



Q. No. 2 (i)

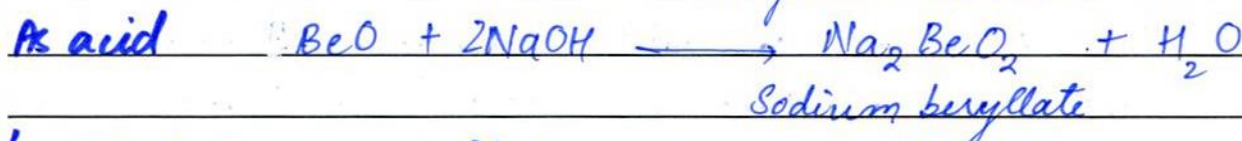
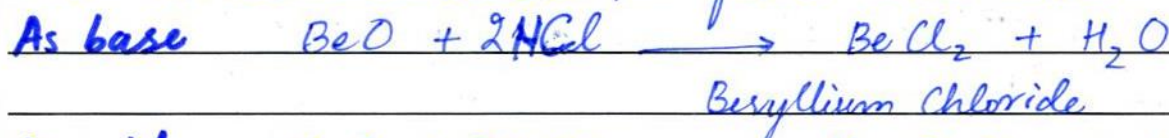
• NaCl has an ionic structure in which positive and negative ions are attracted by electrostatic forces. Conductivity is determined by presence of charge carriers. In solid state,  $\text{Na}^+$  and  $\text{Cl}^-$  ions are not free so there is no conduction. But in molten state, ions become free and they conduct electricity.



• In  $\text{AlCl}_3$ , there is partly ionic and partly covalent structure. In ionic state,  $\text{AlCl}_3$  is solid while it behaves as covalent when liquid. So, in solid state, there is no conduction as ions are not free while in liquid or molten state there is no conduction because ionic structure is lost and covalent bond is present.

Q. No. 2 (ii)

a.  $\text{BeO}$  is amphoteric as it behaves both as acid and a base. In acid behaviour, it behaves as covalent and in basic behaviour, it forms ionic bond.



b. It is because  $\text{Be}^{2+}$  ion is very small in size it has high electron density. It is polymeric in nature. Therefore, it is hard and has high melting point.



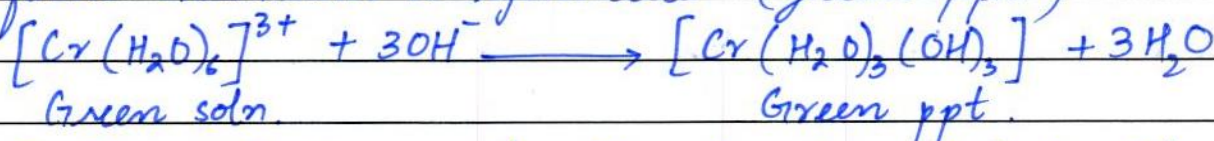
Q. No. 2 (iii) a.

It is due to inert pair effect. As we move down the group only  $np^2$  electrons take part in bond formation while  $ns^2$  electrons remain inert. So, +2 oxidation state becomes more stable as we move down in group. so  $Pb^{+2} > Pb^{+4}$  (stability) hence  $PbCl_2$  is more stable than  $PbCl_4$ .

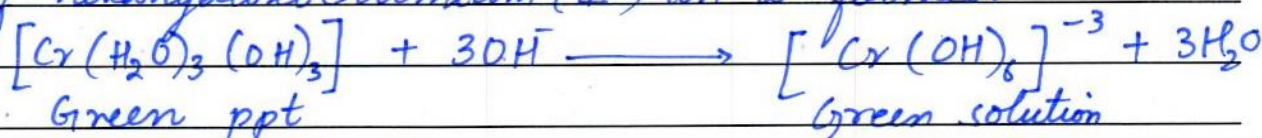
b. For hydrolysis, lone pair from water is accommodated in empty d-orbital. Carbon belongs to period 2 so it does not have d-orbital to accommodate lone pair from oxygen of  $H_2O$  to form unstable intermediate compound. All other elements Si, Ge, Sn have empty d-orbitals so they can undergo hydrolysis. Carbon can undergo hydrolysis in the presence of super-heated steam

Q. No. 2 (iv)

1-  $OH^-$  group from base like sodium hydroxide take hydrogen from water ligand of hexa aquachromium (III) ion to form chromium III hydroxide (green ppt)



2. Further  $OH^-$  ions react with chromium III hydroxide such that green ppt dissolves in solution and green solution of hexahydroxochromium (III) ion is formed.



