**Q. No. 2 (i)**

**$AlCl_3$ is non conductor:** $AlCl_3$ is non conductor in solid state because ions are not free to move. It does not conduct electricity in molten or solution form because there are no more ions left.

$$AlCl_3 + 6H_2O \longrightarrow [Al(H_2O)_6]^{+3} + 3Cl^-$$

$$AlCl_3 + 6H_2O \longrightarrow Al(OH)_3 + 3HCl.$$

**NaCl is conductor:** NaCl is non conductor in solid form because ions are not free to move but it conducts electricity in molten or fused form because of formation of ions which carry charge.

$$NaCl \xrightarrow{H_2O} Na^+ + Cl^-$$

.....

**Q. No. 2 (ii)**

**a) BeO is amphoteric:**

It is amphoteric because it reacts with both acids and base. It has both ionic & covalent character. reactions are

- $BeO + 2HCl \longrightarrow BeCl_2 + H_2O$
  (acid) (salt)
- $BeO + NaOH \longrightarrow Na_2BeO_2 + H_2O$
  (base) (Berrylate)

**b) Covalent nature & high melting point:**

The size of $Be^{+2}$ ion is very small which greatly increases the charge

**Q. No. 2 (iii)** a) **$PbCl_4$ is thermally unstable:-**

It is because in lead $Pb^{+2}$ oxidation state is more stable than $Pb^{+4}$ oxidation state. $PbCl_4$ decomposes as

$$PbCl_4 \xrightarrow{25^\circ C} PbCl_2 + Cl_2$$

**b) $CCl_4$ donot give hydrolysis:-**

$CCl_4$ does not give hydrolysis reaction because carbon does not have d orbital & hence there are no vacant orbitals for attack of oxygen atom. Other elements, Si, Ge, Sn, have d orbitals for oxygen attack. However under superheated steam $CCl_4$ do give this reaction.

$$CCl_4 + H_2O \xrightarrow{\text{steam}} COCl_2 + 2HCl$$

Phosgene.

.....

**Q. No. 2 (iv)**

1. $[Cr(H_2O)_6]^{+3} + NaOH \longrightarrow [Cr(H_2O)_3(OH)_3] + 3H_2O$

green sol. green ppt.

2. $[Cr(H_2O)_3(OH)_3] + NaOH \longrightarrow [Cr(OH)_6]^{-3} + 3H_2O$

deep green solution

3. $[Cr(OH)_6]^{-3} + 5H_2O_2 \longrightarrow CrO_4^{-2} + 8H_2O + [O]$

yellow

$\longleftrightarrow$

**Q. No. 2 (v)**

**Reaction:-**

$$S_2O_8^{-2} + 2I^- \xrightarrow[\text{catalyst}]{\text{iron}} 2SO_4^{-2} + I_2$$

**Mechanism:-**

- $Fe^{+2}$ reduces sulphur and gets converted to $Fe^{+3}$

$$S_2O_8^{-2} + 2Fe^{+2} \longrightarrow 2SO_4^{-2} + 2Fe^{+3}$$

- $Fe^{+3}$ oxidizes $2I^-$ to $I_2$:-

$$2I^- + 2Fe^{+3} \longrightarrow I_2 + 2Fe^{+2}$$

as @ it is seen that catalyst remains same at the end of reaction. If $Fe^{+3}$ is to be used as catalyst the second reaction happens first.

.....

**Q. No. 2 (vi)**

**Importance of functional group:-**

They are important because of three reason

- functional group serves bases for nomenclature of organic compounds
- They help classify compounds in different classes. All compounds having same functional group belong to same class
- They are site of chemical reactivity in compound.

⟷

**Q. No. 2 (vii)** **Structural isomerism:-**

Structural isomerism occurs because of same molecular formula and different structural formula of compound. There are 5 types of it. ⇒ • chain isomerism • position isomerism • functional group isomerism • metamerism • tautomerism

eg ⇒ n-butane & iso butane.

