ALDEHYDES, KETONES AND CARRBOXYLIC ACIDS PHYSICAL PROPERTIES

PHYSICAL PROPERTIES

State: Formaldehyde is the only gaseous carbonyl compound; all others up to C_{11} are in liquid form, while those from C_{12} onward are solid.

Odor: Lower aldehydes emit an unpleasant odor, whereas higher aldehydes and all ketones have a pleasant fragrance.

Solubility

C₁ to C₃ (formaldehyde, acetaldehyde and propionaldehyde) and acetone are freely soluble in water due to polarity of $>_{C=0}^{8^+ 8^-}$ bond and can form H—bond with water molecule. C₅ onwards are insoluble in water.

$$>^{8+8-}_{C=0}$$

H-bonding

Boiling point

Boiling point ∞ Molecular weight

Boiling point order is:

Alcohol > Carbonyl compounds > Alkane

This distinction arises because alcohols exhibit intermolecular hydrogen bonding, while carbonyl compounds lack hydrogen bonding and instead rely on dipole-dipole van der Waals forces of attraction. In contrast, alkanes are nonpolar.



Density : Density of carbonyl compounds is lower than water.

CHEMICAL PROPERTIES

Reactions of both aldehydes and ketones

The pronounced electronegativity of oxygen causes the mobile electrons to be drawn strongly toward oxygen, resulting in a deficit of electrons at the carbon atom.

$$>c \stackrel{\bullet}{=} c \longrightarrow > c \stackrel{\bullet}{\sim} c \stackrel{\bullet}{\to} c$$

Carbon is thus readily attacked by. The negatively charged oxygen is attacked by electron deficient (electrophile) E^+ .

> C = C bond in carbonyl group is stronger than C=C bond in alkanes.

(C - O Bond energy is 84.0 K Cals)	(C – O Bond energy is 84.0 K Cals
(C = 0 Bond energy is 178 K Cals)	C = 0 Bond energy is 178 K Cals

Reactivity of carbonyl group ∞ Magnitude of + ve charge ∞ – I group $\infty \frac{1}{+ I \text{ group}}$