# Section: B

## Question: 2

(vii)

**Lucas Test:-**

It is a test used to distinguish between primary, secondary and tertiary alcohols.

In lucas test the 1°, 2° and 3° alcohols are distinguished on the basis of rate of reaction.

**Lucas Reagent:**

Anhydrous $ZnCl_2$ and concentrated HCl is called lucas reagent.

i-e Anhydrous $ZnCl_2$ + conc HCl.

**Distinguish Test:** Alcohol reacts with lucas reagent to form alkyl halides which are insoluble due to which

cloudiness appears.

$$R-OH + zncl_2 \xrightarrow{HCl} R-X_{(ppt)} + H_2O$$

**Tertiary Alcohol:-**

Tertiary alcohols react fast with lucas reagent and cloudiness appear immediately.

**Secondary Alcohol:**

Secondary alcohols react slowly with lucas reagent and cloudiness appear in 5-10 minutes.

**Primary Alcohol:**

Primary alcohols react very slowly with lucas reagent and cloudiness appear by Δ heating.



## viii

**Tollen's Test:**

• It is a test which is used to distinguish between aldehyde and ketone.

Ammonical solution of silver nitrate is called tollen's reagent.

i-e $AgNO_3 + NH_4OH \longrightarrow Ag(NH_3)_2$

**Reaction:**

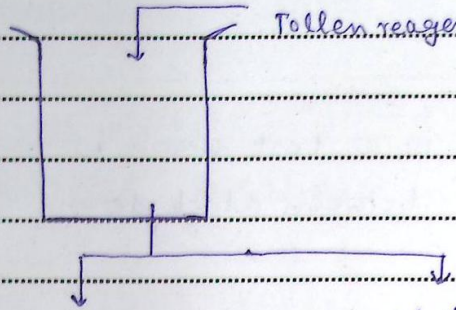
When aldehyde reacts with tollen reagent then the aldehyde is oxidized to carboxylate (ammonium) and silver ion is reduced silver. Due to silver, white silver mirror is formed. Therefore, this reaction is also called silver mirror test.

$$R-\overset{O}{\overset{\|}{C}}-OH + AgNO_3 + NH_4OH \longrightarrow R-\overset{O}{\overset{\|}{C}}-ONH_4 + Ag^{+1} + H_2O$$

**Importance:**

It is used to differentiate

aldehyde and ketone by following way:




If silver mirror is formed: it is positive test for aldehyde and negative test for ketone.

If silver mirror is not formed then it is positive test for ketone and -ive for aldehyde.

## Fehling Solution's Test:-

:- **Fehling Solution:**

• Alkaline solution of cupric tartrate is called fehling solution.

→ It has blue colour due to $Cu^{+2}$.

**Test:**

• When fehling solution is added to aldehyde then it is oxidized to carboxylate ion and the $Cu^{+2}$ is reduced to $Cu_2Cl_2$ due to which red ppt is formed which confirms aldehyde.



→ Ketone does not react with fehling solution.

$$R-\overset{O}{\overset{\|}{C}}-OH + Cu^{+2} + NH_4 \longrightarrow R-\overset{O}{\overset{\|}{C}}-O^- + Cu_2Cl_2 \cdot$$

Red

**Importance:**

It is used to estimate the level of glucose in urine of diabettic patient.

ii

## Typical Transition Elements:

• Those elements which have unpaired electron is its atomic state or common oxidation state are called typical transition elements.

→ They show all the properties of transition element.

→ They form complexes.

**Example:**

Cu, Ni, Fe etc.

## Non-Typical Transition elements:

Those elements which have vacant or fully filled d-orbital are called non-Typical transition elements.

→ They do not show all the properties of transition metals.

→ They are included in transition metals only because they form complexes.

**For example:**

Zn, Sc etc.

**Xi**

**Poly Vinyl Chloride:**

· It is a polymer formed by repeating units called vinyl chloride.

$$\left[ CH_2 - \underset{Cl}{CH} \right]_n$$



i **Daily uses:-**

It is widely used in imitations, leather and roofing materials.

ii) **Electrical Wires making:-**

It is used in making the electrical wires.

iii) **Floor Covering:-**

It is widely used in floor covering.

iv **Pipes:** It is widely used in making pipes in industry.