**Stereo Isomerism:-**

It occurs due to different configuration of atoms in space. They also have same molecular formula. It is subdivided in Geometrical and optical isomerism. It is shown by chiral carbon.

⇒ eg:- optical isomer of tartaric acid

:- Geometrical isomers of 2-butene.

.....

**Q. No. 2 (viii)** 1-butene ⇒ $H_2C=CH-CH_2CH_3$.

**a** **$Br_2/CCl_4$**

$$CH_2=CH-CH_2-CH_3 + Br_2 \xrightarrow{CCl_4} \underset{\substack{| \\ Br}}{CH_2}-\underset{\substack{| \\ Br}}{CH}-CH_2-CH_3$$

(1,2-dibromobutane)

**b** **$Cl_2+H_2O$**

$$CH_2=CH-CH_2-CH_3 + Cl_2 + H_2O \longrightarrow \underset{\substack{| \\ Cl}}{CH_2}-\underset{\substack{| \\ OH}}{CH}-CH_2-CH_3 + HCl$$

Chlorohydrin.

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

$$CH_2=CH-CH_2-CH_3 + C_6H_5COOOH \xrightarrow[CHCl_3]{CHCl_3} CH_2-\underset{\diagdown O \diagup}{CH}-CH_2-CH_3$$

**Q. No. 2 (ix)** **Reducing property of halide ions:**

The trend is as

$$I^- > Br^- > Cl^- > F^-$$

for halide ion to act as reducing agent it must lose electrons. As Iodide ion, because of its largest size, can easily lose electrons so it is strong reducing agents. The results can be justified as follows.

$8HI + H_2SO_4 \longrightarrow H_2S + 4I_2 + 4H_2O$

$2NaCl + H_2SO_4 \longrightarrow Na_2SO_4 + 2HCl$.

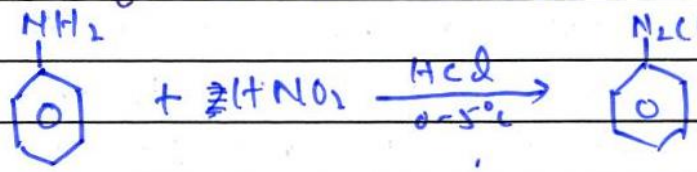
(NaCl does not redule sulphur)

$2HBr + H_2SO_4 \longrightarrow Br_2 + SO_2 + 2H_2O$

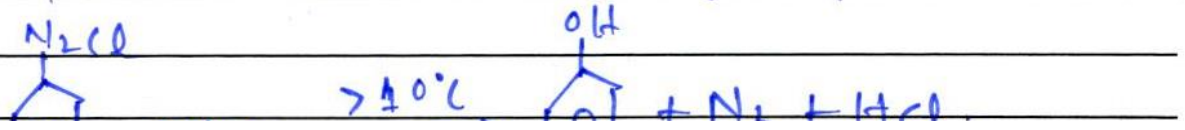
as Iodide redules Sulphur from $+6 \rightarrow -2$ & Bromide reduces from $+6 \rightarrow +4$ so Iodide is strongest reducing agent..

.....

**Q. No. 2 (x)** **Diazonium salts:** compounds having diazonium group ($-N \equiv N-$) are called diazonium salts. It is prepared by reaction of aniline with $HNO_2$ (fresh) in presence of Hcl. The reaction must be below 10°C




any primary amine can be used instead of aniline. Now, as these salts are highly unstable so increasing temperature above 10°C will form phenol & $N_2$.



**Q. No. 2 (xi)**

**Reaction:-** $2CH_3CH_2OH \xrightarrow[140^\circ C]{H_2SO_4} CH_3CH_2OCH_2CH_3$

diethyl ether.

