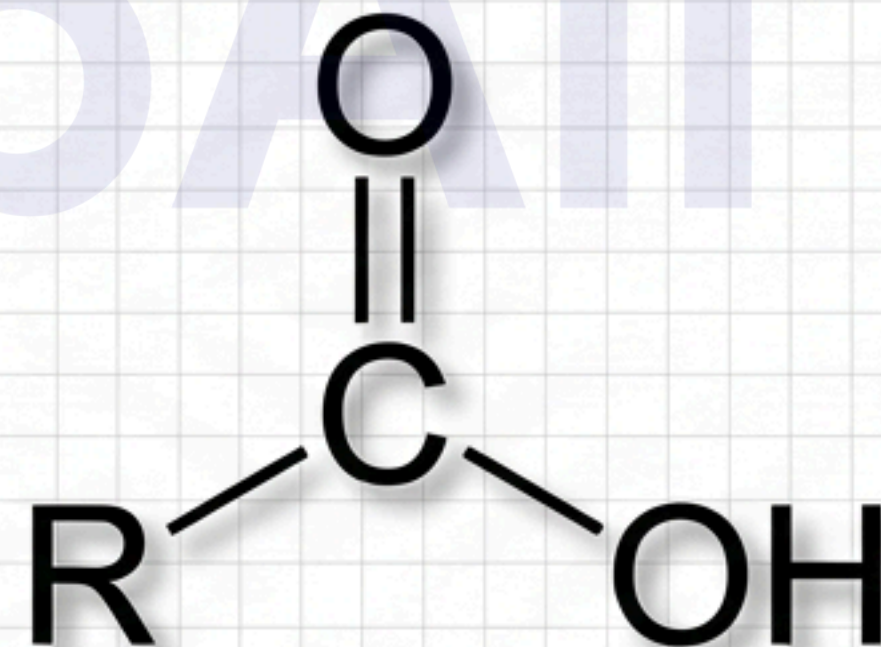


Physical Properties of Carboxylic Acids



Dimer Formation

Two molecules associating via double hydrogen bonds to act as a single, heavier unit.

Aprotic Solvent

Solvents unable to donate hydrogen bonds (e.g., benzene, ether) where dimers remain intact.

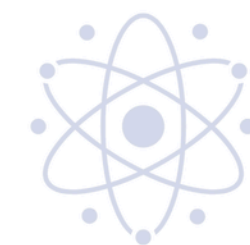
Hydrophobic Interaction

The water-repelling force of a growing hydrocarbon chain that limits solubility.



