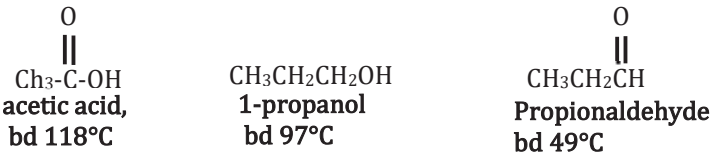
PHYSICAL PROPERTIES OF CARBOXYLIC ACID

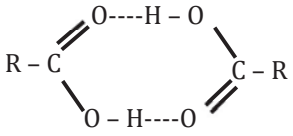
Physical Properties of Acids and Acid Derivatives

(1) Boiling point

Carboxylic acids have higher boiling points compared to alcohols, ketones, or aldehydes with similar molecular weights.



The high boiling points of carboxylic acids is the result of formation of a stable hydrogen-bonded dimer.



hydrogen bonded acid dimer

(2) Melting points

Melting points of carboxylic acids exhibit no consistent pattern. However, when considering carboxylic acids with up to 10 carbon atoms, those with an even number of carbon atoms tend to have higher melting points compared to neighboring members with an odd number of carbon atoms. This is due to the fact that carboxylic acid and methyl groups in even-numbered members are positioned on opposite sides of the zig-zag carbon chain, leading to a better fit within the crystal lattice, which results in higher melting points. Conversely, the opposite trend is observed in the case of carboxylic acids with an odd number of carbon atoms.

Higher melting point Lower melting point

Amides exhibit remarkably elevated boiling and melting points when compared to compounds of similar molecular weight. This phenomenon can be attributed to the strong hydrogen bonding that primary and secondary amides engage in.

(3) Solubility

Carboxylic acids have the ability to form hydrogen bonds with water, and carboxylic acids with lower molecular weights (up to 4 carbon atoms) are miscible with water.

Acid derivatives, including esters, acid chlorides, anhydrides, nitriles, and amides, exhibit solubility in common organic solvents such as alcohols, ethers, chlorinated alkanes, and aromatic hydrocarbons. However, it's important to note that acid chlorides and anhydrides cannot be utilized in nucleophilic solvents like H_2O and alcohols due to their reactivity with these solvents.