**Mechanism:-**

- protonation

$CH_3CH_2-OH + H^+ \longrightarrow CH_3-CH_2-\overset{+}{O}H_2$

- attack of another alcohol molecule

$CH_3-CH_2-\overset{+}{O}H_2 + CH_3CH_2-OH \longrightarrow CH_3CH_2-\overset{+}{O}(H)-CH_2CH_3 + H_2O$

- formation of ether

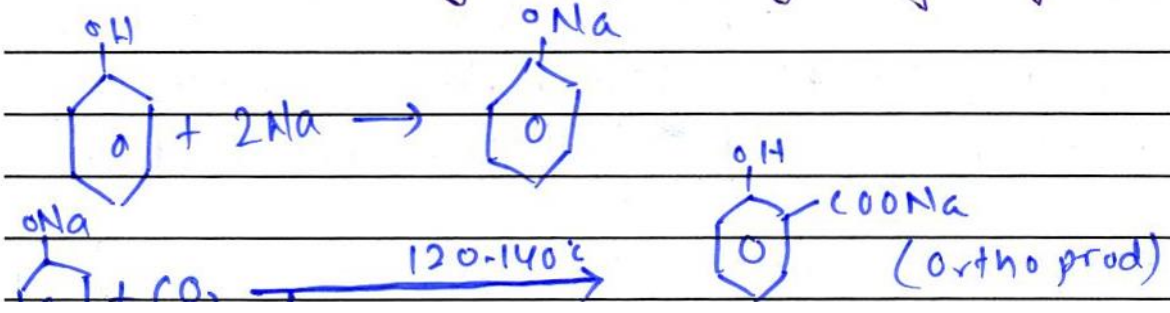
$CH_3-CH_2-\overset{+}{O}(H)-CH_2CH_3 + H_2O \longrightarrow CH_3CH_2-O-CH_2CH_3 + H_3O^+$

diethyl ether.

.....

**Q. No. 2 (xii)**

**Kolbe schmitt reaction:-** The reaction of $CO_2$ with sodium phenoxide is called kolbe schmitt reaction. at temp of 120-140°C, sodium salicylate is formed and at 240°C, para-hydroxy sodium benzoate is major product. On treatment with acid they can form hydroxy benzoate.



**Q. No. 2 (xiii)**

.....

**Q. No. 2 (xiv)**

a Acetamide to ethyl amide.

$$CH_3-\overset{O}{\overset{\|}{C}}-NH_2 + 4[H] \xrightarrow{LiAlH_4} CH_3CH_2NH_2 + H_2O$$

b acetyl chloride to acetic anhydride:.

$$CH_3-\overset{O}{\overset{\|}{C}}-Cl + CH_3-\overset{O}{\overset{\|}{C}}-OH \xrightarrow{\text{pyridine}} CH_3-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3 + HCl.$$

c Calcium acetate to acetone.

$$Ca\left(O-\overset{O}{\overset{\|}{C}}-CH_3\right)_2 \xrightarrow[\text{distillation}]{\text{dry}} CaCO_3 + CH_3-\overset{O}{\overset{\|}{C}}-CH_3.$$

**Q. No. 2 (xv)** preparation of $CH_3COOH$

a from Grignard reagent:-

$$C=O + CH_3MgBr \longrightarrow CH_3-C(=O)-OMgBr \xrightarrow{H^+} CH_3COOH + Mg(OH)Br$$

b from Nitrile:-

$$CH_3C\equiv N + 2H_2O \xrightarrow{HCl} CH_3COOH + NH_3$$

c An alcohol:-

$$CH_3CH_2OH \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3-C(=O)-H + H_2O$$

$$CH_3-C(=O)-H \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3COOH$$

.....

