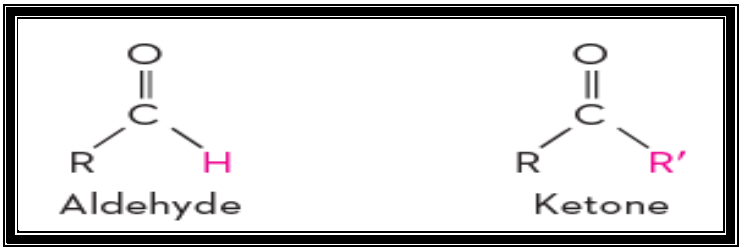
Lecture 4: Aldehydes & Ketones

The aldehydes and ketones are characterized by the presence of the carbonyl group



- The **carbonyl group** of an aldehyde or a ketone is polar because oxygen is more electronegative than carbon. This produces a dipole in which the oxygen carries a partial negative charge and the carbon carries a partial positive charge.
- Thus, the attractive forces between carbonyl-containing compounds include London dispersion forces between the hydrocarbon chains and dipole-dipole attractions between carbonyl groups.
- Because of the polar carbonyl cannot form hydrogen bonds with one another. As a result, they have higher boiling points than comparable hydrocarbons, but lower boiling points than comparable alcohols.

IUPAC Nomenclature and Common Names

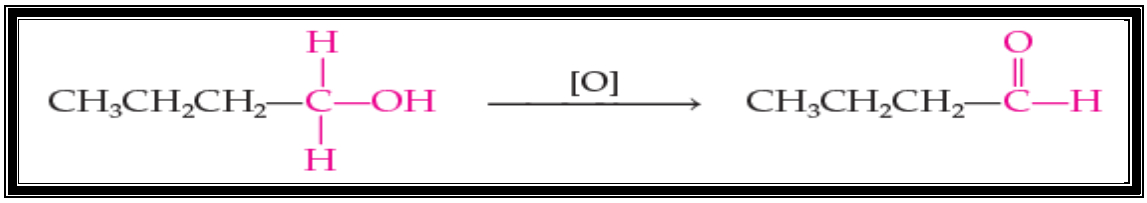
1- aldehydes are named by determining the parent compound and replacing the final -e of the parent alkane with -al.

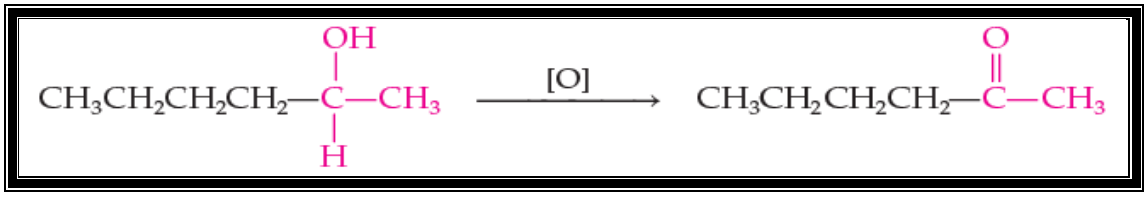
2- ketones are named by determining the parent compound and replacing the -e of the parent alkane with the -one suffix of the ketone family.

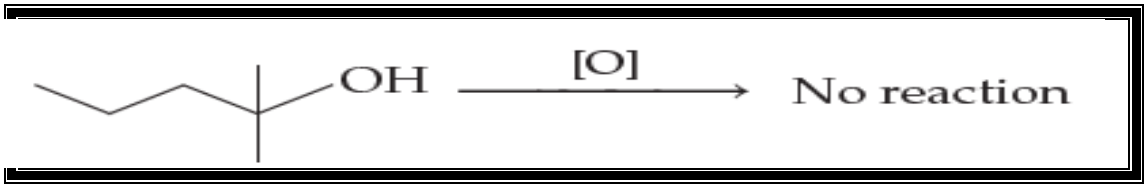
IUPAC Name	Common Name	Formula
Methanal	Formaldehyde	$H_2C{=}O$
Ethanal	Acetaldehyde	CH_3CHO
Propanal	Propionaldehyde	CH_3CH_2CHO
Butanal	Butyraldehyde	$CH_3CH_2CH_2CHO$
Pentanal	Valeraldehyde	$CH_3CH_2CH_2CH_2CHO$

Preparation of Aldehydes and Ketones

Aldehydes and ketones are prepared primarily by the oxidation of the corresponding alcohol. The oxidation of a primary alcohol produces an aldehyde, and the oxidation of a secondary alcohol yields a ketone. Tertiary alcohols do not undergo oxidation under the conditions normally used.



