown \quad \diagup O-\overset{\overset{O}{\|}}{C}-CH_3 \quad Ca \xrightarrow[\text{distillation}]{\text{dry}} CaCO_3 + CH_3-\overset{\overset{O}{\|}}{C}-CH_3$$

Q. No. 2 (xv) (a) $CH_3-\overset{O}{\overset{\|}{C}}-OH$ FROM GRIGNARD

$$CH_3-Mg-Br + \underset{O}{\overset{\|}{C}}=O \xrightarrow{\text{dry ether}} CH_3-\underset{O^-}{\overset{\|}{C}}-O^- \overset{+}{M}gBr$$

$$CH_3-\underset{O}{\overset{\|}{C}}-OMgBr \underset{H^+/OH^-}{\overset{H_3O^+}{\rightleftharpoons}} CH_3-\underset{O}{\overset{\|}{C}}-OH + Mg\begin{matrix}Br\\OH\end{matrix}$$

Reaction with CO_2 gives acetic acid

(b) A NITRILE

$$H_3C-C\equiv N + H_2O \longrightarrow CH_3-\underset{O}{\overset{\|}{C}}-NH_2$$

ethyl cyanide

$$CH_3-\underset{O}{\overset{\|}{C}}-NH_2 + H_2O \longrightarrow CH_3-\underset{O}{\overset{\|}{C}}-OH + NH_3$$

(c) AN ALCOHOL

$$CH_3-CH_2-OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7/} CH_3-\underset{O}{\overset{\|}{C}}-H + H_2O$$

ethanol

$$CH_3-\underset{O}{\overset{\|}{C}}-H + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7/} CH_3-\underset{O}{\overset{\|}{C}}-OH$$

.....

Q. No. 2 (xvi)

DNA	RNA
NAME	
Deoxyribose Nucleic acid	Ribonucleic acid
SUGAR	
2-Deoxyribose ~~ribose~~ sugar	Ribose sugar
NITROGENOUS BASE	
It has adenine, thymine, cytosine, guanine	It has adenine, uracil, cytosine, guanine
STRAND	
Its double stranded	Its single stranded
STRUCTURE & FUNCTION	

متعلقہ سوال کا جواب صرف مختص کردہ جگہ پر اور بیرونی نشان کے اندر دیا جائے۔

Q. No. 2 (xvii)

Q. No. 2 (xviii) **REFINING OF PETROLEUM**

"The separation of crude oil into its components is refining of petroleum."

PRINCIPLE

→ Different components have different boiling points.

→ On fractional distillation, the components separate out on their respective boiling point and are then condensed.

→ Components with high boiling point are collected at bottom, lighter ones rise in the distillating tower and are condensed out.

COMPONENTS

→ The components of petroleum are:
Fuel oil, Diesel, Kerosene, Naphtha, Gasoline, Refinery gases, Residue

Q. No. 2 (xix) → When an organic compound is subjected to visible radiation in the wavelength range of 200 - 800 nm, **electronic transition** takes place.

→ Electrons make transitions as:

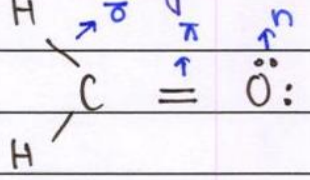
$\sigma \rightarrow \sigma^*$, $\pi \rightarrow \pi^*$, $n \rightarrow \sigma^*$, $n \rightarrow \pi^*$

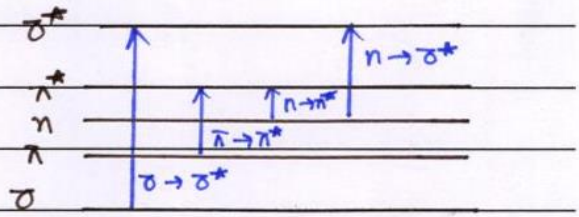
→ $\sigma \rightarrow \sigma^*$ occurs in vacuum UV.

→ $\pi \rightarrow \pi^*$ occurs in compound which have unsaturation

→ $n \rightarrow \sigma^*$ occurs in compounds with atoms having lone pairs, as N, O, etc

→ $n \rightarrow \pi^*$ occurs in unsaturated compounds having unsaturation.