**Q. No. 2 (xvi)**

| DNA | RNA |
|---|---|
| • it consists of deoxy ribose sugar | • It consist of ribose sugar |
| • It is found in nucleas | • It is found in nucleolus. |
| • It consists of two strands | • It consist of one strand |
| • Base pairs are A-T G-C | • Base pairs are A-U G-C |
| • stands for deoxy | • stands of ribonucleic acid. |

**Q. No. 2 (xvii)**

Classification of petrochemical raw materials:

They can be classified as

- olefins ⇒ ethylene, propylene, butadiene
- aromatics ⇒ benzene, toluene, xylene
- synthesis gase ⇒ $H_2$ and carbon monoxide for preparation of Ammonia & $CH_3OH$.

**Q. No. 2 (xviii)**

When electron is subjected to radiation in range 200-800 nm following transition can occur.

- $\sigma \rightarrow \sigma^*$ :-
  It is only possible in vacuum ultraviolet region:-
- $\pi - \pi^*$ :- Occurs in molecules having double bonds eg C=C, C≡C, ...
- $n \rightarrow \sigma^*$ :-
  Occurs in molecules having lone pair of electrons
- $n \rightarrow \pi^*$
  occurs in molecules having lone pair of electrons on hetroatoms.

**Q. No. 2 (xix)**

When electron is subjected to radiation in range 200-800nm following transition occurs:-

- $\sigma \rightarrow \sigma^*$

  only possible in vacuum ultraviolet region.

- $\pi \rightarrow \pi^*$

  Occurs in molecules having double bond $C=C$, $C\equiv C$,..

- $n \rightarrow \sigma^*$

  Occurs in molecules having lone pair of electrons, Sulphur etc

- $n \rightarrow \pi^*$

  Occurs in molecules having lone pair of electrons on hetro atom.

Energies:-

$n \rightarrow \pi^* \leq \pi \rightarrow \pi^* < n \rightarrow \sigma^*$

**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)**

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



**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)**

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

**Space for diagram/rough work**

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

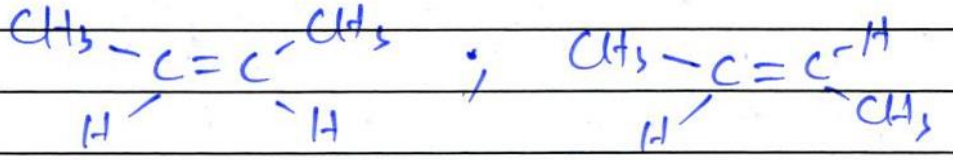
Q. No. 4 (Page 1/6)

(a)

# GEOMETRICAL ISOMERISM:-

Geometrical isomerism or Cis Trans isomerism occurs due to restriction of bonds (double bonds in aliphatic substances & single bonds in cyclic alkanes). The restiction of rotation around double bond allows atoms to be arranged in two ways resulting in Cis-Trans isomerism. The rotation will break the bond.

ex⇒ Geometrical isomers of 2-butene are



Cis-2-butene ; Trans 2-butene.

Cis isomers occur when there are two identical groups on same side of double bond. Trans isomer occurs when there are 2 identical groups on opposite side of double bond.

**Stability:-**

Cis isomer is ~~more~~ less stable than trans isomer due to great steric hindrance of bulky groups. They can be interconverted at high temperature and pressure

**Conditions for geometrical isomerism:-**

Geometrical

Q. No. 4 (Page 2/6) no less.

- It only occurs if each double bonded carbon atom is bonded to two different atoms. forex

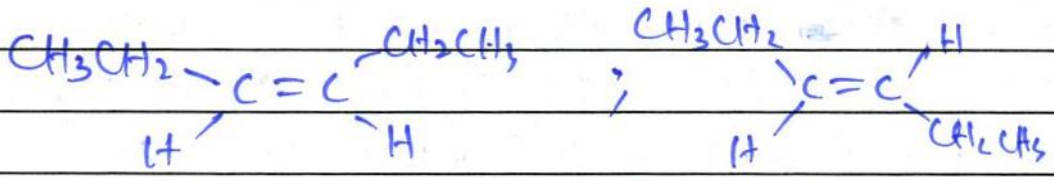
$H_3C-C(H)=C(H)-H$ (propene)

No geometrical isomers are possible for propene as there are 2 identical Hydrogen atoms on terminal carbon.