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$$E=mc^2$$



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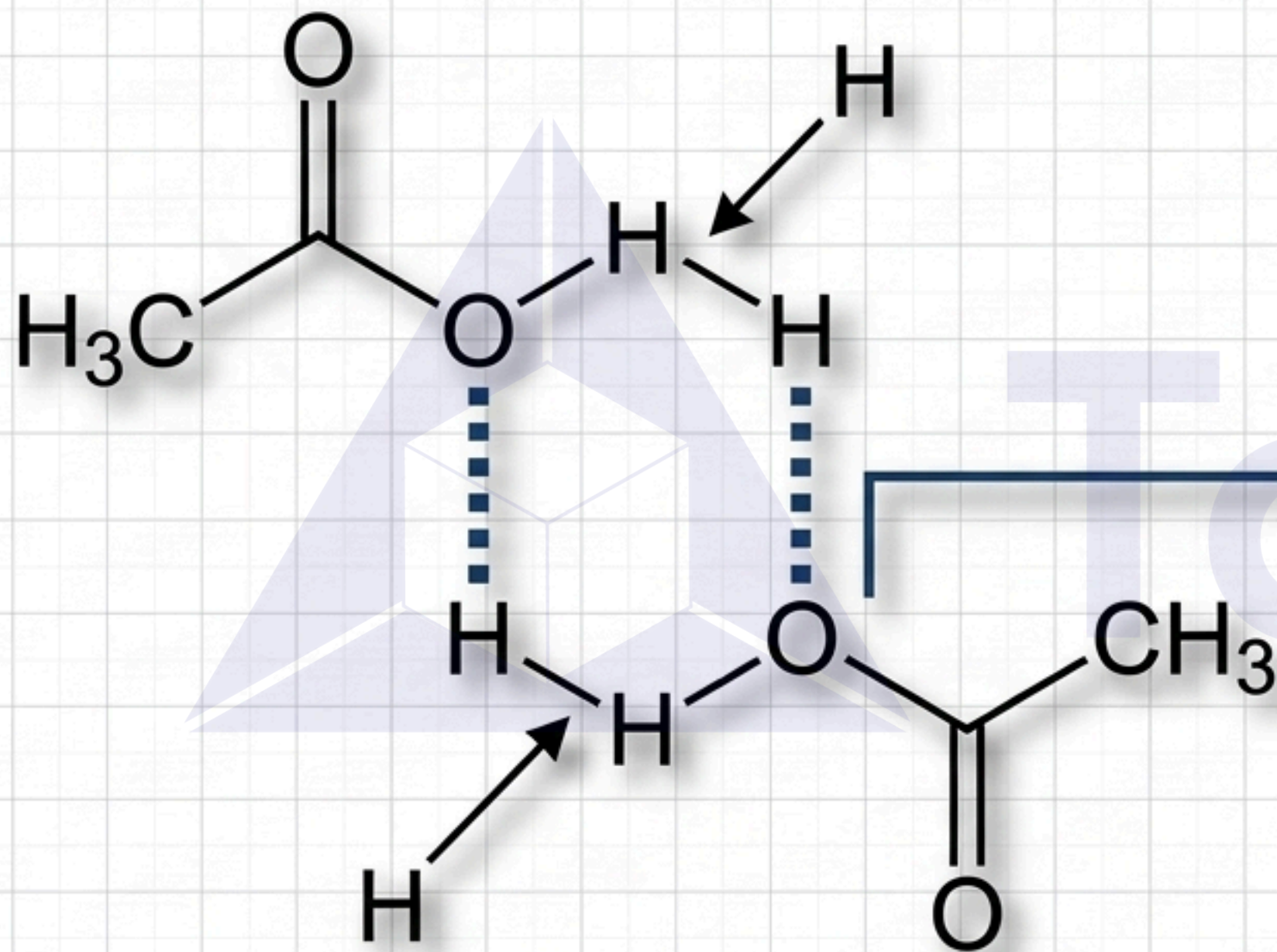


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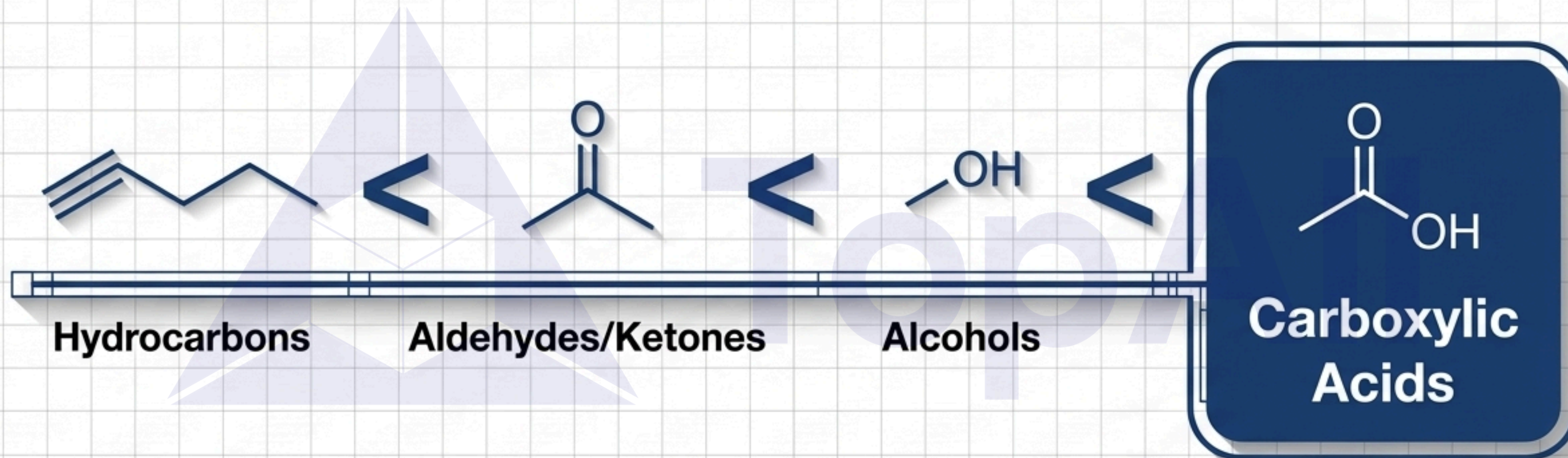




The Double Lock.