Q. No. 2 (xx)

متعلقہ سوال کا جواب صرف مختص کردہ جگہ پر اور بیرونی نشان کے اندر دیا جائے۔

Q. No. 3 (Page 1/6)

Q. No. 3 (Page 2/6)

متعلقہ سوال کا جواب صرف مختص کردہ جگہ پر اور بیرونی نشان کے اندر دیا جائے۔

Q. No. 3 (Page 3/6)

Q. No. 3 (Page 4/6)

متعلقہ سوال کا جواب صرف مختص کردہ جگہ پر اور بیرونی نشان کے اندر دیا جائے۔

Q. No. 3 (Page 5/6)

Space for diagram/rough work

Q. No. 3 (Page 6/6)

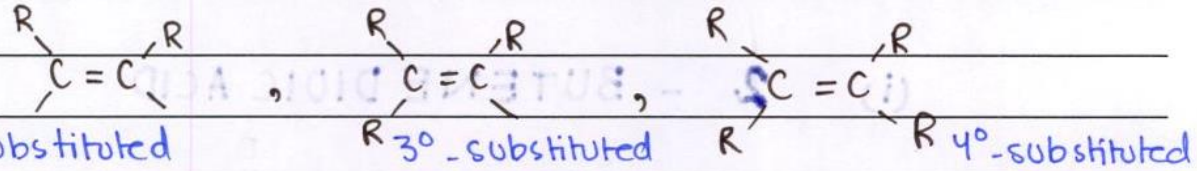
Q. No. 4 (Page 1/6) (a)

GEOMETRICAL ISOMERISM

"The different configuration of compounds with respect to nodal plane in alkenes and cyclo alkanes is called Geometrical isomerism or Rautamerism."

EXAMPLE

→ It occurs in disubstituted, tri-substituted, and 4° substituted alkenes.



TYPES

There are two types of rautamers:

- Cis - isomer
- Trans -isomer

CIS - ISOMER: When two lighter substituents (or of same mass) are in same plane (both above nodal plane or both below) it produces Cis- isomer.

TRANS - ISOMER: When similar substituents are on the opposite side of nodal plane, it produces trans -isomer.

CONDITIONS

→ In 2° substituted organic compounds,

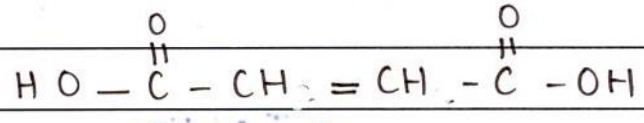
Q. No. 4 (Page 2/6)

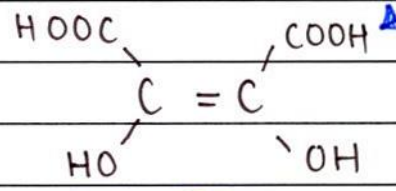
(ii) The substituents should be **one on each** carbon $\left(\begin{matrix} & & C=C & & \\ R & & & & R \end{matrix}\right)$ (on separate carbons)

- When both substituents are on same carbon atom, it doesn't show geometrical isomerism. $\left[\begin{matrix} & & C=C & R & \\ & / & & & \backslash R \end{matrix}\right]$

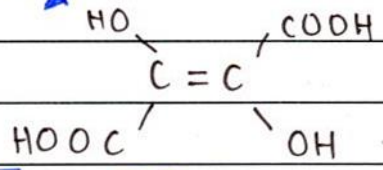
GEOMETRICAL ISOMERISM IN ALKENES

(i) 2 - BUTENE DIOIC ACID





Cis - 2-Butenedioic acid



Trans- 2 Butenedioic acid.

→ In cis, -COOH groups are above the nodal plane (same side)

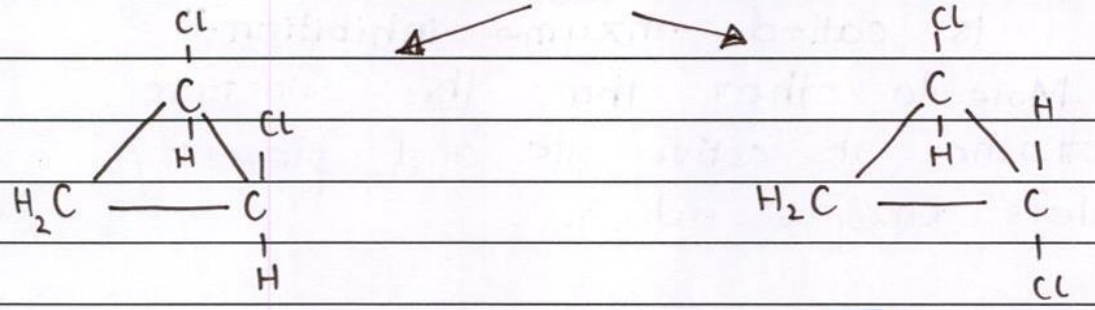
→ In trans, -COOH are on the opposite sides of nodal plane.

- Cis_isomer is less stable as compared to trans_isomer because of increased stearic hindrance in cis_isomer.