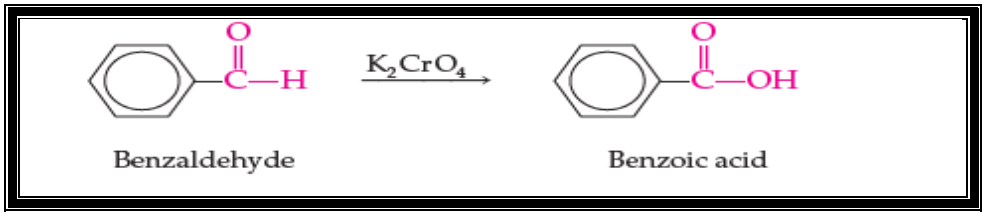




Reactions of aldehyde and ketone

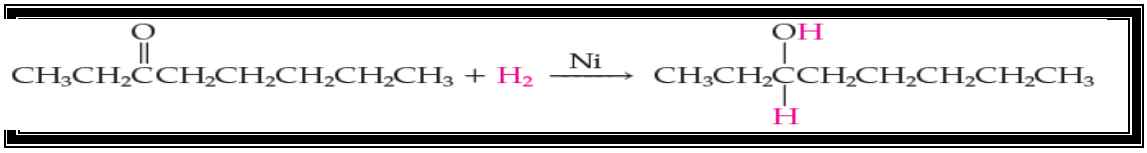
1. Oxidation Reactions

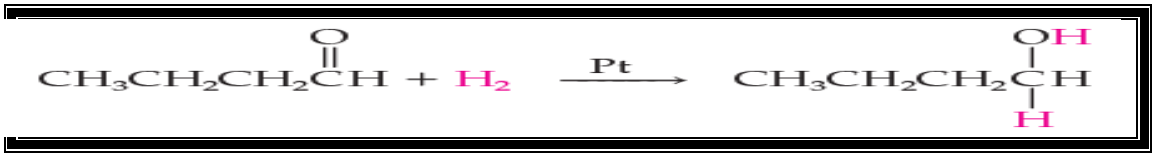
Aldehydes are oxidized to carboxylic acids, whereas ketones do not generally undergo further oxidation. The reason is that a carbon-hydrogen bond, present in the aldehyde but not in the ketone, is needed for the reaction to occur.



2. Reduction Reactions

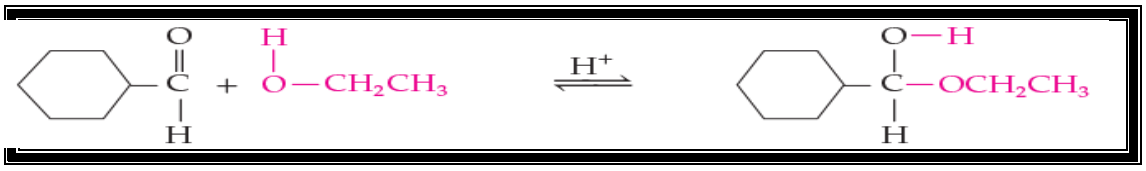
Aldehydes and ketones are both readily reduced to the corresponding alcohol by a variety of reducing agents. Throughout the text, the symbol [H] over the reaction arrow represents a reducing agent.





3. Addition reaction

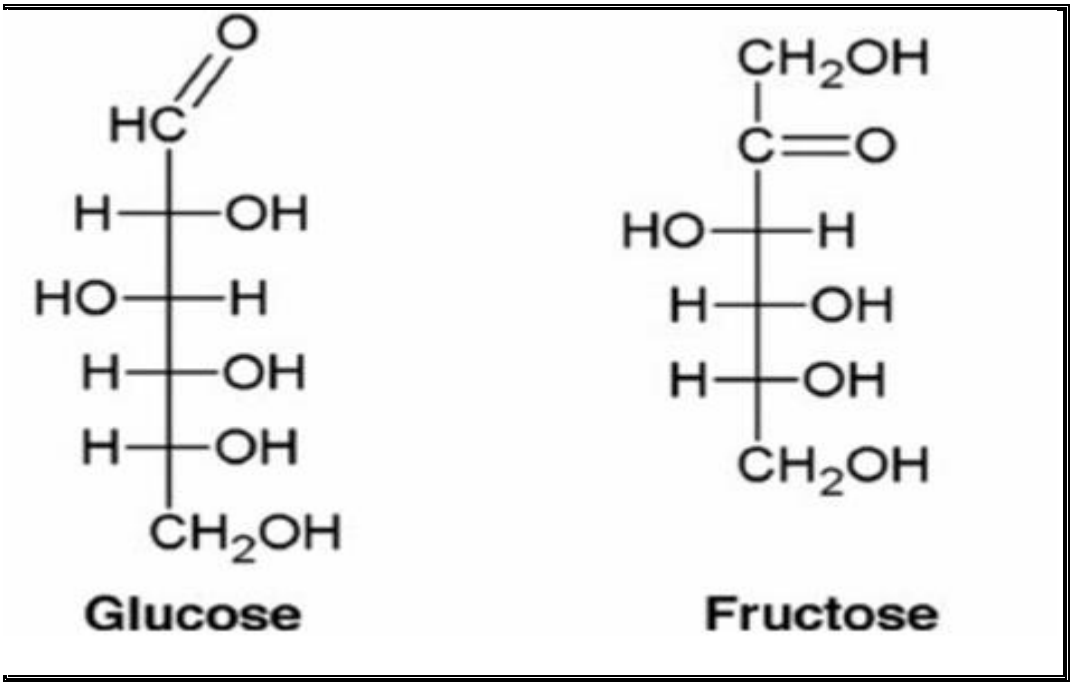
Addition reaction is the reaction of aldehydes and ketones with alcohols in the presence of catalytic amounts of acid.



2.1.5 Important Aldehydes and Ketones

Members of the aldehyde and ketone families are important as food and fragrance chemicals, and as medicinal and agricultural chemicals.

- Methanal (formaldehyde) is used to preserve tissue.
- Ethanal (acetaldehyde) is produced from ethanol in the liver. Ethanol is oxidized in this reaction, which is catalyzed by the liver enzyme alcohol dehydrogenase. The ethanal that is produced in this reaction is responsible for the symptoms of a hangover. As well as, it is oxidized to produce acetic acid commercially.
- Propanone (acetone) is a useful and versatile solvent for organic compounds. In human body An excess of acetone in the bloodstream is a common symptom of diabetes mellites (DM).
- Aldohexose is glucose, fructose is ketohexose respectively. Glucose is present in our blood, and gives rise to energy on oxidation. Aldopentose Ribose is constituent of nucleic acids monomer or nucleotides of DNA & RNA.



Structures of glucose and fructose