## ix

## Conversion of carboxylic acid to Acid Amides And Acid Anhydride:

Carboxylic acids can be converted into acid amides and acid anhydride by following ways:-

a):- **Conversion to Acid Anhydride:-**

When two carboxylic acids react in the presence of dehydrating agent $H_3PO_4$, it forms acid anhydride.

$$R-\overset{O}{\overset{\|}{C}}-OH + R-\overset{O}{\overset{\|}{C}}-OH \xrightarrow{H_3PO_4} R-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-R$$

When two moles of acetic acid reacts together in the presence of $H_3PO_4$, acetic anhydride is formed with removal of water.



$$CH_3-\overset{O}{\overset{\|}{C}}-OH + CH_3-\overset{O}{\overset{\|}{C}}-OH \xrightarrow{H_3PO_4} CH_3-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3 + H_2O$$

## Conversion to Acid amide:

Following reactions show the conversion of carboxylic acid to acid amide:

i) From Carboxylic Acid And $NH_3$:

$$R-\overset{O}{\overset{\|}{C}}-OH + NH_3 \longrightarrow R-\overset{O}{\overset{\|}{C}}-NH_2 + H_2O.$$

ii) From Acid Halide And $NH_3$:

$$R-\overset{O}{\overset{\|}{C}}-Cl + NH_3 \longrightarrow R-\overset{O}{\overset{\|}{C}}-NH_2 + HCl.$$

iii) From Ester And $NH_3$:

$$R-\overset{O}{\overset{\|}{C}}-O-R + NH_3 \longrightarrow R-\overset{O}{\overset{\|}{C}}-NH_2 + R-OH$$

iv) From Acid Anhydride and $NH_3$:

$$R-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-R + NH_3 \longrightarrow R-\overset{O}{\overset{\|}{C}}-NH_2 + R-\overset{O}{\overset{\|}{C}}-OH.$$

X

## Effect of Temperature:

The temperature at which an enzyme performs maximum activity is called optimum PH.

**Effect::**

→ Increasing temperature upto optimum increase the catalytic activity of enzyme.

→ However, if the temperature is increased beyond the optimum, the enzyme gets denatured.

## optimum Temperature:

For most enzymes in human body, the optimum temperature is 37°C.

There are some enzymes which also work above the room temperature and 37°.

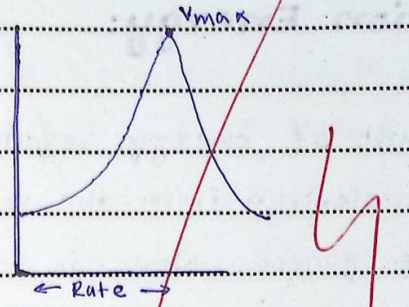
**Examples:**

Urease is an enzyme that works at 60°C

→ Taq polymerase is an enzyme that works at 94°C.



→ Decrease in temperature below optimum decrease the activity of enzymes and stops at 0°C.




## Effect of PH:

**Optimum PH:-**

The PH at which an enzyme performs maximum activity is called optimum PH.

For most enzymes, the optimum PH ranges from 5-9. However, different enzymes have different PH.

The optimum PH of pepsin is 1-2.

The optimum PH of trypsin is 8-9.

**Increase or Decrease in PH:**

→ Increase or decrease in temperature beyond optimum denatures enzyme.

It mainly affects the polar amino acids of enzyme.

i

## Ionization Energy:

The amount of energy required to remove an electron from the valence shell of ~~excite~~ gaseous atom is called ionization energy.

$Na_{(g)} \longrightarrow Na^{+1} + 1e^{-} \quad \Delta E = +496\ KJ/mol.$

- It is an endothermic process.

- The ionization energy of phosphorous is greater than the ionization energy of sulphur. due to stable $p^3$ electronic configuration.

## Explanation:

- From left to right the ionization energy increases due to increase in nuclear charge, decrease in atomic size.

i P: The electronic configuration of phosphorous is $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$.



2): Sulphur: The electronic configuration of sulphur is $1s^2, 2s^2, 2p^6, 3s^2 \rightarrow 3p^4$.