Q. No. 4 (Page 3/6)

GEOMETRICAL ISOMERISM IN CYCLO ALKANES

1,2 DICHLORO CYCLOPRONE



Cis - isomer Trans - isomer

→ In cis isomer, both -Cl are above the nodal plane.

→ In trans, -Cl are on the opposite sides.

(b)

ENZYMES

"Enzymes are biocatalysts which alter the speed of biochemical reactions by interfering with the metabolic pathways."

STRUCTURE

→ Consider lock and key model of enzyme action for the structure.

→ According to it, enzyme has an active site, to which substrate attaches and is converted into product.

Q. No. 4 (Page 4/6)

INHIBITION OF ENZYME

"When a foreign molecule attaches itself at the active site and hinders the enzyme action, this is called enzyme inhibition."

→ Molecule other than the substrate attaches at active site and prevents / hinders enzyme action.

TYPES OF INHIBITION

Inhibition is of two types:

- Reversible inhibition
- Irreversible inhibition

REVERSIBLE INHIBITION

When enzyme activity and active site can be recovered without affecting enzyme action, its reversible.

IRREVERSIBLE INHIBITION

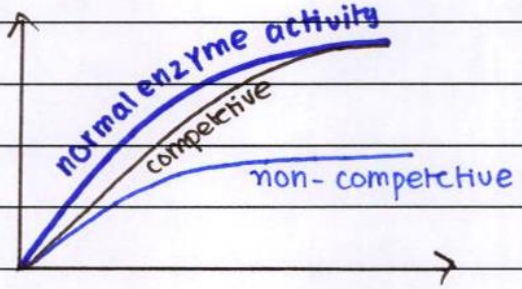
When enzyme activity can't be recovered, its irreversible inhibition and enzyme loses its activity.

TYPES OF REVERSIBLE INHIBITION

It's of two types

- Competetive

Q. No. 4 (Page 5/6)



(i) COMPETETIVE

In this inhibition, inhibitor attaches at the active site, and activity can be restored by increasing substrate concentration.

(ii) NON- COMPETETIVE

In this inhibition, inhibitor attaches ∅ itself at a place other than active site and alters enzyme shape which can't be recovered by increasing substrate concentration.

The relevant question should be answered only in the allotted space and inside the outer mark

Space for diagram/rough work

Q. No. 4 (Page 6/6)

Q. No. 5 (Page 1/6) (a)

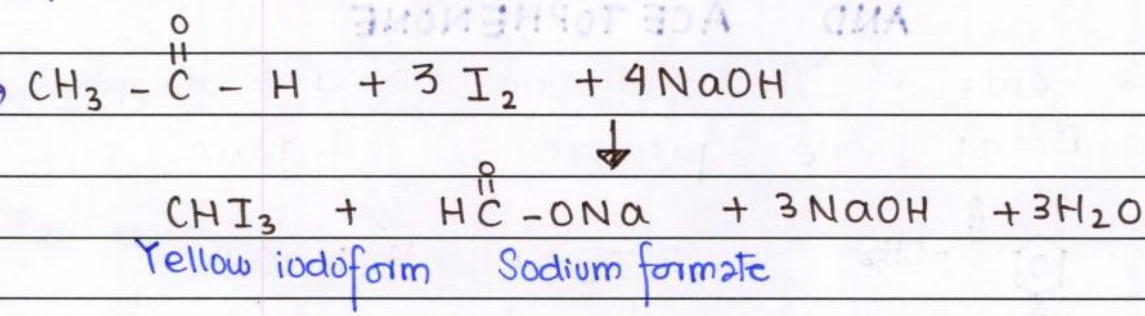
IODOFORM TEST

"The production of yellow ppt of iodoform (CHI_3) for the indication of specific compounds is iodoform test."

APPLICATIONS

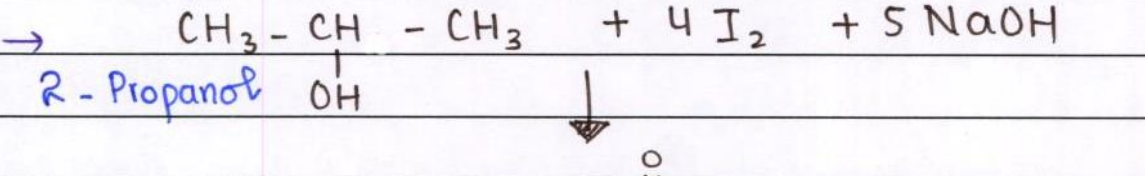
(i) DIFFERENTIATION BETWEEN ACETALDEHYE AND OTHER ALDEHYDES

→ Among aldehydes only acetaldehyde produces CHI_3.