- There should be different groups on different carbon atoms. Not on single carbon atom.

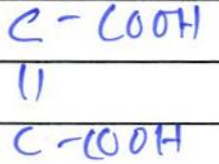
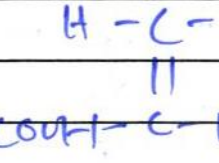
## Geometrical Isomerism in alkenes:-

From above conditions we get following examples in which geometrical isomerism occurs:- • In 3-hexene



Cis 3-hexene ; Trans 2-hexene.

- In butene dioic acid.

| | |
|---|---|
|  |  |
| Cis-2-butene dioic acid | Trans 2-butene dioic acid |

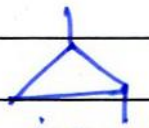
**Q. No. 4 (Page 3/6)**

In this case Cis isomer is stable because of Hydrogen bonding.

**Geometrical isomer in cycloalkanes:-**

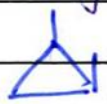
It can also occur in cyclo alkanes. ~~for example~~ because there is restriction in rotation of bond which will collapse the ring structure.

- geometrical isomers for cyclopropane are



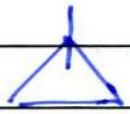
Trans isomer

;



Cis isomer.

It should be noted that groups should be on adjacent carbon atoms. not on only one carbon atom as



In this case no geometrical isomers are possible for 1,1-dimethyl cyclopropane.


**Enzymes:-**

Enzymes are complex protein molecules which act as biocatalyst and sustain such useful reactions without which life would be impossible.

**Enzyme inhibition:-**

Inhibitor is any substance

Q. No. 4 (Page 4/6)

activity by changing the aspects of active side of enzyme. Inhibition can be of 2-types.

- **Irreversible inhibition:-**

When inhibitor binds to active side of enzyme by making strong covalent bonds with enzymes active site, it attatches itself permenantly, than such type of inhibition is called irreversible inhibition.

- **reversible inhibition:-**

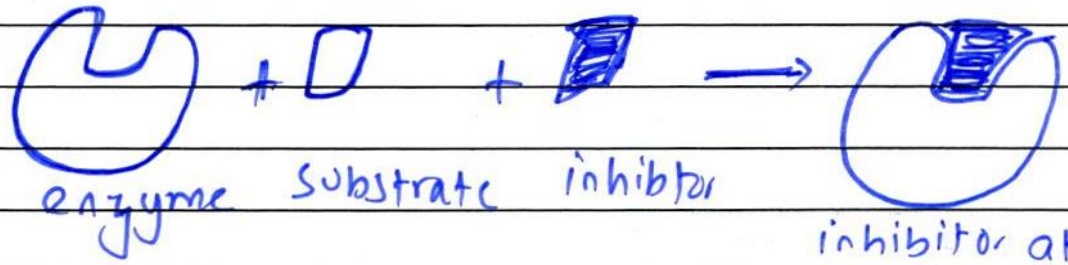
reversible inhibition occurs when the inhibitor attaches temporarily with enzyme and enzyme activity can be restored by changing concentrations of substrate. They are further classified in 2-types as

- competitive inhibitor
- Non competitive inhibitor.

