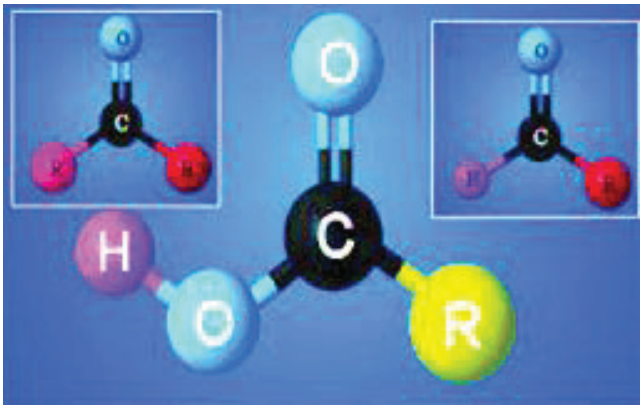
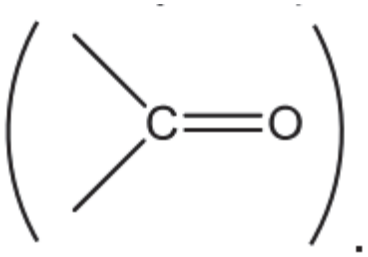
ALDEHYDES, KETONES AND CARBOXYLIC ACIDS



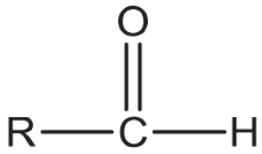
ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

Introduction

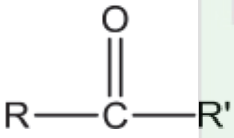
- Carbonyl compounds are organic compounds containing carbon-oxygen double bond



- Aldehydes have carbonyl group bonded to a carbon and hydrogen.

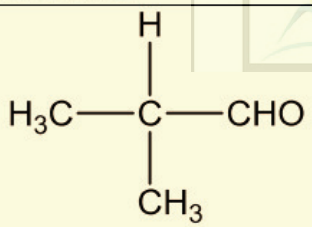
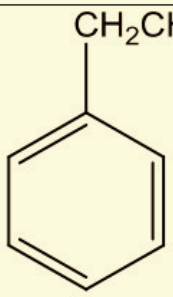

(Where R = H or alkyl or aryl group)

- Ketones have carbonyl group bonded to two carbon atoms.O

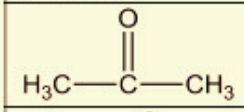
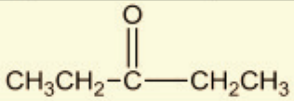
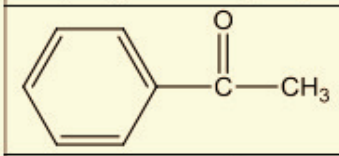
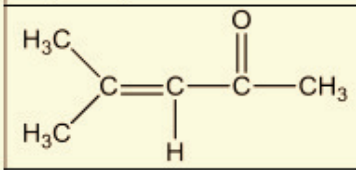
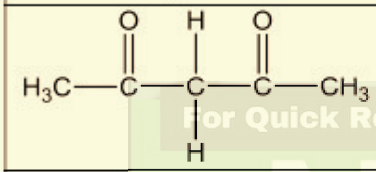
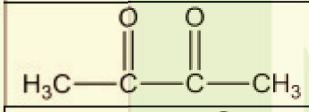
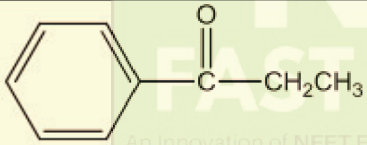

(Where R and R′ may be same or different alkyl or aryl groups)

Nomenclature of Aldehydes and Ketones

Aldehydes

Structure	Common name	IUPAC name
CH_3CHO	Acetaldehyde	Ethanal
	Isobutyraldehyde	2-Methylpropanal
$H_2C{=}CHCHO$	Acrolein	Prop-2-enal
	Phenylacetaldehyde	2-Phenylethanal
$CH_3CH{=}CHCHO$	Crotonaldehyde	But-2-en-al

Ketones

Structure	Common name	IUPAC name
	Dimethyl ketone or Acetone	Propanone
	Diethyl ketone	Pentan-3-one
	Methyl phenyl ketone	1-Phenylethan-1-one
	Mesityl oxide	4-Methylpent-3-en-one
	Acetylacetone	Pentane-2,4-dione
	Biacetyl	Butane-2,3-dione
	Ethyl phenyl ketone	1-Phenylpropan-1-one

