ALDEHYDES, KETONES AND CARRBOXYLIC ACIDS

NOMENCLATURE AND STRUCTURE OF CARBONYL GROUP

INTRODUCTION

Organic Compounds having $>C=O$ group are called carbonyl compounds and $>C=O$ group is known as carbonyl or oxo group. It's general formula is $C_n H_{2n}O$ ($n = 1, 2, 3.....$) Carbonyl compounds are grouped into two categories.

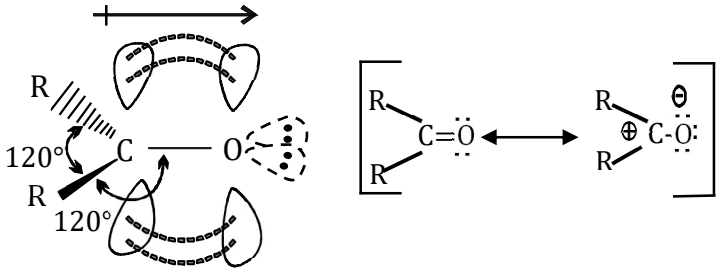
(a) **Aldehydes:** Aldehyde group is $-\overset{\overset{O}{\|}}{C}-H$ (also known as formyl group). It is a monovalent group

(b) **Ketones:** The carbonyl group ($>C=O$) is a Ketonic group when it's both the valencies are satisfied by alkyl group. It is a bivalent group.

STRUCTURE AND BONDING IN ALDEHYDES AND KETONES

The carbonyl carbon atom displays sp^2 hybridization. The unhybridized p-orbital of carbon forms a pi bond through overlap with a p-orbital of oxygen. This results in a double bond between carbon and oxygen, which is characterized by being shorter, stronger, and polar in nature.

Orbital diagram for the formation of carbonyl group is as follows

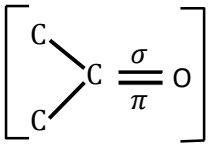


The presence of polarity indicates that nucleophilic addition reactions occur in carbonyl compounds.

The carbonyl group's double bond possesses a significant dipole moment due to the higher electronegativity of oxygen compared to carbon.

Carbonyl carbon act as an electrophile **(Lewis's acid)**

Carbonyl oxygen act as a nucleophile **(Lewis's base)**



The C—C—O and H—C—O bond angles are of 120°.

Due to electro-negativity difference in C & O atoms, the $\rangle C=O$ group is polar.

$$\overset{+\delta}{\rangle C}=\overset{-\delta}{O}$$

Hence aldehydes and Ketones possess dipole moment.

Ketones are further classified as

(i) **Simple or Symmetrical ketones**: Having two similar alkyl groups. $\begin{matrix} R \\ R \end{matrix}\rangle C=O$

(ii) **Mixed or unsymmetrical ketones**: Having two different alkyl groups. $\begin{matrix} R \\ R \end{matrix}\rangle C=O$

Ex: **(Ketones)** **Symmetrical** **Unsymmetrical**

$\begin{matrix} CH_3 \\ CH_3 \end{matrix}\rangle C=O$ $\begin{matrix} CH_3\,CH_2 \\ CH_3 \end{matrix}\rangle C=O$

(Acetone or Dimethyl ketone) (Ethyl methyl ketone)

2–Propanone 2–Butanone