3- Product reacts with hydrogen peroxide to form chromate



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Q. No. 2 (v)

Reaction between persulphate ion and iodide ion is:



If  $Fe^{+2}$  behaves as a catalyst reaction occurs as



$Fe^{+2}$  is oxidized to  $Fe^{+3}$  and it reduces  $S_2O_8$  to  $SO_4^{-2}$



$I^-$  is oxidized by  $Fe^{+3}$  which itself reduces to  $Fe^{+2}$  thus catalyst  $Fe^{+2}$  is regenerated at end of reaction. If second step is performed first,  $Fe^{+3}$  would be used as catalyst

Q. No. 2 (vi)

Functional group holds important position in organic chemistry because.

- i- They serve to classify organic compounds into classes. Organic compounds having same functional group are placed in the same series.
- ii- They serve as basis for nomenclature of organic compounds.
- iii- They are the site of chemical reactivity in a molecule.



06



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



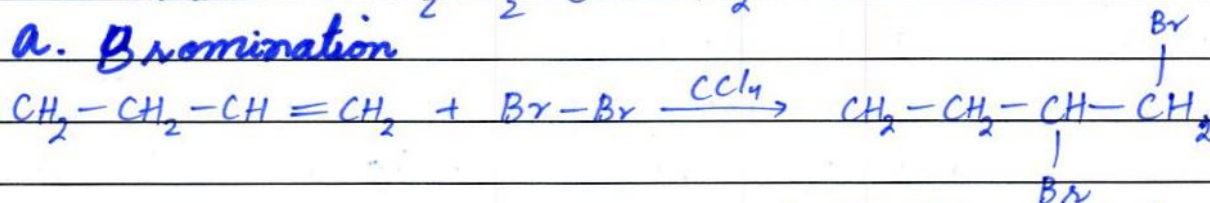
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Q. No. 2 (vii)

Q. No. 2 (viii)

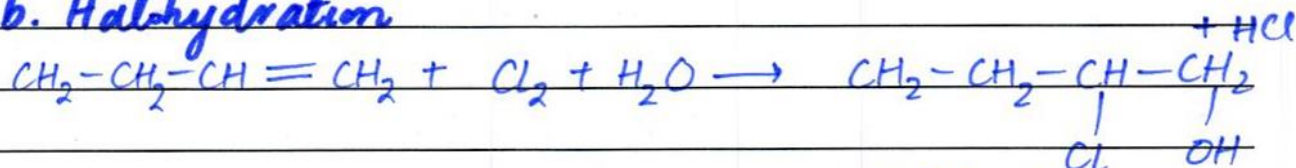
1-Butene  $\text{CH}_2-\text{CH}_2-\text{CH}=\text{CH}_2$ 

a. Bromination



1, 2-dibromobutane

b. Halohydrin



Halohydrin

(2-chloro-1-hydroxybutane)

c. Epoxidation



Q. No. 2 (ix)

The reactivity of halide ions as reducing agents is

$$F^- < Cl^- < Br^- < I^-$$

$I^-$  is most reactive while  $F^-$  is least reactive.

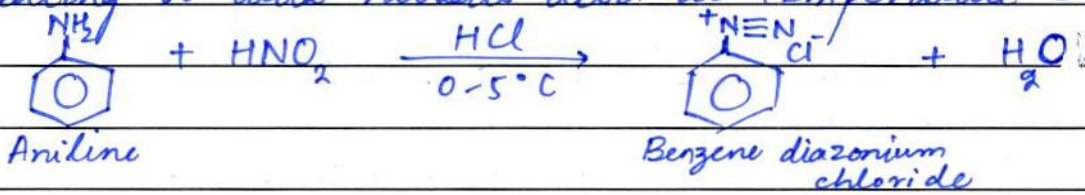
It is because as halide ions behave as reducing agents, it means they are themselves oxidized and reduce other substances. So, they need to lose their electrons. As  $I^-$  ion is greatest in size so valence electrons is at greater distance from nucleus resulting in greater shielding effect and less effective nuclear charge so  $e^-$  can be removed more easily as compared to others which have smaller size. So, they are easily oxidized. Therefore  $I^-$  ions are good reducing agents.