## ↳ Competitive inhibitor:-

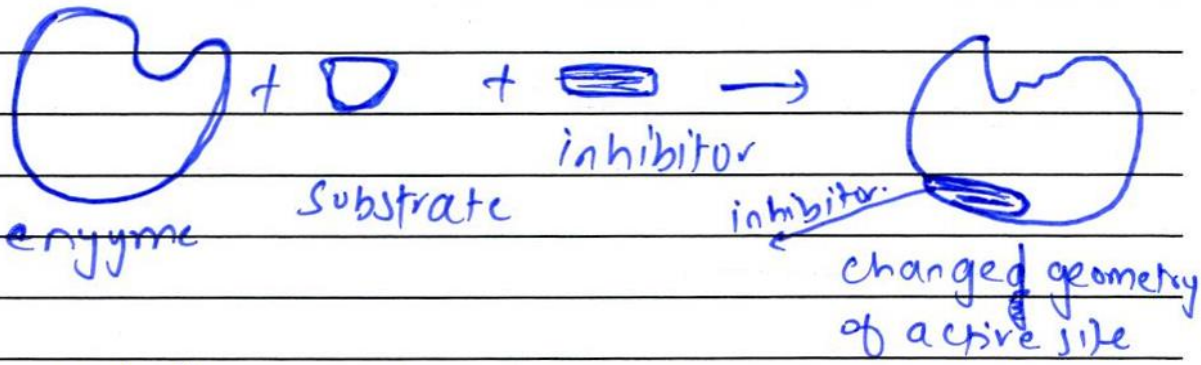
Competitive inhibitor resembles substrate in shape and geometry and is capable of binding to active site of enzyme in same way as that of substrate thus decreasing activity of enzyme. Its effect can be reversed by decreasing concentration of substrate which restores

Q. No. 4 (Page 5/6)

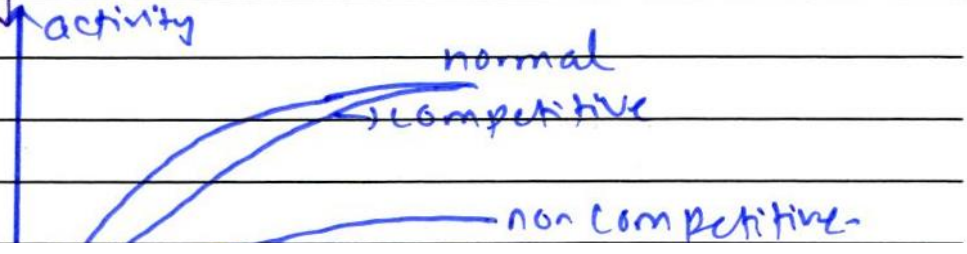



## ↳ non competitive inhibitor:-

Non competitive inhibitor does not resemble substrate and also it does not binds at active site of enzyme rather it attaches it self on some other sites. These sites are called allosteric sites. This attachment results in changing geometry of active site which decreases activity because substrate cannot bind with active site.




The activity can be shown as.



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**Q. No. 4 (Page 6/6)**

Q. No. 5 (Page 1/6)

~~(a)~~

# Iodoform Test:-

Iodoform is base catalysed nucleophilic addition reaction of aldehydes & ketones and alcohol. They react with iodine in presence of base and result in formation of triiodomethane which is known as iodoform. It is yellow in color. Basicelly iodoform test is used for distuinguishing certain elements. In aldehydes and ketones only compounds having $CH_3CO-$ group will give this test positive. Its applications are:-

## applications:-

It is used to distuinguish:-

- ethanal from other aldehydes
- methyl ketones from other ketones
- ethanol from other primary alcohol:-

## reactions of alcohols:-

In alcohol only ethanol will give this test positive.

$$CH_3CH_2OH + 4I_2 + 6NaOH \longrightarrow CHI_3 + HCOONa + 5NaI + 5H_2O$$

- $CHI_3$ is iodoform (yellow color, ppt).

In secondary alcohol only these alcohols will give this test positive which have following group

$$CH_3-\overset{*}{\underset{H}{C}}-OH$$

Q. No. 5 (Page 2/6)

$$R-\underset{CH_3}{\overset{I+}{C}}-OH + 4I_2 + 6NaOH \longrightarrow CHI_3 + RCOONa + 5NaI + 5H_2O.$$

3° alcohol donot give this reaction because no H atom is attached with central carbon.