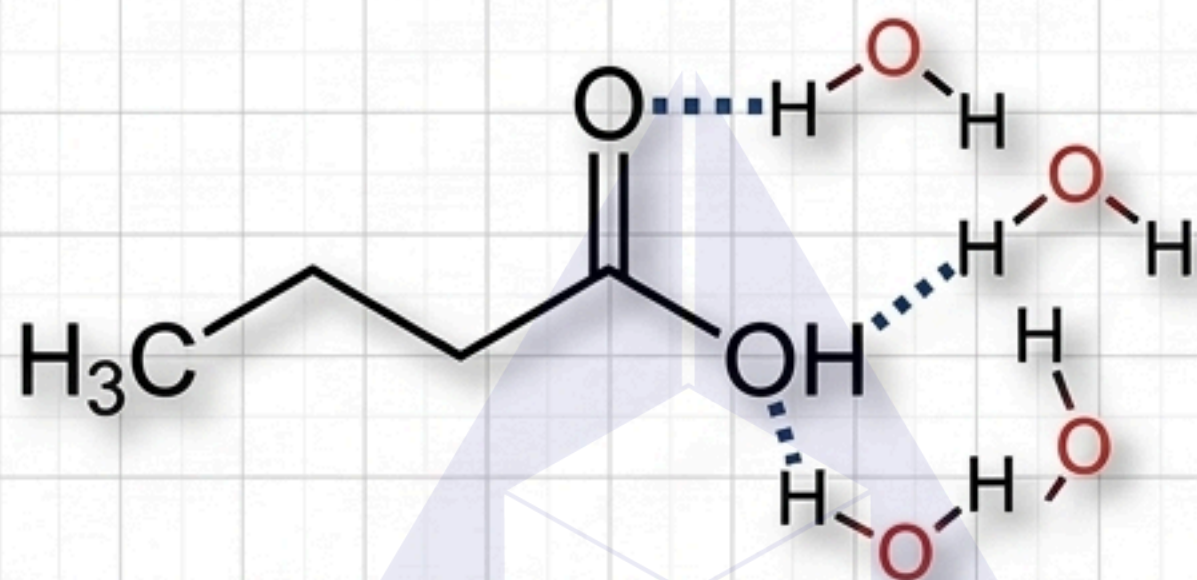
These hydrogen bonds are so strong they are not completely broken even when boiled. The dimer survives into the vapour phase and in aprotic solvents.

Boiling Point Hierarchy



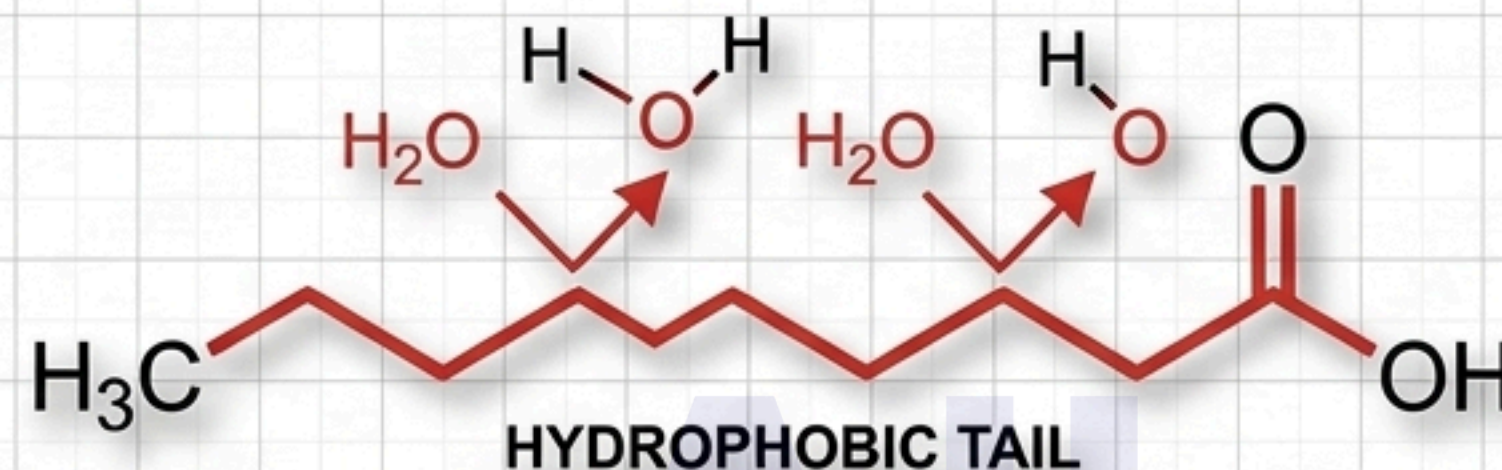
Extensive association via dimer formation outpaces the single H-bonds of alcohols (comparing similar molecular masses).

