Ch(10) : Aldehydes and ketones

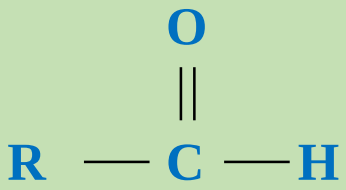
$C_nH_{2n}O$

I-Introduction

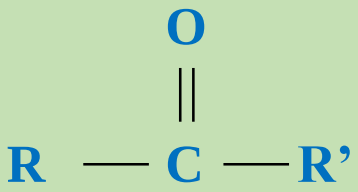
Aldehydes and ketones are organic compounds having the same general molecular formula and they are characterized by the carbonyl group (C=O).

Aldehydes and ketones having the same molecular formula are positional isomers that differ by the position of the carbonyl group in the molecule

Aldehydes (R-CHO)

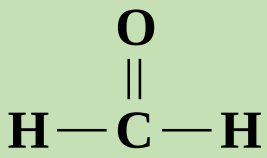


Ketones (R-CO-R')

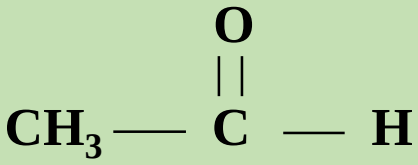


II- IUPAC names of aldehydes and ketones

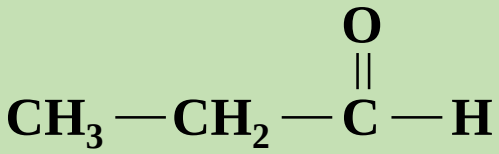
Aldehydes



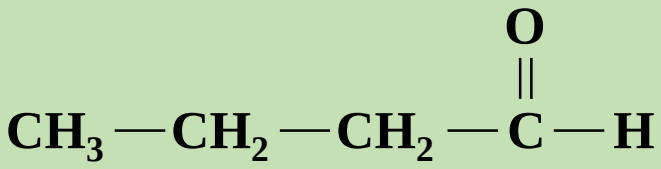
Methanal



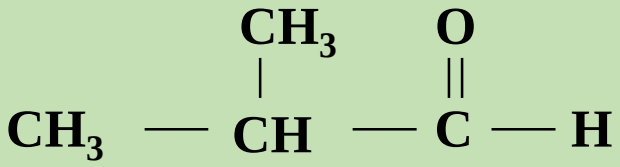
Ethanal



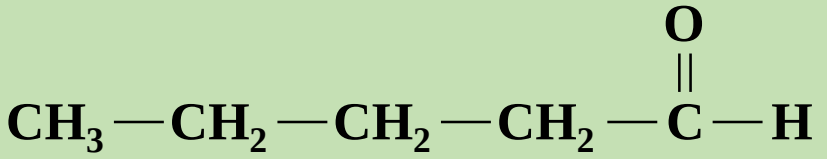
Propanal



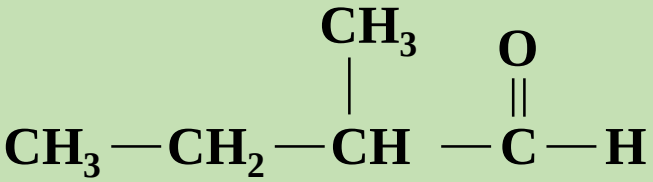
Butanal



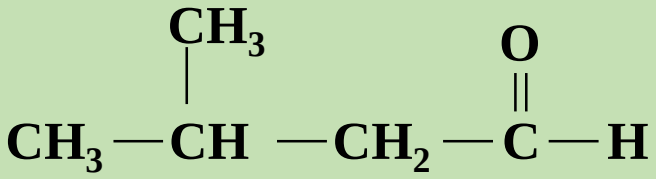
2-methylpropanal



Pentanal

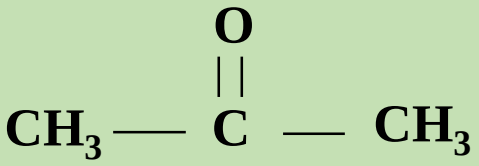


2-methylbutanal

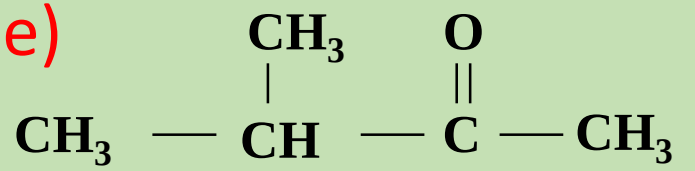


3-methylbutanal

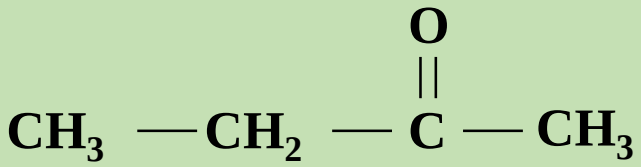
Ketones



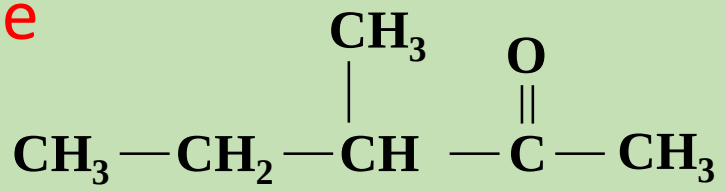
Propanone (acetone)



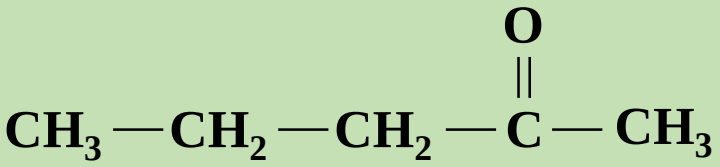
Methylbutanone



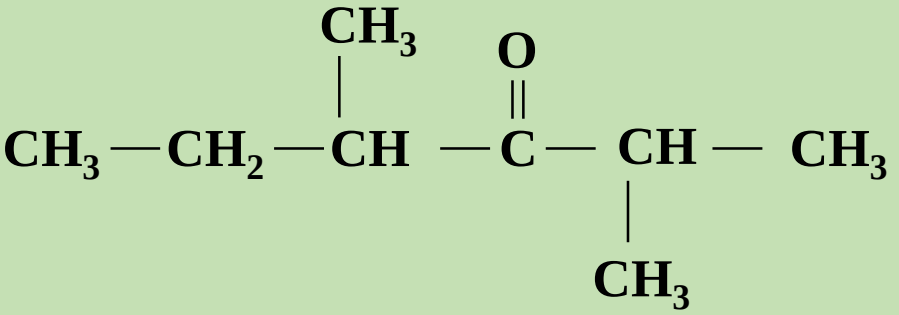
Butanone

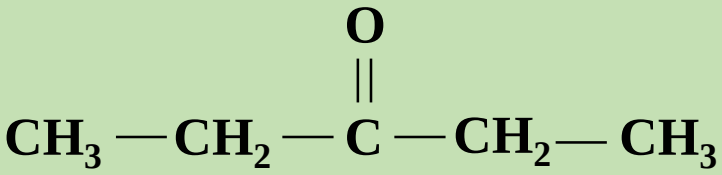


3-methyl-2-pentanone



2-pentanone





3-pentanone

2,4-dimethyl-3-hexanone

III-Identification tests of carbonyl group