- **reactions of aldehydes:-**

Only ethanal (acetaldehyde) gives this test positive.

$$CH_3-\overset{O}{\overset{\|}{C}}H + 3I_2 + 4NaOH \longrightarrow CHI_3 + HCOONa + 3NaI + 3H_2O.$$

- **reaction of ketones:-**

only methyl ketones give this test positive.

$$R-\overset{O}{\overset{\|}{C}}-CH_3 + 3I_2 + 4NaOH \longrightarrow \underset{\text{iodoform (yellow ppt)}}{CHI_3} + RCOONa + 3NaI + 3H_2O$$

In all reactions yellow ppt of iodoform is obtained.

(b)

**Ozone layer:-**

Ozone ($O_3$) is present

Q. No. 5 (Page 3/6)

cause pollution. In stratosphere ultraviolet light produces ozone as follows.

$$O_2 + h\nu \longrightarrow 2O$$
$$2O + 2O_2 \longrightarrow 2O_3$$
$$3O_2 \xrightarrow{U.V} 2O_3$$

This means constantly ozone is being prepared in stratosphere. But presence of substances in stratosphere adversely affect ozone development and decreases its concentration.

**Ozone depletion and ozone hole:-**

The use of aerosol sprays, refrigerants and nuclear reactions release oxides of Nitrogen & CFCs which damage ozone layer when they reach ozonelayer. The increasing concentration of ozone in troposphere is because of reason that it is reducing in stratosphere. ozone layer in stratosphere protects the earth from ultraviolet radiations of sun to reach its surface. If ultraviolet radiations are allowed to reach earth surface it can cause skin cancer and other problems.

In 1985, scientists discovered hole in ozone layer above antarctica region. The hole was allowing ultraviolet radiations of sun to pass thrwah it and reach the surface of

Q. No. 5 (Page 4/6)

• **Oxides of Nitrogen:-**

The oxides of Nitrogen are badly damaging ozone layer. They decompose ozone and are themselves regenerated in reaction and continue process of ozone depletion.

$$NO + O_3 \longrightarrow NO_2 + O$$
$$NO + O \longrightarrow NO_2$$

• **Nuclear reactions:-**

The nuclear reactions performed generate a lot of heat which converts nitrogen in air to its oxides ($NO, NO_2$) which damages ozone layer as already shown above.

• **Chlorofluorocarbons:-**

Chlorofluoro carbons are halo tetrachloromethane or tetrahaloalkanes. For ex Freon-I ($CFCl_3$) & Freon-II ($CF_2Cl_2$). They are known as chlorofluoro alkanes. They are used as refrigerants, aerosol sprays. They are inert and donot react in troposphere but they damage ozone in stratosphere by producing Chlorine free radical.

On reaching stratosphere following rxns occur.

$$CF_2Cl_2 \xrightarrow{\text{Ultraviolet light}} Cl^\circ + \dot{C}F_2Cl$$

$$\dot{C}l + O_3 \longrightarrow \dot{C}lO + O_2$$

Q. No. 5 (Page 5/6) destruction of ozone.

**protection of ozone layer:-**

Scientists are worried about alarming destruction of ozone layer in recent years. which is increasing pollution in earth. They are trying day and night to use those substance which donot contain chlorine freeradical. they have devised the use of hydrofluoro carbons instead of chlorofluoro carbons.

- **Hydrofluoro carbons:-**

hydrofluoro carbons are also known as hydrofluoroalkanes and they have replaced chlorofluoro carbons. An example of hydrofluoro carbon is (1,1,1,2 - tetrafluoroethane) which is ($CF_3CH_2F$). They donot contain any free radical of chlorine which damages $O_3$. They are used as refrigerants, aerosols etc. More over they contain carbon and Hydrogen which readily decompose in different unharmful products after being used thus causing no kind of damage.

— x — x — x — x —

THE END!

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

**Space for Diagram/rough work**

**Q. No. 5 (Page 6/6)**