The Solubility Threshold

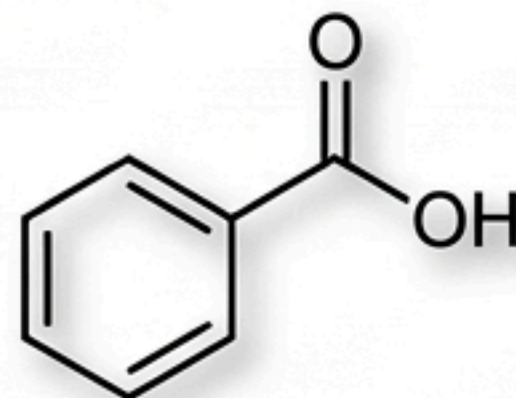


Miscible in water.

Aliphatic chain. Aliphatic chains up to 4 carbons easily form hydrogen bonds with H₂O.

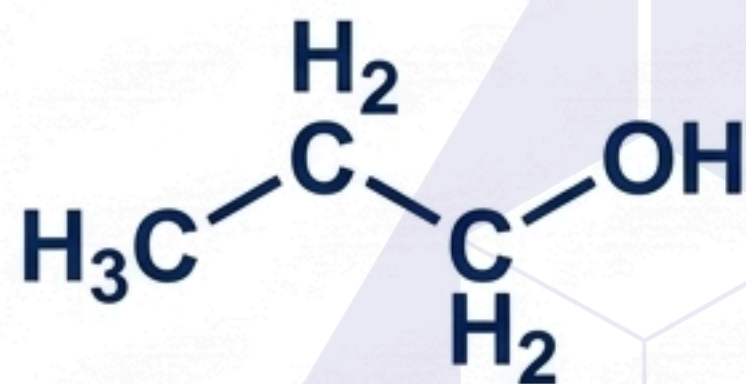


Solubility drops rapidly as the hydrophobic alkyl chain grows.

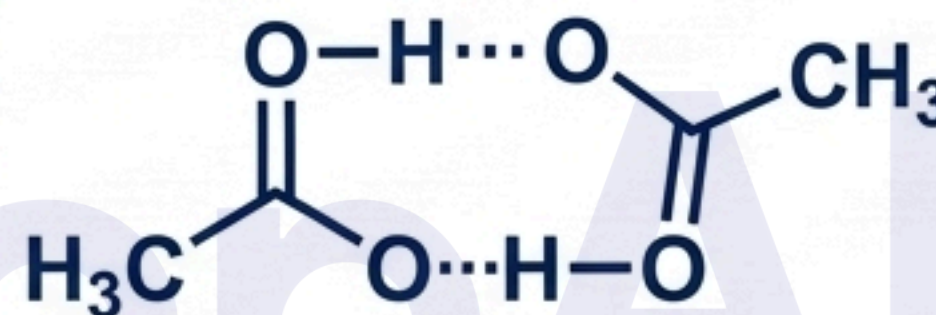


Specific Exception:
Benzoic acid is nearly **insoluble** in cold water.

Watch for this: Carboxylic acids outrank alcohols!



Mass ~60



Mass ~60



Students often rank alcohols highest due to H-bonding. But carboxylic acids form double H-bonds (dimers). For comparable molecular masses, the Carboxylic Acid always boils higher.

Key Takeaways

- Boiling points are exceptionally high because double H-bonds create stable dimers that survive into the vapour phase and aprotic solvents.
- Water miscibility ends at 4 carbons due to hydrophobic interaction; benzoic acid is practically insoluble in cold water.



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