The electronic configuration shows that in p ~~stable~~ p-orbital is half-filled and stable while the p-orbital of sulphur is fully filled and unstable. Therefore, due to stable $p^3$ electronic configuration, phosphorus has high ionization energy than sulphur.

## xii

## Photochemical smog:

: The smog which is formed by the reaction of pollutants in the presence of sunlight.

The major constituents of photochemical smog is given as:

i): ozone ii): $NO_2$ iii): PAN (Peroxyacetyl nitrate).

⇒ ozone is one of the major components of photochemical smog.

⇒ It is primarily caused by $NO_2$.

:- **Formation:**

. Photochemical smog is formed due to following reactions:

. It is characterised by formation of brown hazy fumes due to $NO_2$.

$VOC's + NO \longrightarrow NO_2$

$NO_2 \xrightarrow{UV} NO + O$

$O_2 + O \longrightarrow O_3$

$VOC's + NO_3 \longrightarrow PAN$

$NO_2 + 2VOC's + O_2 \longrightarrow PAN + O_3$

=) It is also called oxidizing fumes.

iv

**Metamerism:**

i): Def: Two or more than two molecules having same general molecular formulas, same functional group but different arrangement of atoms around the functional group are called metameres and this phenomenon is called metameris.



**Properties:**

. They have same chemical properties due to same functional group.

. They have different physical properties.

**Example:**

Di-ethyl ether and ethyl methyl ethers are metameres.

$CH_3 - CH_2 - O - CH_2 - CH_3 \longrightarrow CH_3 - O - CH_2 - CH_2 - CH_3$

**Tautomerism:**

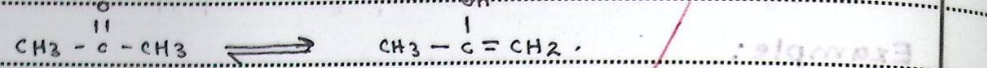
. The type of isomerism in which the isomers have same functional group, general formula but they differs from each other in position of $\pi$-bond or the position of proton.

→ It is the special case of functional group isomerism.

→ The isomers are present in dynamic equillibrium.

**For Example:**

. Acetone and ~~Ethano~~ propanol are tautomers.



Acetone propen-2-ol.

V

## Geometric Isomerism:

The type of isomerism in which the movements of atoms around the double bond is restricted is called geometric isomerism.

→ They have same functional group but different physical and chemical properties.

**Conditions:**

: Following conditions are necessary for geometric isomerism:-

i): The isomers must have double bond.

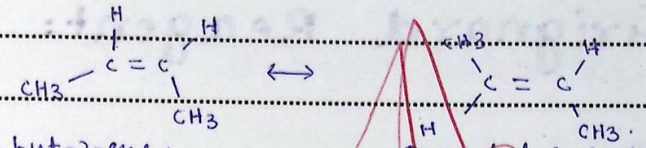


ii): Two different atoms or group of atoms must be bonded to the double bonded carbon atoms.

For example:

⇒ (i): But-2-ene:

The structural formula of But-2-ene is:



cis-but-2-ene. Trans-but-2-ene.

The but-2-ene has double ~~bond~~ bond.

→ Different atoms and group of atoms are also bonded to double bonded carbon.

Hence, shows geometric isomerism.

# Section C

## Question:5

## Grignard Reagent:

i):- Def:

The alkyl magnesium halide is called grignard reagent.

or

The aryl magnesium halide is called grignard reagent.

**General Formula:**

The general formula of grignard reagent is as follow:

R - Mg - X or Ar - mg - X

**Example:**

Methyl magnesium chloride = $CH_3-Mg-Cl$

Ethyl magnesium bromide = $CH_3-CH_2-Mg-Br$



**Discovery:**

Grignard Reagent was discovered by Vector Grignard Reagent. Due to its synthetic importance he was awarded Nobel Prize in 1920.

## Preparation of Grignard Reagent:

When the alkyl halide reacts with magnesium grignard reagent, is formed in the presence of dry ether or tetrahydrofuran.

$$R-X_{(s)} + Mg_{(s)} \xrightarrow[THF]{\text{Dry Ether}} R-Mg-X$$

alkyl halide — Grignard Reagent.

→ It is a heterogenious reaction.