Q. No. 2 (x)

• Diazonium salts contain two nitrogen atoms joined together and one of them is attached to alkyl or aryl group.

like  $R-\overset{+}{N}\equiv N Cl^-$

• From aniline, we can prepare diazonium salts by treating it with nitrous acid at temperature  $0-5^\circ C$



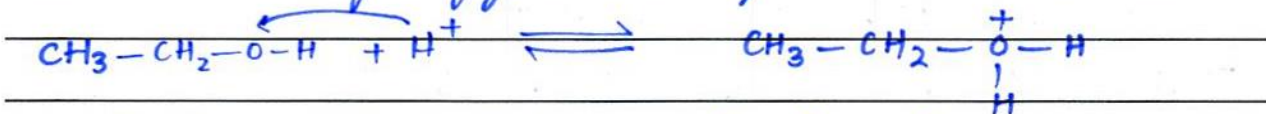
• If this salt is heated above  $10^\circ C$ , it decomposes to form nitrogen and phenol.

$$\begin{array}{c} \overset{+}{N}\equiv N \\ | \\ \text{C}_6\text{H}_5 \\ | \\ \text{Cl}^- \end{array} \xrightarrow{\text{heat}} \begin{array}{c} \text{OH} \\ | \\ \text{C}_6\text{H}_5 \end{array} + \text{N}_2 + \text{HCl}$$

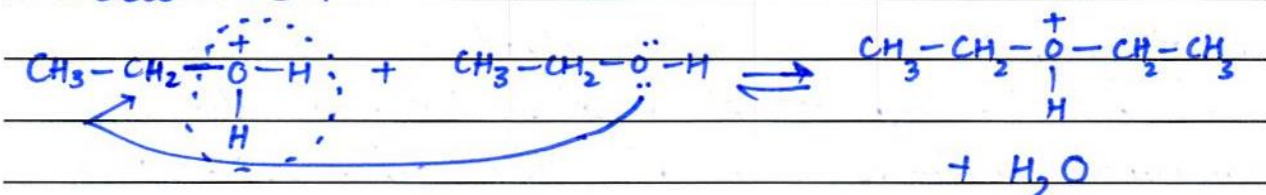
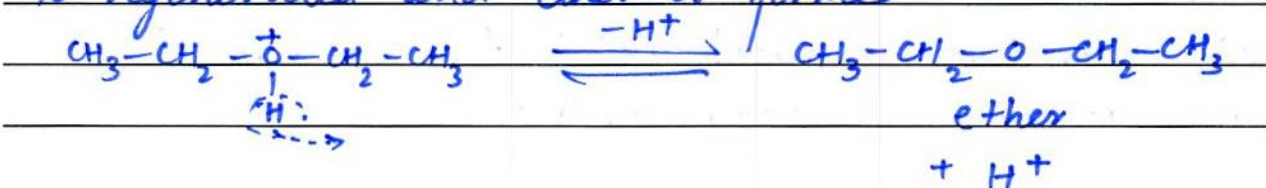