The presence of carbonyl group (C=O) can be identified by two tests :

- **Carbonyl group(aldehyde or ketone) + sodium bisulfate ($NaHSO_3$) → white crystals**
- **Carbonyl group (aldehyde or ketone) + DNPH → yellow precipitate**

IV- identification tests that allow to differentiate between aldehydes and ketones

1. **The reaction with Schiff's reagent :**

Aldehyde + Schiff's reagent (placed in ice water bath) → Pink color

Ketone + Schiff's reagent → No reaction (no change, remains colorless)

2. Oxidation with $KMnO_4$ in acidic medium

Aldehyde + MnO_4^- + acidic medium (H^+) → carboxylic acid + Mn^{2+}

Ketone + MnO_4^- + acidic medium → no reaction (the color remains purple)

Purple color

Slight pink color

3. Oxidation with $Na_2Cr_2O_7$ in acidic medium

Aldehyde + $Cr_2O_7^{2-}$ + acidic medium → carboxylic acid + Cr^{3+}

Orange color — Green color

Ketone + $Cr_2O_7^{2-}$ + acidic medium → no reaction (the color remains orange)

4. Oxidation with ammonical silver nitrate ($Ag(NH_3)^+_2$) in basic medium (OH^-)

Aldehyde + $Ag(NH_3)^+_2$ (Tollen's reagent) + basic medium + heat → silver solid (silver mirror)

Ketone + $Ag(NH_3)^+_2$ (Tollen's reagent) + basic medium + heat → no reaction

5. Reaction with Fehling reagent in basic medium

Aldehyde + Fehling solution (blue) + basic medium (OH^-) + heat → $Cu_2O_{(s)}$ (red brick precipitate)

Ketone + Fehling solution → no reaction (the color remains blue)