1.5: ALDEHYDES AND KETONES

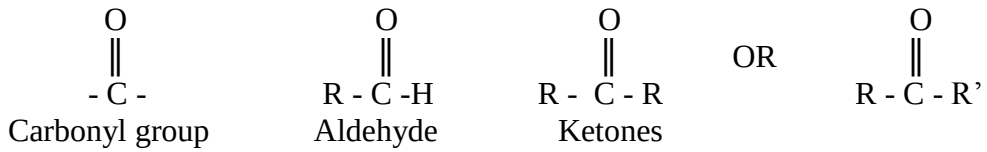
Aldehydes: organic compounds characterized by terminal carbonyl functional group bonded to at least an hydrogen atom.

Ketones: organic compounds characterized by the presence of a carbonyl group bonded to two atoms

Carbonyl Group: A functional group containing a carbon atom joined with a double covalent bond to an oxygen atom(a characteristics of many scents and flavors)

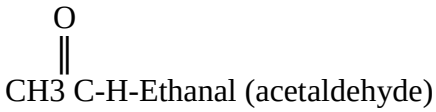
C = O

The position of the carbonyl group distinguishes aldehydes from ketones and also affects their chemical reactivity.



NAMING ALDEHYDES AND KETONES

Take parent alkane name, drop the -e and add the suffix -al e.g., HCHO - Methanal or (formaldehyde)



Ketones

Ketones are named by replacing the -e ending of the name of a corresponding alkane with -One.

Example CH_3-CO-CH_3 (Propanone) the simplest ketone in the family. It is also called Acetone.

In ketones, if the carbon chain contains five atoms or more, numbering is necessary to specify the location of the carbonyl group. Example, 2-pentanone and 3-Pentanone

2-Pentanone 3-Pentanone

Try These:

Write the IUPAC name and structure of the following

1. $CH_3CH_2CH_2-\overset{\overset{O}{\|}}{C}-H$

2. 3-Hexanone

3. Draw structural diagrams and write IUPAC names for aldehyde and ketone, each containing three C atoms.

4. Practice Exercise P.41#1-2; P. 42 #1-2

Properties of Aldehydes and Ketones

They have lower boiling points than analogous alcohol (see table 1 p. 51) and are less soluble in water than alcohols.

This is because they do not have -OH and so do not participate in hydrogen bonding. The carbonyl group is polar enough to make them more soluble than their corresponding hydrocarbons. So they mix with both polar and nonpolar solvents.

Practice: p.44 #1-5

REACTIONS Involving Aldehyde & Ketones

a. Oxidation

Aldehydes and ketones can be prepared by the controlled oxidation of alcohol.

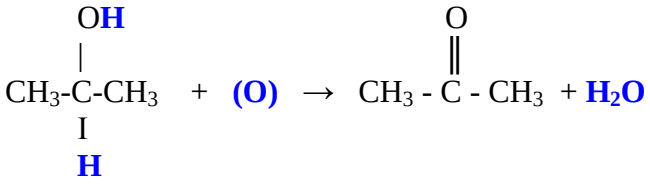
Example:

$$R - OH + (O) \rightarrow R - \overset{\overset{O}{\|}}{C} - H \qquad OR \qquad R - C - R + H_2O$$

When a primary alcohol is oxidized, an H atom remains on the C atom, and an aldehyde is produced.

$$\begin{array}{l} \quad \mathbf{H} \\ \quad | \\ \text{H-C-O-}\mathbf{H} \\ \quad | \\ \quad \text{H} \end{array} \quad + \mathbf{(O)} \quad \rightarrow \begin{array}{l} \quad O \\ \quad \| \\ \text{H-C-H} \end{array} + \mathbf{H_2O}$$

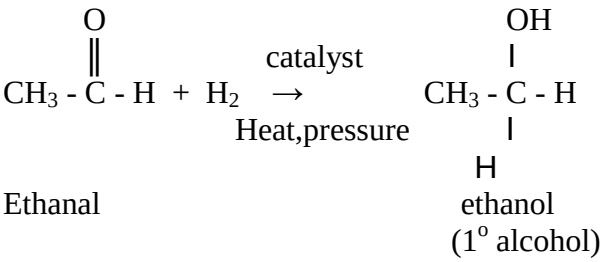
When a secondary alcohol is oxidized, the carbonyl group formed is necessarily attached to two alkyl groups, forming a ketone

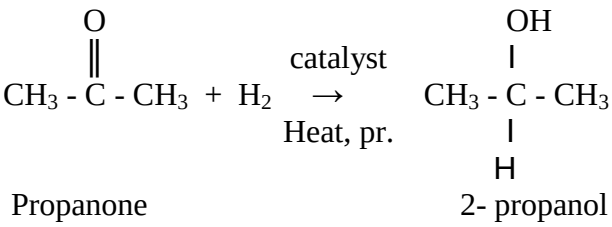


Tertiary alcohols do not undergo this type of oxidation since there is no H atom on the central C atom.

b. **Hydrogenation Reactions**

This type of reaction results in the formation of alcohols. It is the reversal of oxidation reaction. For example, ethanal forms ethanol and propanone forms 2- propanal





Practice p. 45# 1-3