Q. No. 2 (xi)

1. Protonation of oxygen atom of one alcohol molecule

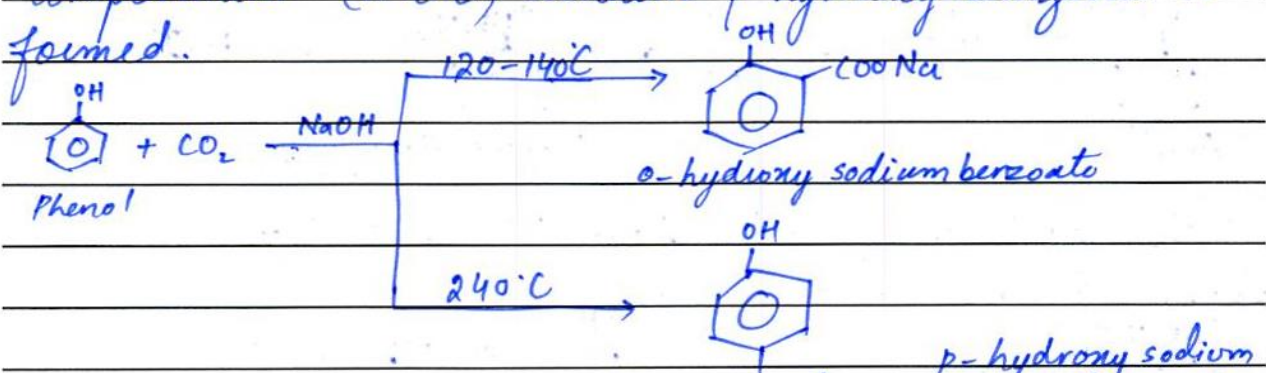


2. Attack of other alcohol molecule at oxonium ion behaving as nucleophile (alcohol) and water molecule leaves

3. Removal of H<sup>+</sup> proton such that acid catalyst is regenerated and ether is formed.

Q. No. 2 (xii)

Addition of CO<sub>2</sub> to phenol is called Kolbe-Schmitt reaction. When CO<sub>2</sub> is added to phenol in the presence of NaOH, at low temperature (120-140°C) sodium o-hydroxy benzoate (salicylic acid) is formed while at high temperature (240°C) sodium p-hydroxy benzoate is formed.





09



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Q. No. 2 (xiii)

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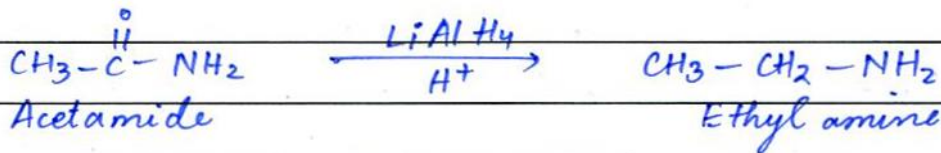
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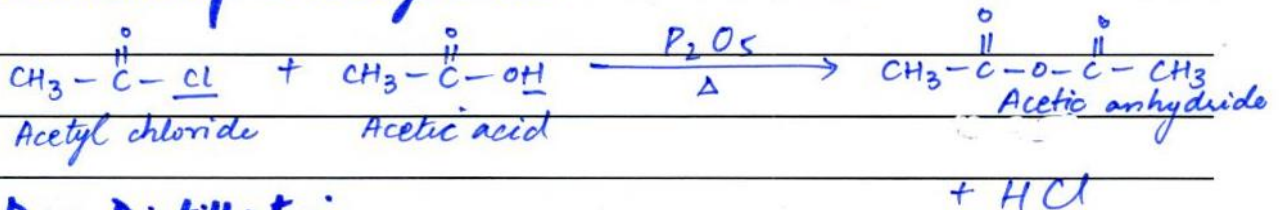
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Q. No. 2 (xiv)

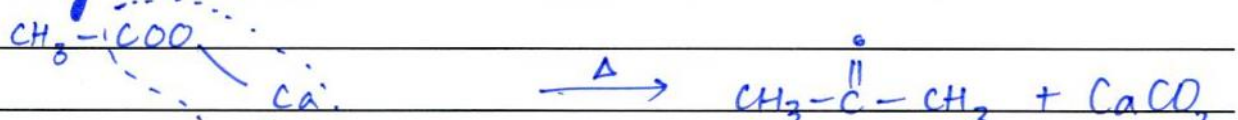
a. Reduction



b. Addition of Carboxylic acid



c. Dry Distillation









Q. No. 2 (xvii)

They can be classified as:

- i. **Olefins**: Olefins include ethylene, propylene and butadiene. Ethylene and propylene are important sources of industrial chemicals. Butadiene is used for making synthetic rubber.
- ii. **Aromatics**: These include benzene, toluene and xylene. At oil refineries, aromatic hydrocarbons are formed by catalytic reforming or similar processes.
- iii. **Synthetic gas**: Synthetic gas is a mixture of carbon monoxide and hydrogen which is used for making ammonia and methanol. Ammonia is used to make fertilizer urea while methanol is used as industrial solvent and chemical intermediate.



Q. No. 2 (xviii)

**Refining:** Refining process is the separation of crude oil mixture into various useful components (fractions)

**Fractional Distillation:** It is the process of separation of miscible liquids on the basis of difference in boiling points by evaporation and condensation.

**Principle:**

It is based on separation of mixture of liquids on the basis of difference of their boiling point. Liquids having higher boiling point and less volatile boil out first. Liquids having lower boiling point and more volatile boil out next. This process is continued until a residue is left behind. Vapours of each fraction are collected and condensed separately.



















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

**Space for diagram/rough work**



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

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Q. No. 4 (Page 1/6)

b.

