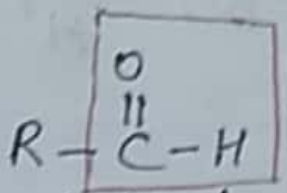
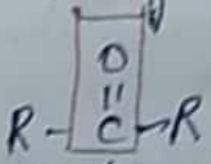
(1) Aldehydes and Ketones:

Both Aldehydes and Ketones contain a carbon-oxygen double bond ($\rangle C=O$). This unit is referred to as the Carbonyl group.

$\rangle C=O$ Carbonyl group.



Aldehyde

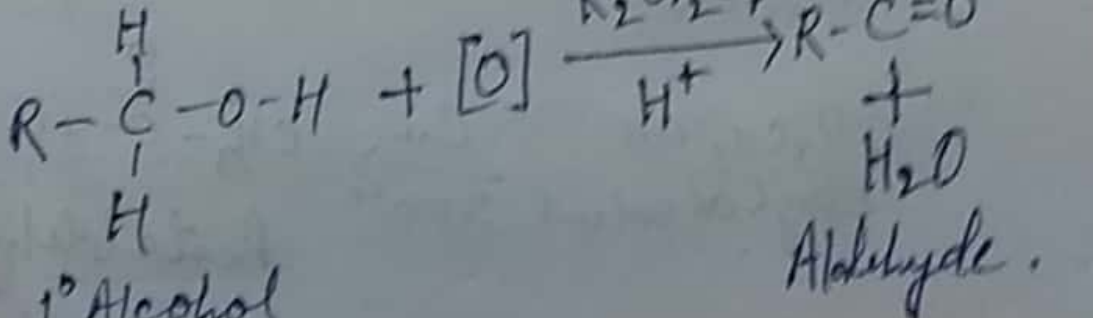


Ketone

Methods of Preparation:

Aldehydes and Ketones:

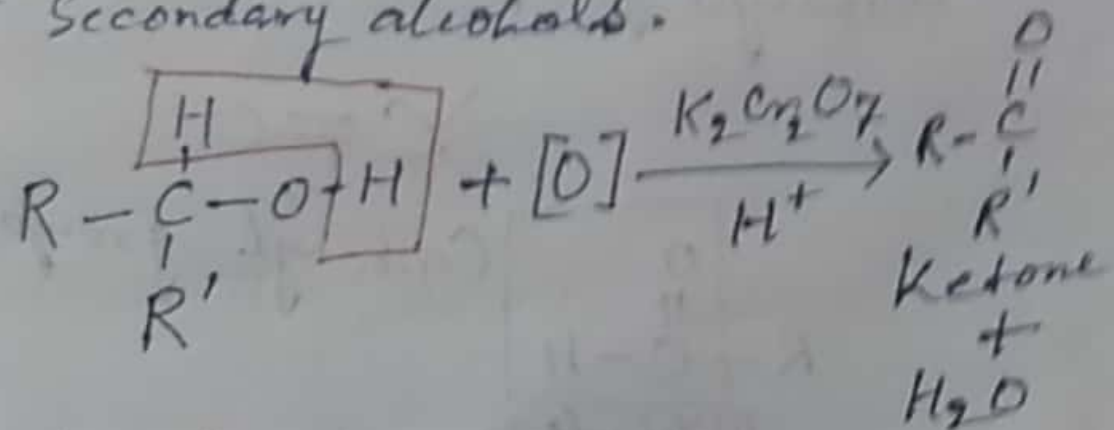
Oxidation of Alcohols: Aldehydes and ketones can be prepared by the controlled oxidation of primary and secondary alcohols using an acidified solution of potassium dichromate.



1° Alcohol

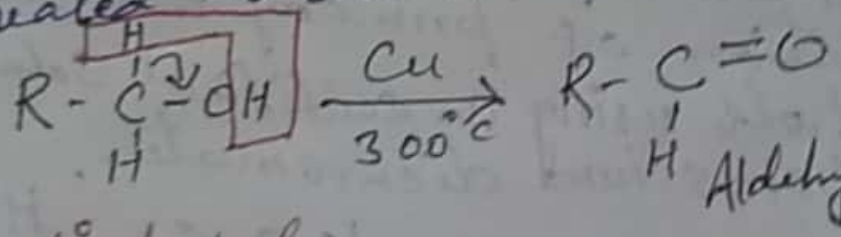
Aldehyde.

Ketones are prepared by the oxidation of Secondary alcohols.