**Mechanism:**

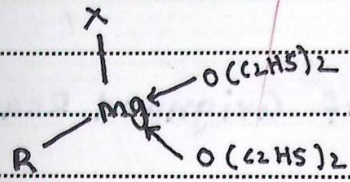
. It occurs in two steps.

Step #1:-

$R-\overset{\curvearrowright}{X}\overset{\curvearrowright}{+}Mg \longrightarrow$

:- **Importance of Ether:**

- It acts as a solvent i.e provide a medium for preparation of grignard reagent.
- It stabilizes the grignard reagent by solvation.




→ The X-Rays diffraction analysis shows that the geometry of grignard reagent is tetrahedral.

→ Two ether molecules are bonded to magnesium by co-ordinate covalent bond.

:- **Ease of preparation:**

- Ease of preparation of grignard reagent depends upon:

a): Size of Alkyl Group:

- Greater is the size of alkyl group, more unstable will be carbanion and grignard reagent will not be formed easily, and vice versa.



:- **Size of Halogen:**

- The ease of preparation of grignard reagent is directly proportional to the size of halogen.

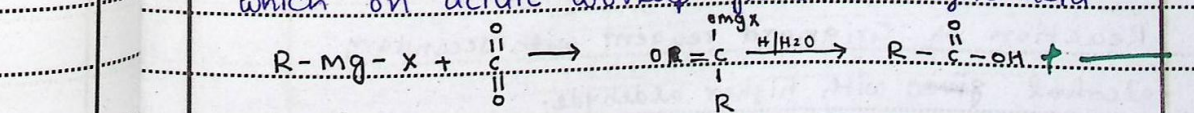
→ larger is the size of halogen, more easily will the grignard reagent form and vice versa.

:- **Reactions of Grignard Reagent:**

a):- **Reaction with carbon dioxide:**

- The addition of $CO_2$ to grignard reagent is called carboxylation.
- It is a nucleophillic addition reaction.
- It is a way to extend the length of chain.

When carbon dioxide is added to grignard reagent, addition product is formed which on acidic workup gives carboxylic acid.



→ Addition of $CO_2$ to ethyl magnesium chloride gives propanoic acid.

$$CH_3-CH_2-Mg-Cl + CO_2 \longrightarrow CH_3-CH_2-\overset{O}{\overset{\|}{C}}-OH$$

:- **Reaction with Aldehyde And Ketone:**

→ It is an nucleophillic addition reaction.

**General Reaction:**

The grignard reagent reacts with aldehyde or ketone to give addition product which on acidic workup gives alcohol.

$$R-Mg-X + R-\overset{O}{\overset{\|}{C}}-H \longrightarrow R-\overset{R}{\underset{OMgX}{\overset{|}{\underset{|}{C}}}}-H \xrightarrow{H/H_2O} R-\overset{O}{\overset{\|}{C}}-R$$

Alkoxide.

→ Reaction of grignard reagent with formaldehyde gives primary alcohol.

$$R-Mg-X + H-\overset{O}{\overset{\|}{C}}-H \rightarrow H-\overset{R}{\underset{OMgX}{\overset{|}{\underset{|}{C}}}}-H \xrightarrow{H/H_2O} R-CH_2-OH$$

→ Reaction of Grignard reagent ~~with~~ secondary alcohol ~~gives~~ gives with higher aldehyde.

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$$R-Mg-X + R-\overset{O}{\overset{\|}{C}}-H \rightarrow R-\overset{R}{\underset{OMgX}{\overset{|}{\underset{|}{C}}}}-H \xrightarrow[-OMgX]{H/H_2O} R-\overset{OH}{\overset{|}{C}}H-R$$

Reaction of grignard reagent with ketone gives tertiary alcohol.

$$R-Mg-X + R-\overset{O}{\overset{\|}{C}}-R \rightarrow R-\overset{R}{\underset{OMgX}{\overset{|}{\underset{|}{C}}}}-R \xrightarrow{H/H_2O} R-\overset{R}{\underset{OH}{\overset{|}{\underset{|}{C}}}}-R$$

## Question: 6

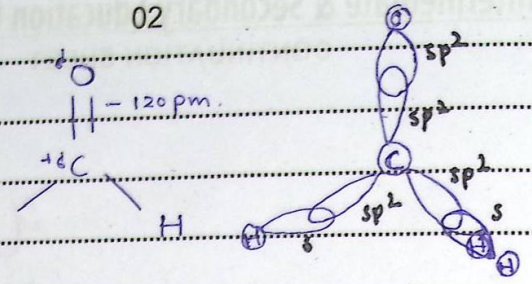
**Aldehyde:-** Organic compound in which formyl group is present is called aldehyde.