Structure and Nature of Carbonyl Group

Structure

- The carbonyl carbon group is sp^2 hybridised and forms three sigma bonds.
- The fourth electron in the p-orbital forms a n-bond by overlapping with p-orbital of oxygen.
- The oxygen atom also has two non-bonding electron pairs.
- So the carbonyl carbon with the three atoms linked to it lies in the same plane and the n-cloud liesabove and below the plane.
- The bond angle is 120° with expected trigonal coplanar structure.
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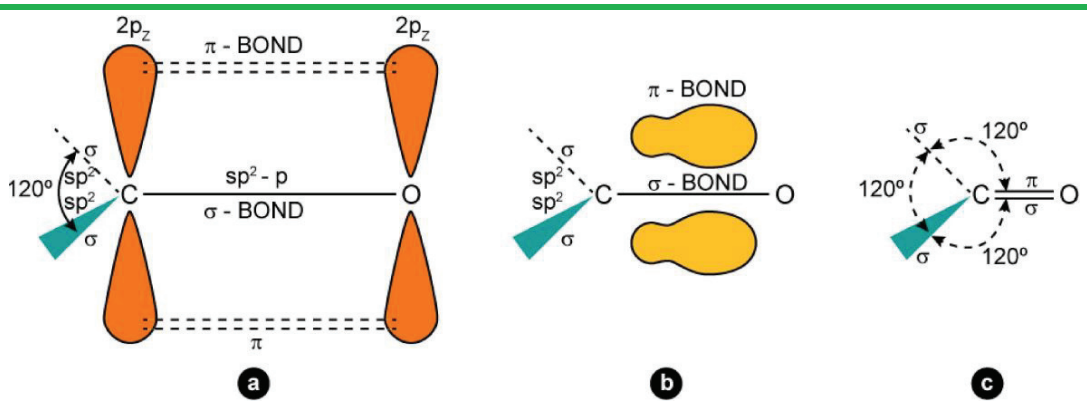
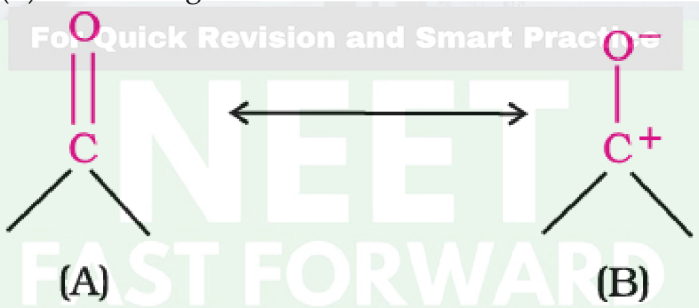


Nature

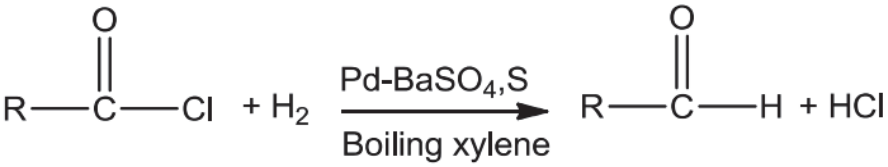
- The C-O double bond is polarised since oxygen is electronegative than carbon.
- So the carbonyl carbon is an electrophilic centre and the carbonyl oxygen is a nucleophilic centre.
- The carbonyl compounds have substantial dipole moments and are polar than ethers.
- The high polarity of the carbonyl group can be explained on the basis of resonance involving a neutral
  (A) and a dipolar (B) structures given below.



Preparation of Aldehydes

➢ Rosenmund Reduction

In this reaction, acyl chloride on hydrogenation in the presence of palladium catalyst and bariumsulphate gives aldehydes.



➢ Stephen Reaction

Nitriles on reduction with stannous chloride in the presence of HCI give imine which on hydrolysisgives corresponding aldehyde.

An alternate method to reduce nitriles selectively is by diisobutylaluminium hydride to imines which onhydrolysis yields aldehydes.

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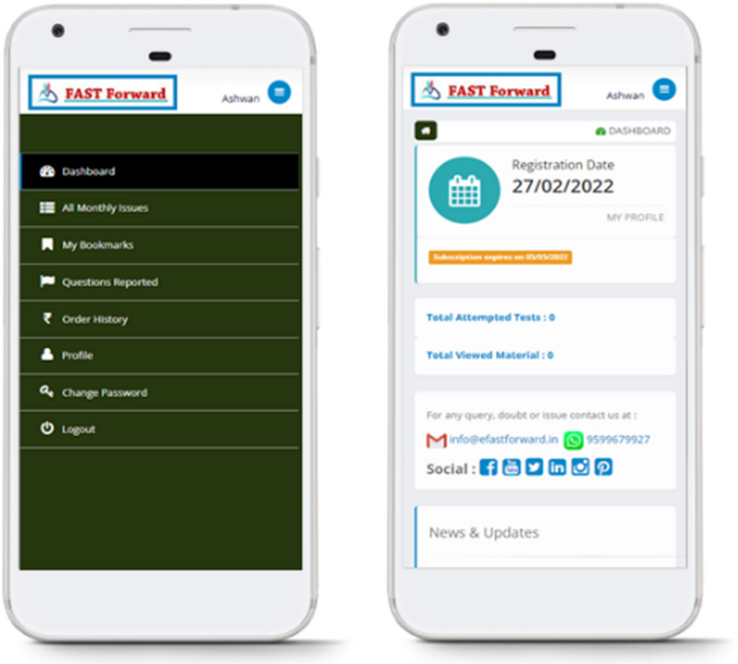

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