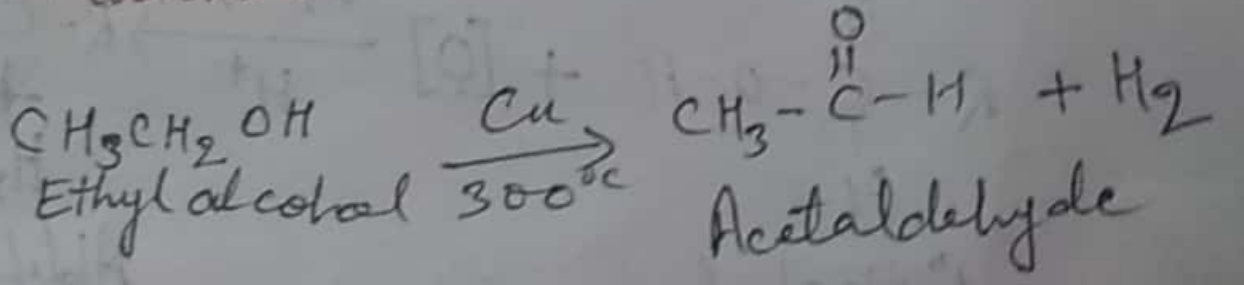


Catalytic Dehydrogenation of Alcohols.

Aldehydes may be prepared by passing the vapours of primary alcohols over a copper catalyst heated to about 300°C.



1° alcohol



Hydration of Alkynes:

$$CH \equiv CH + H-OH \xrightarrow[H_2SO_4]{HgSO_4} \underset{\text{(Unstable)}}{\overset{H}{\overset{|}{C}}=\overset{H}{\overset{|}{C}}-OH} \longrightarrow CH_3CHO$$

Acetylene — Acetaldehyde

Hydration of alkynes, otherthan acetylene, gives Ketones. Water adds according to the Markovnikov rule to give an unstable enol-intermediate. This intermediate rearranges to form Ketones.

$$CH_3C \equiv CH + H-OH \xrightarrow[H_2SO_4]{HgSO_4} \underset{\text{(Unstable)}}{CH_3-\overset{OH}{\overset{|}{C}}=CH_2} \longrightarrow CH_3-\overset{O}{\overset{\|}{C}}-CH_3$$

Propyne — Acetone

Wacker Process:

Both aldehydes and ketones can be prepared by this method. This process involves the treatment of an alkene with an acidified aqueous solution of Palladium Chloride and Cupric Chloride.

Wacker Process:

$$CH_2=CH_2 + PdCl_2 + H_2O \xrightarrow{CuCl_2} CH_3-\overset{H}{C}=O + Pd + 2HCl.$$

Ethylene — Acetaldehyde

The Cupric chloride promotes the second reaction, enhancing the reconversion of the palladium back into palladium chloride.

$$Pd + 2CuCl_2 \rightarrow PdCl_2 + 2CuCl$$

Acetone is prepared similarly from propene.

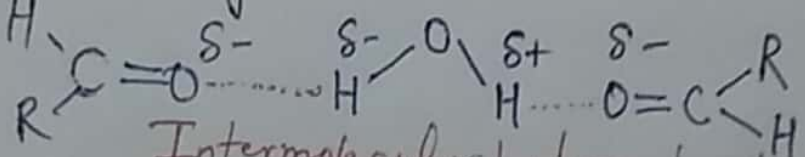
$$CH_3CH=CH_2 + PdCl_2 + H_2O \xrightarrow{CuCl_2} CH_3-\overset{O}{\overset{\|}{C}}-CH_3 + Pd + 2HCl$$

Propene

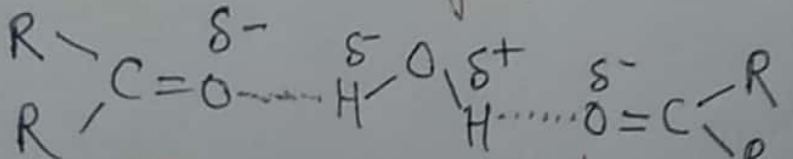
Physical Properties:

1. Formaldehyde ($HCHO$) is a gas at room temp. It boils at $-20^{\circ}C$.
2. Lower aldehydes posses rather unpleasant, pungent smells whereas the Ketones have pleasant, sweet odours.

3. Solubility in water: The lower aldehydes and Ketones are soluble in water because aldehydes and Ketones form hydrogen bonds with water, even though they are incapable of intermolecular hydrogen bonding with themselves.



Intermolecular hydrogen bonding between water and aldehydes.



Intermolecular hydrogen bonding between water and Ketones.