**Ketone:-**

organic compound in which Ketone functional group is present.

**Structure of Aldehyde: and Ketone:**

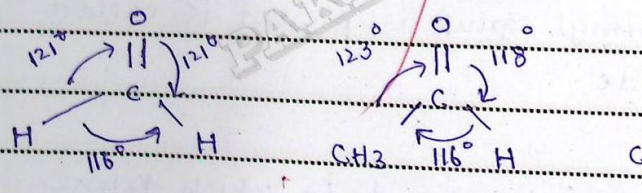
Consider formaldehyde to explain the structure of aldehyde and Ketone:




- In aldehyde and ketone, the carbonyl carbon and carbonyl oxygen are $sp^2$-hybridized.
- The bond between the C and oxygen is formed by linear overlap of $sp^2$-$sp^2$ orbitals.
- The C-H bonds are sigma bonds and are formed by $sp^2$-s overlap.

- The bond length of C=O is 120pm.

**Bond Angle:**






# Oxidation of Aldehyde and Ketone:

The aldehyde and ketone are oxidized by both mild oxidizing agent and strong oxidizing agent.

**By Strong oxidizing Agent:**

: Following are the strong oxidizing agents.

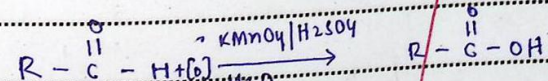
i):- $KMnO_4 / H_2SO_4$ ii):- $K_2Cr_2O_7 / H_2SO_4$

iii):- $Na_2Cr_2O_7 / H_2SO_4$.

**1):- oxidation of Aldehyde:**

: Aldehyde can be oxidized by both strong oxidizing agents and mild oxidizing agents.

The oxidation of aldehyde in the presence of strong oxidizing agent produces carboxylic acid.




**2):. oxidation of Ketone:**

: Ketone can also be oxidized by strong oxidizing agent forming formic acid.

For example:

The oxidation of acetone produces ethanoic acid and methanoic acid.

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

## By mild oxidizing Agent:

- Mild oxidizing agent can only oxidize the aldehyde because of polar C-H bond.
- It cannot oxidize the ketone because polar-CH bond is not present.

### a): Oxidation by Tollen's Reagent:

When aldehyde reacts with tollen reagent, it is oxidized to carboxylate and silver ion is reduced to silver which forms silver mirror. Hence called silver mirror test.

→

$$R-\overset{O}{\overset{\|}{C}}-H + AgNO_3 + NH_4OH \longrightarrow R-\overset{O}{\overset{\|}{C}}-ONH_4 + Ag.$$

silver mirror.

### b): Oxidation by Fehling Solution:

When aldehyde reacts with fehling solution, is it is oxidized to carboxylate ion and $Cu^{+2}$ is reduced to $Cu_2Cl_2$ due to which red precipitate is formed.

$$R-\overset{O}{\overset{\|}{C}}-H + Cu^{+2} \longrightarrow R-\overset{O}{\overset{\|}{C}}-O^- + Cu_2Cl_2$$

Red ppt

This test is used to estimate the level of glucose in urine of diabetic patients.

### Benedict's Solution:

- Alkaline solution of cupric citrate is called benedict's solution.

→ It reacts in same way with aldehyde.

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# Q No: 4

Alkene undergoes following reactions:

i):- Electrophillic addition

ii):- Oxidation

iii):- Polymerization.

⇒ Electrophillic addition reactions are the most important i-e characteristic reactions of alkenes.

## a):- Hydrogenation:-

Addition of hydrogen to alkene is called hydrogenation.

**Reaction:-**

$CH_2 = CH_2 + H_2 \xrightarrow[Pt/Pd\cdot 25^oC]{Ni\,250^oC} CH_3 - CH_3$

**Importance:**

This reaction is used to convert vegetable oil into ghee in the presence of rany nickle.

