

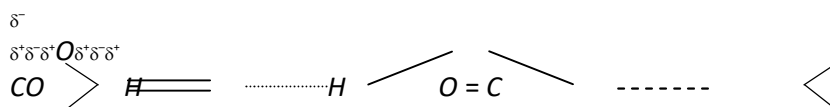
Physical properties of carbonyl compounds.

The important physical properties of aldehydes and ketones are given below,

(1) **Physical state:** Methanal is a pungent smell gas. Ethanal is a volatile liquid, b.p. 294 K. Other aldehydes and ketones containing up to eleven carbon atoms are colourless liquids while still higher members are solids.

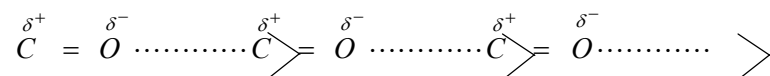
(2) **Smell:** With the exception of lower aldehydes which have unpleasant odours, aldehydes and ketones have generally pleasant smell. As the size of the molecule increases, the odour becomes less pungent and more fragrant. In fact, many naturally occurring aldehydes and ketones have been used in blending of perfumes and flavouring agents.

(3) **Solubility:** Aldehydes and ketones upto four carbon atoms are miscible with water. This is due to the presence of hydrogen bonding between the polar carbonyl group and water molecules as shown below :



With the increase in the size of alkyl group, the solubility decreases and the compounds with more than four carbon atom are practically insoluble in water. All aldehydes and ketones are, however, soluble in organic solvents such as ether, alcohol, etc. The ketones are good solvents themselves.

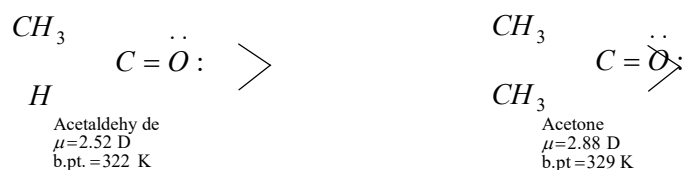
(4) **Boiling points:** The boiling points of aldehydes and ketones are higher than those of non polar compounds (hydrocarbons) or weakly polar compounds (such as ethers) of comparable molecular masses. However, their boiling points are lower than those of corresponding alcohols or carboxylic acids. This is because aldehydes and ketones are polar compounds having sufficient intermolecular dipole-dipole interactions between the opposite ends of $C=O$ dipoles.



However, these dipole-dipole interactions are weaker than the intermolecular hydrogen bonding in alcohols and carboxylic acids. Therefore, boiling points of aldehydes and ketones are relatively lower than the alcohols and carboxylic acids of comparable molecular masses.

Compounds	$CH_3CH_2CH_2CH_2CH_3$ Pentane	$CH_3CH_2OCH_2CH_3$ Ethoxyethane	$CH_3CH_2CH_2CH_2OH$ Butan - 1-ol	$CH_3CH_2CH_2CHO$ Butanal	$CH_3COCH_2CH_3$ Butan-2-one
Molecular mass	72	74	74	72	72
Boiling point (K)	309	308	391	349	353

Among the carbonyl compounds, ketones have slightly higher boiling points than the isomeric aldehydes. This is due to the presence of two electron releasing groups around the carbonyl carbon, which makes them more polar.



(5) **Density:** Density of aldehydes and ketones is less than that of water.