## Enzyme Inhibition

The process by which enzyme activity is blocked by presence of a substance called inhibitor.

Inhibition of enzymes is of two types depending upon type of interaction formed between inhibitor and enzyme.

### Types :

#### i. Irreversible Inhibition

Enzyme is attached to inhibitor by strong covalent bond, so it is irreversible and stable.

#### ii. Reversible Inhibition

The type of inhibition in which activity of enzyme is restored is called reversible inhibition.

### Types of Reversible Inhibition

#### 1. Competitive Inhibition

It is the type of reversible inhibition in which inhibitor resembles in structure to normal substrate. Therefore, inhibitor competes with substrate for attaching to enzyme's active site. When inhibitor binds with enzyme it resists normal substrate from binding.

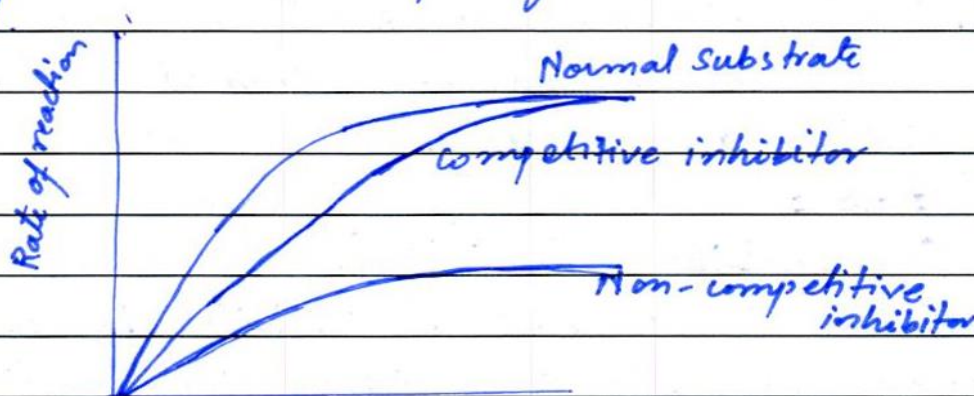
The effect of inhibitor can be overcome by increasing the substrate concentration.

#### 2. Non-competitive Inhibition



Q. No. 4 (Page 2/6)

active site of enzyme. This other binding site of enzyme is called allosteric site. When inhibitor binds of other binding site, it inhibits normal substrate from binding to active site because shape of active site is altered.



Q.

## Geometrical Isomerism

It arises due to restriction of rotation about a double bond.

Sigma bond can freely rotate about itself but pi-bond restrict rotation as a result two different isomers are formed.

Cis Isomer

It contains bulky groups on same side of double bond.

Trans Isomer

It contains bulky groups on opposite side of



Q. No. 4 (Page 3/6)

## Conditions

1. Double bond must be present (alkenes) or cyclic structure must be present (cycloalkanes)
2. Carbon atom of double bond must contain two different atoms or groups of atoms attached to it.

## Examples

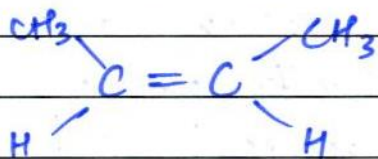
### i. In Alkenes

By example of 2-butene. There is double bond between two carbon atoms and each doubly bonded carbon atom contains one methyl group and one hydrogen.

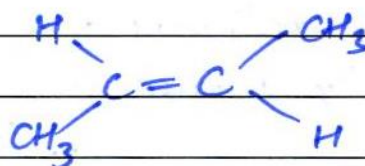


2-butene

Thus two isomers are possible



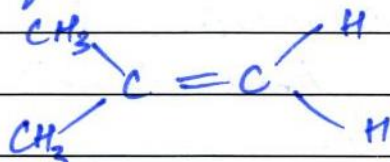
cis-2-butene



trans-2-butene

Trans isomer is more stable as compared to cis isomer due to reduced steric repulsions due to bulky groups.

If structure of alkene is





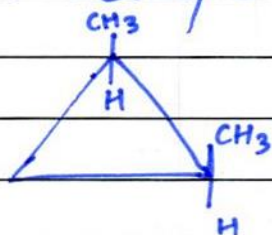
Q. No. 4 (Page 4/6)

to carbon atom.