Vegetable oil $+ H_2 \longrightarrow$ Vegetable Ghee.



gt is because the vegetable oil has;

①:- Unpleasant taste ②:- Raincidification occurs in it.

## 2):- Hydrohalogenation:-

The addition of halogen acid to alkene in presence of alkohlic KOH is called hydrohalogenation.

e.g

The addition of HCl to ethene gives ethylchloride.

$CH_2 = CH_2 + HCl \xrightarrow[60^o]{KOH} CH_3 - CH_2 - Cl$.

**In case of unsymmetrical alkenes markonikauff rule is followed:**

" According to this rule when unsymmetrical reagent is added to unsymmetrical alkene then the partial positive part is added to C having less hydrogen.

e.g

$CH_3 - CH = CH_2 + HCl$

→ $CH_3 - \underset{Cl}{CH} - CH_3$ (Major product)

→ $CH_3 - CH_2 - CH_2 - Cl$ (minor product)

→ gt is a regioselective reaction.

## 3):- Halogenation:-

. Addition of halogen to alkene to form vicinyl di halide is called halogenation.

e.g:-

$CH_2=CH_2 + Cl_2 \xrightarrow[CCl_4]{Br_2}$ $CH_2(Cl)-CH_2(Cl)$

Ethene. 1,2-dichloroethane.

⇒ Bromine water test is used to differentiate or detect alkene in a solution.

## 4):- Halohydration:

The addition of hypohalous acid to form halohydrin is called halohydration.

e.g

The addition of HOCl to ethene forms ethylene bromohydrin.

$CH_2=CH_2 + HOCl \xrightarrow[Aq]{Br_2}$ $CH_2(OH)-CH_2(Cl)$

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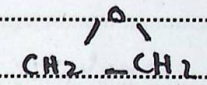
## 5):- Epoxidation:

The reaction in which epoxide is formed is called epoxidation.

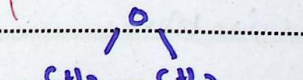
**Industrial method:-**

when ethene is reacted with per-oxyacetic acid, then ethylene epoxide is formed.

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

**Industrial method:-**

In industrial method the alkene is reacted with $AgNO_3$ to form epoxide.

$CH_2=CH_2 + AgNO_3 \xrightarrow{200^\circ C}$ 

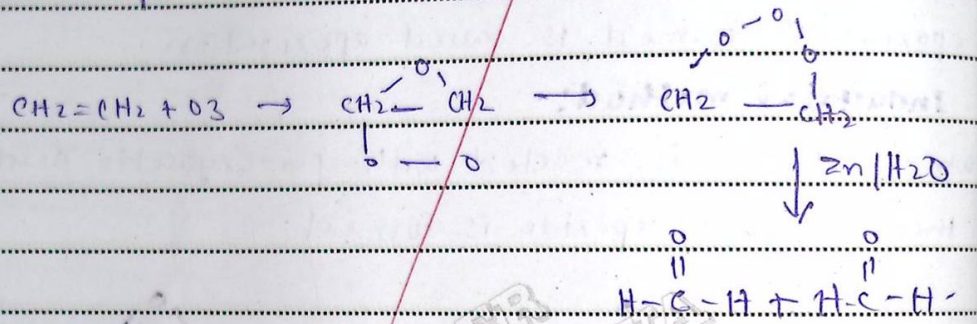
## Epoxide:-

Three member cyclic ether is called epoxide.

## Ozonolysis:

The conversion of alkene to carbonyl compounds in the presence of ozone is called ozonolysis.

For example:



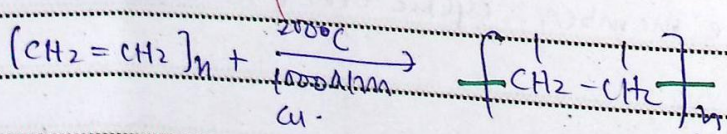
The ozonolysis of ethene form form-aldehyde.

## Polymerization:

The reaction in which monomers combine to form polymers is called polymerization.

E.g

When ethene polymerizes in presence of copper, it forms polythene.





Best quality polythene is produced in the form of ticly.