(ii) DIFFERENTIATION BETWEEN SECONDARY ALCOHOLS AND OTHER ALCOHOLS

→ Among alcohols, only secondary alcohols and more specifically 2- Alcohols produce CHI_3.



Q. No. 5 (Page 2/6)

(iii) DIFFERENTIATION BETWEEN 2-KETONES AND OTHER KETONES

→ Among ketones, only 2-Ketones (methyl ketones) give CHI_3 positive test.

→ $CH_3 - \underset{\underset{O}{\|}}{C} - CH_3 + 3I_2 + 4NaOH \rightarrow$

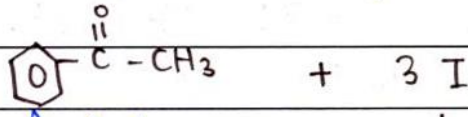
2-Propanone (Acetone)

$CHI_3 + CH_3 - \underset{\underset{O}{\|}}{C} - ONa + 3NaOH + 3H_2O$

Iodoform

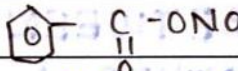
(iv) DIFFERENTIATION BETWEEN BENZOPHENONE AND ACETOPHENONE

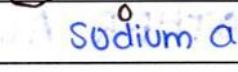
→ Between Acetophenone and Benzophenone, Acetophenone produces iodoform.



Acetophenone

$+ 3I_2 + 4NaOH \rightarrow$



$CHI_3 +$  $+ 3NaOH + 3H_2O$

Iodoform

Sodium acetophenate

Q. No. 5 (Page 3/6) ——— (b) ———

OZONE HOLE

"The depletion in the ozone layer (specifically in Antarctic region) is called ozone hole."

→ Ozone is a protective layer in Stratosphere.

→ Its composed of O_3

→ The O_3 absorbs harmful UV rays from sun and prevent them from entering into earth.

→ When ozone hole is created, the harmful UV and cosmic rays enter into the earth surface directly.

EFFECTS

Due to ozone hole:

→ Eye diseases and skin cancer is caused

→ Mental retardation in infants is caused

→ The global temperature is increasing.

REASONS FOR OZONE HOLE

→ Ozone hole is created because of breakdown of ozone molecules into oxygen as:

$$2O_3 \xrightarrow{UV} 3O_2$$

Q. No. 5 (Page 4/6)

→ The lighter pollutants remain unreactive in troposphere and rise to stratosphere

→ There on UV breakdown, they react and cause breakdown of O_3.

→ The pollutants include Sulphur oxides, Nitrogen and Chlorofluorocarbons (CFCs)

SULPHUR OXIDES

→ Sulphur and sulphur dioxide react with ozone molecule and breaks it down.

→ Reactions are:

$$S + 2O_3 \xrightarrow{UV} SO_2 + 2O_2$$

$$SO_2 + O_3 \xrightarrow{UV} SO_3 + O_2$$

NITROGEN

→ Nitrogen on reaction with Ozone produces NO_2.

→ Reaction occurs as:

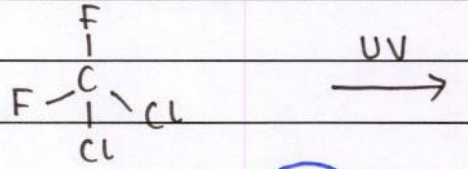
$$N + 2O_3 \rightarrow NO_2 + 2O_2$$

CHLOROFLUOROCARBONS

→ CFCs are light molecules and their main source is refrigerator and coolants, solvents.

Q. No. 5 (Page 5/6) and cause breakdown of several O_3.

→ Mechanism occurs as:



$Cl^{\bullet} + O^{-}\leftarrow O^{+}=O \rightarrow ClO^{\bullet} + O_2$

↳ breakdown

$ClO^{\bullet} + ClO^{\bullet} \longrightarrow Cl-O-O-Cl$

$Cl-O-O-Cl \rightarrow ClO_2^{\bullet} + Cl^{\bullet}$

↳ again reacts

$ClO_2^{\bullet} \longrightarrow Cl^{\bullet} + O_2$

↳ reacts again ↳ breakdown

→ In this way CFCs cause breakdown of several hundred O_3 molecules and the reactions keep on happening.

PROTECTION OF OZONE LAYER

- **ELIMINATION OF SULPHUR** Sulphur compounds from industries and automobiles should be reduced to limit the amount of Sulphur in air.
- **USE OF CONVERTORS IN AUTOMOBILES** To avoid unburned or incompletely combusted fuel TEL (Tetraethyl lead) $Pb(C_2H_5)_4$ and catalytic converters should be used.
- **USE OF HYDROFLUOROCARBONS** Instead of CFCs, HFCs should be used because

Space for Diagram/rough work

Q. No. 5 (Page 6/6)