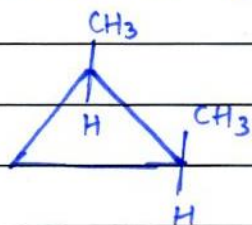
## ii. In cycloalkanes

If adjacent carbons in cycloalkanes contain two different attachments, they will exhibit geometrical isomerism.

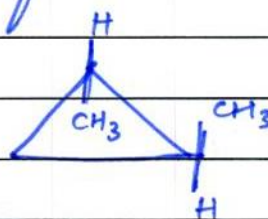
Consider the example of 1,2-dimethylcyclopropane



It exists in two isomeric forms

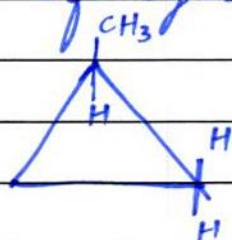


cis-1,2-dimethyl  
cyclopropane  
(bulky groups on same  
side)



trans-1,2-dimethyl  
cyclopropane  
(bulky groups on  
opposite sides)

If structure of cycloalkane is



Then no geometrical isomerism is possible because both carbon atoms do not contain different attachments.



Q. No. 4 (Page 5/6)

### Conversion of Isomers

Cis isomer can be converted to trans-isomer or vice versa by heating the isomer at high temperature. Heat of about 62 kcal/mol breaks the pi-bond so rotation about sigma bond is possible. These two isomers are again reformed when cooled.



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

**Space for diagram/rough work**



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

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Q. No. 5 (Page 1/6)

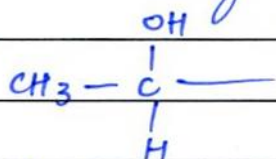
Q.

## Iodoform Test

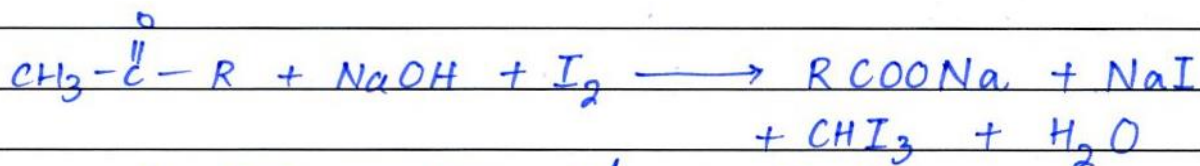
It is a reaction in which carbonyl compounds or alcohols on treatment with strong base and iodine form yellow ppt of iodoform  $\text{CHI}_3$ .

### Conditions

- It takes place in the presence of strong base like  $\text{NaOH}$ .
- For carbonyl compounds, the structure must contain acetyl group  $\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-$  to give this test.
- In alcohols, carbon attached to functional group must be bonded to one hydrogen atom and one methyl group



### General Reactions



Compound + Sodium Hydroxide + Iodine

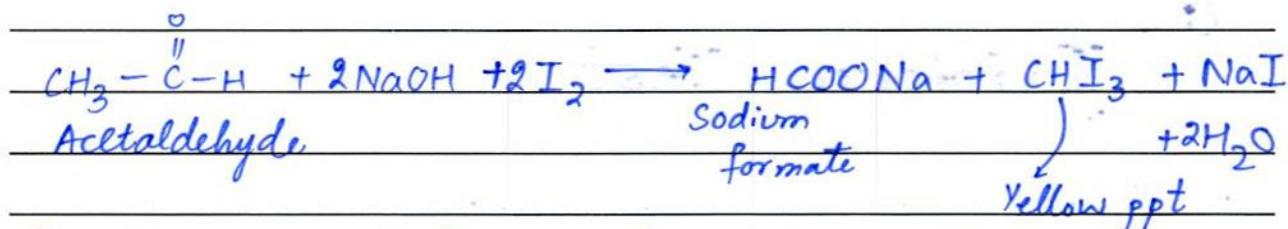
Sodium salt of + Sodium + Iodoform + Water.  
carboxylic acid Iodide (Yellow)

