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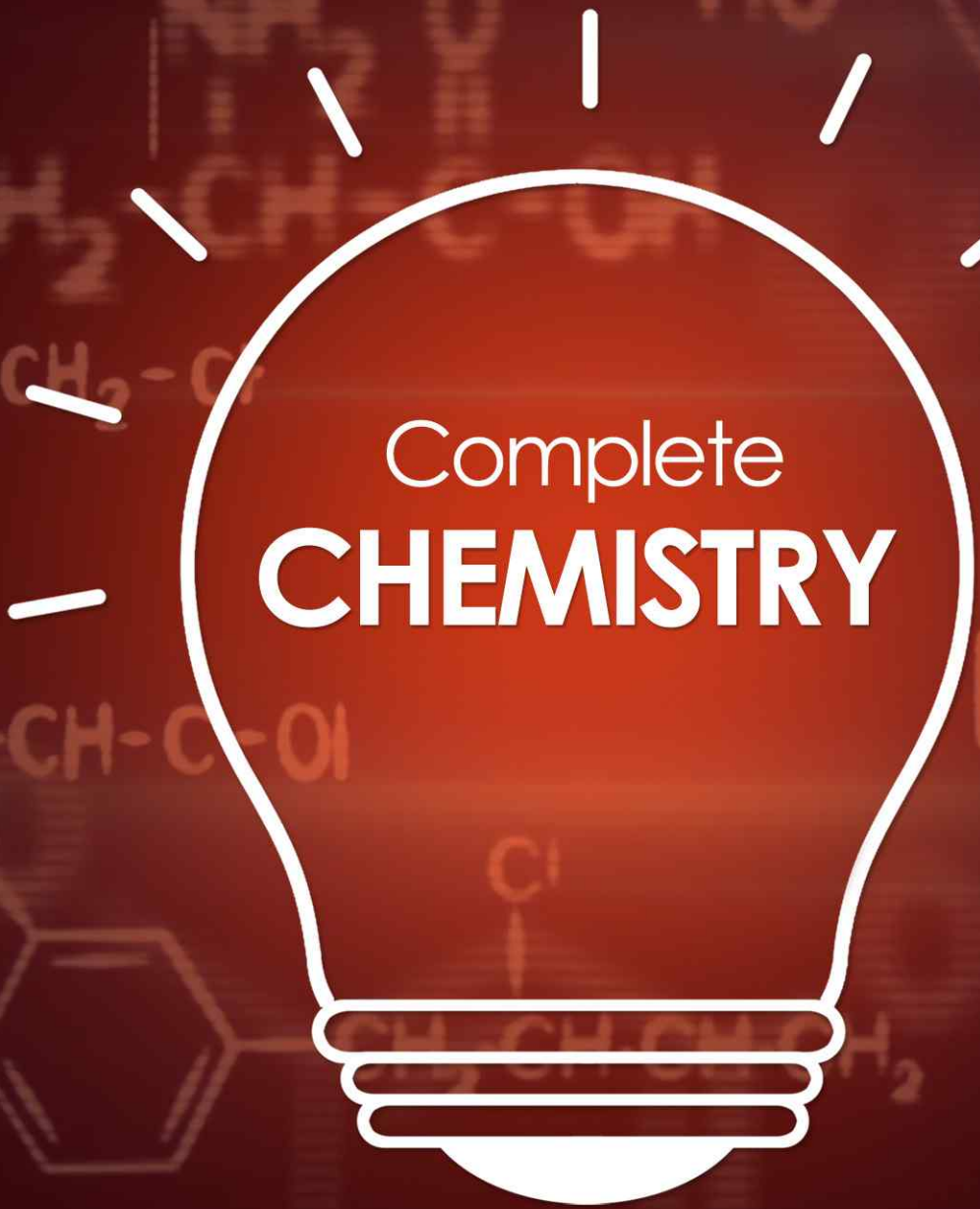

Complete CHEMISTRY

IIT-JEE · NEET · CBSE eBOOKS

CLASS 11&12th

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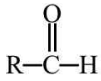
CLASS 12th

Carbonyl Compounds

01. Aldehydes and Ketones

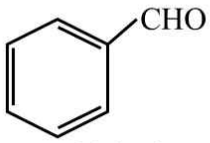
Compounds with general formula  are called aldehydes while compounds with general formula  are called ketones.

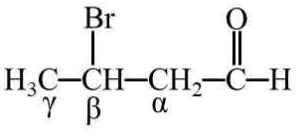
- **Nomenclature**

(a) **Common names :** Aldehydes on oxidation gives carboxylic acids with same number of carbon atoms. The common names of most aldehydes are derived from the common names of the corresponding carboxylic acids by replacing the ending –ic of acid with aldehyde. At the same time, the names reflect the Latin or Greek term for the original source of the acid or aldehyde. The location of the substituent in the carbon chain is indicated by Greek letters α, β, γ, δ etc. The α-carbon being the one directly linked to the aldehyde group, β-carbon the next, and so on. For example;

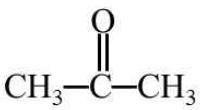
HCHO
Formaldehyde

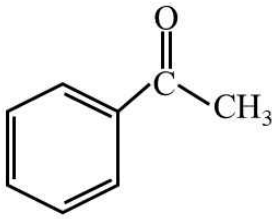
CH_3CHO
Acetaldehyde

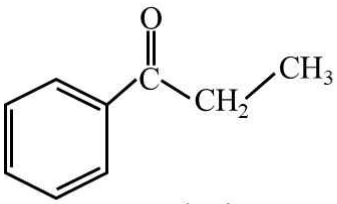

Benzaldehyde

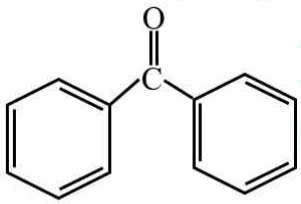

β-Bromobutyraldehyde

The common names of ketones are derived by naming two alkyl or aryl groups bonded to the carbonyl group. The locations of substituents are indicated by Greek letters, α α ' , β β ' and so on beginning with the carbon atoms next to the carbonyl group, indicated as α α ' . Some ketones have historical common names, e.g., dimethyl ketone is called acetone. Alkyl phenyl ketones are usually named by adding the acyl group as prefix to phenone. For example;