### Examples

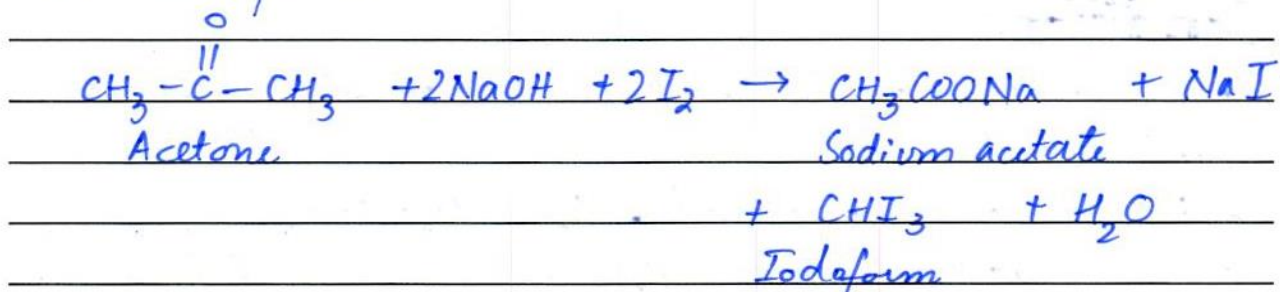
1. In case of aldehyde, only ethanal will



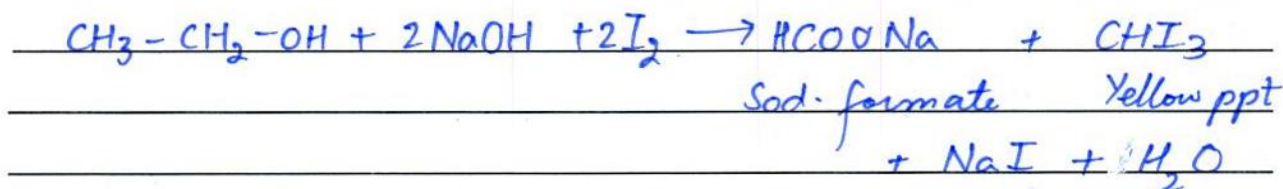
Q. No. 5 (Page 2/6)



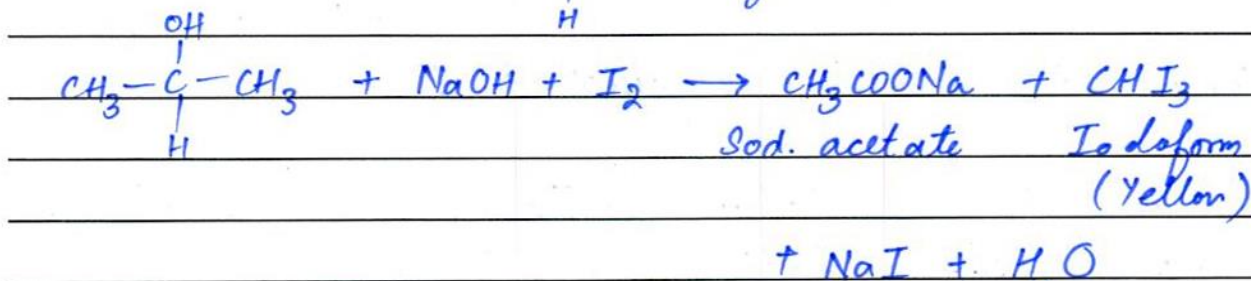
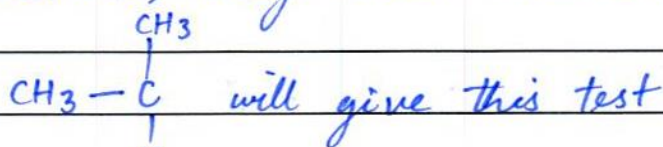
2. In case of ketones, only methyl ketones give this test positive.



3. In primary alcohols, only ethanol gives this test positive.



In secondary alcohols, only those alcohols starting from



Tertiary alcohols do not give this test positive.

### Applications



Q. No. 5 (Page 3/6)

2. Methyl ketones from rest of ketones.

3. Ethanol from methanol and other primary alcohols.

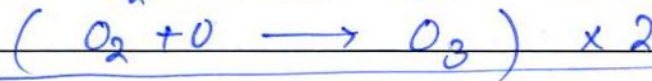
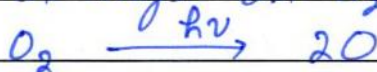
b.

### Ozone Hole

Ozone hole results from depletion of ozone layer found in stratosphere. Ozone is found in stratosphere at distance 25-30 km from earth's surface.

### Formation of ozone and its protective action

Ozone is formed during various combustion processes. It is also formed in stratosphere by action of UV rays on  $O_2$  molecules.