Acetone


Acetophenone


Propiophenone

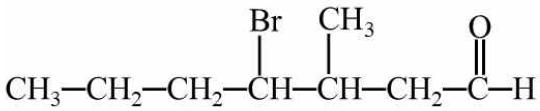

Benzophenone

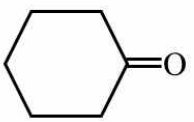
(b) **IUPAC names**

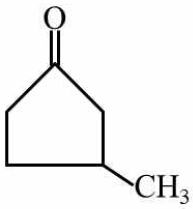
The IUPAC names of open chain aliphatic aldehydes and ketones are derived from the names of the corresponding alkanes by replacing the ending *–e* with *–al* and *–one* respectively. In case of aldehydes, the longest carbon chain is numbered starting from the carbon of the aldehyde group while in case of ketones the numbering begins from the end nearer to the carbonyl group. The substituents are prefixed in alphabetical order along with numerals indicating their positions in the carbon chain. The same applies to cyclic ketones, where the carbonyl carbon is numbered one. When the aldehyde group is attached to a ring, the suffix carbaldehyde is added after the full name of the cycloalkane. The numbering of the ring carbon atoms start from the carbon atom attached to the aldehyde group. The name of the simplest aromatic aldehyde carrying the aldehyde group on a benzene ring is benzaldehyde is also accepted by IUPAC. Other aromatic aldehydes are hence named as substituted benzaldehydes.

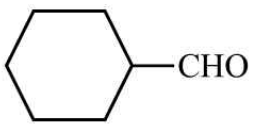

Methanal

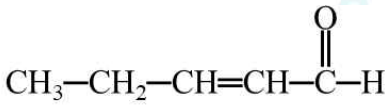
Ethanal

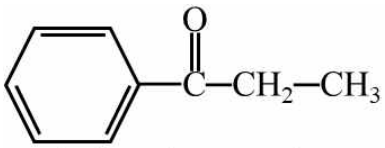

4-Bromo-3-methylheptanal

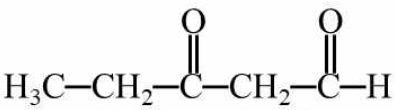

Cyclohexanone

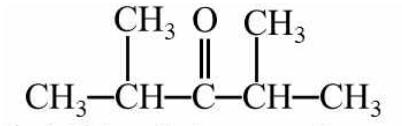

3-Methylcyclopentanone


Cyclohexanecarbaldehyde


Pent-2-emal

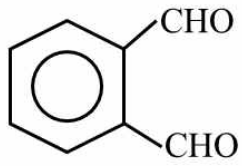

1-Phenylpropan-1-one


3-Oxopentanal

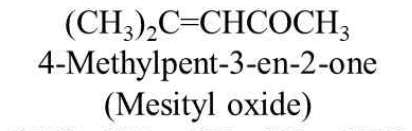


2, 4-Dimethylpentan-3-one

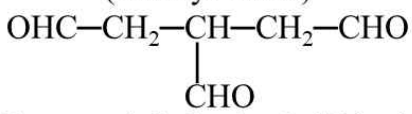
4-Nitrobenzenecarbaldehyde
or
4-Nitrobenzaldehyde



Benzene-1,2-dicarbaldehyde
(Phthaldehyde)



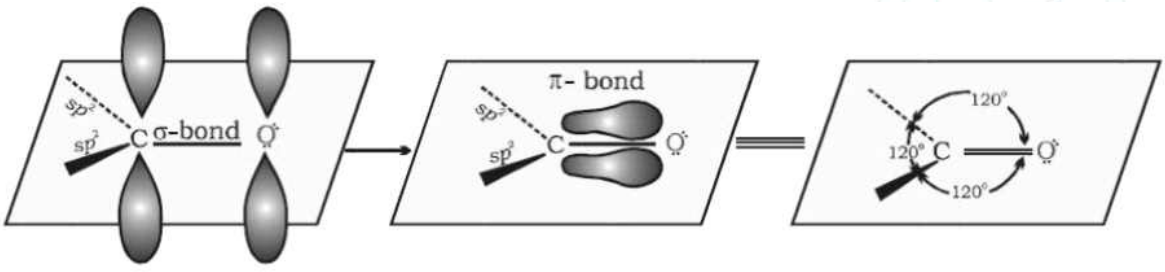
4-Methylpent-3-en-2-one
(Mesityl oxide)



Propane-1,2, 3-tricarbaldehyde

- **Structure of Carbonyl Group**

The carbonyl carbon atom is sp^2-hybridised and forms three sigma (σ) bonds. The fourth valence electron of carbon remains in its *p*-orbital and forms a π-bond with oxygen by overlap with p-orbital of an oxygen. In addition, the oxygen atom also has two non-bonding electron pairs. Thus, the carbonyl carbon and the three atoms attached to it lie in the same plane and the π-electron cloud is above and below this plane. The bond angles are approximately 120° as expected of a trigonal coplanar structure.



Orbital diagram for the formation of carbonyl group