Concentration of ozone less than 0.1 ppm is not harmful. If concentration is greater, it may be harmful. Ozone helps to absorb UV radiations coming from sun towards earth, which would otherwise cause skin cancer and destroy organic molecules essential to life.

### Ozone Depletion

In 1980, scientists detected a hole in the ozone layer. Hole was found in the region of Antarctica.

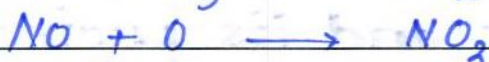


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## Causes

### 1. Oxides of Nitrogen

Major cause of ozone depletion is oxides of nitrogen. These act on ozone and destroy it and are themselves regenerated. About 70% of ozone depletion is due to these oxides of nitrogen. Greater are these oxides, greater will be ozone depletion.



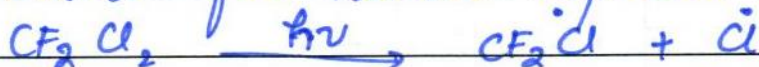
### 2. Nuclear Tests

Nuclear tests being carried throughout the world generate high temperature. At this high temperature,  $\text{N}_2$  and  $\text{O}_2$  in air are converted to oxides of nitrogen which deplete ozone layer.

### 3. Role of Chloro fluorocarbons (CFCs)

Chloro fluorocarbons are actually chloro fluoro alkanes like Freon-1 ( $\text{CFCl}_3$ ) and Freon-2 ( $\text{CF}_2\text{Cl}_2$ ). They are inert and do not react with other substances. Therefore, they are used widely, as refrigerants, fire fighting agents and cleaners for electronic components. When they reach the stratosphere, they are broken down by UV-rays to generate chlorine free radical.

Chlorine free radical depletes ozone as





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## Protective Action

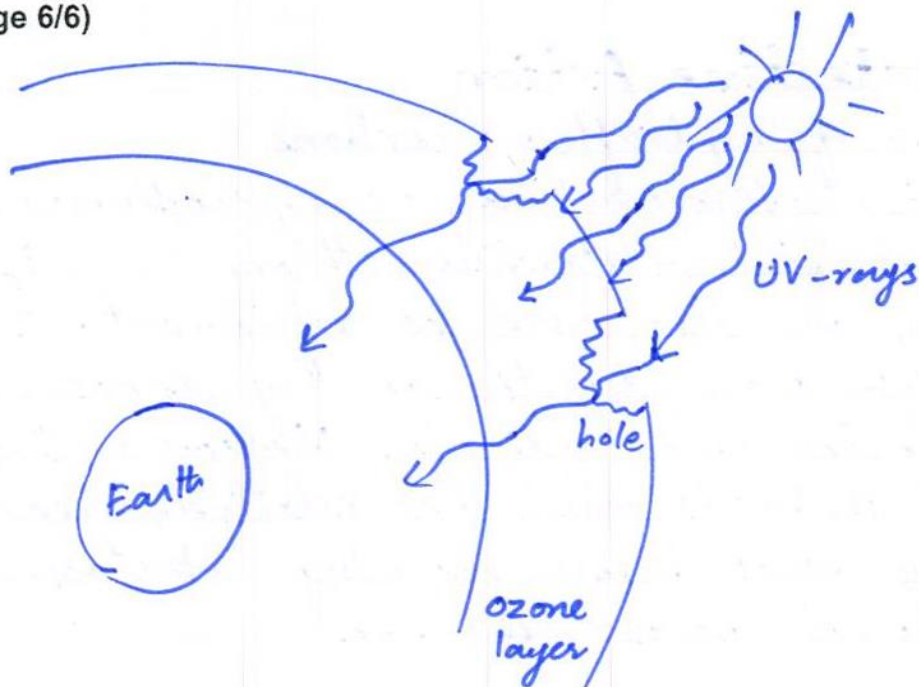
### Use of hydrofluorocarbons

Hydrofluorocarbons are hydrofluoroalkanes (HFAs) like 1,1,1,2-tetrafluoroethane ( $\text{CF}_3\text{CH}_2\text{F}$ ).

They are also used as refrigerant. They do not cause ozone depletion as they do not contain chlorine free radicals. Moreover they contain C-H bonds which are relatively reactive, so they break before reaching stratosphere and do not persist for long.



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Ozone Depletion

