

UNIT 8 • ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

Structure of the Carboxyl Group

Geometry, resonance, and the electrophilicity trap.

Carboxyl Carbon



The sp^2 hybridized carbon atom double-bonded to an oxygen and single-bonded to a hydroxyl group ($-OH$).

**Resonance
Stabilisation**



The delocalization of pi electrons and lone pairs, which lowers the overall energy and alters the charge distribution of the molecule.



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$$E=mc^2$$



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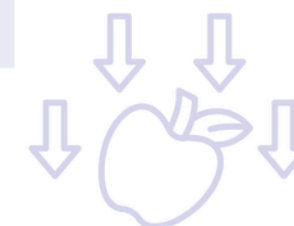
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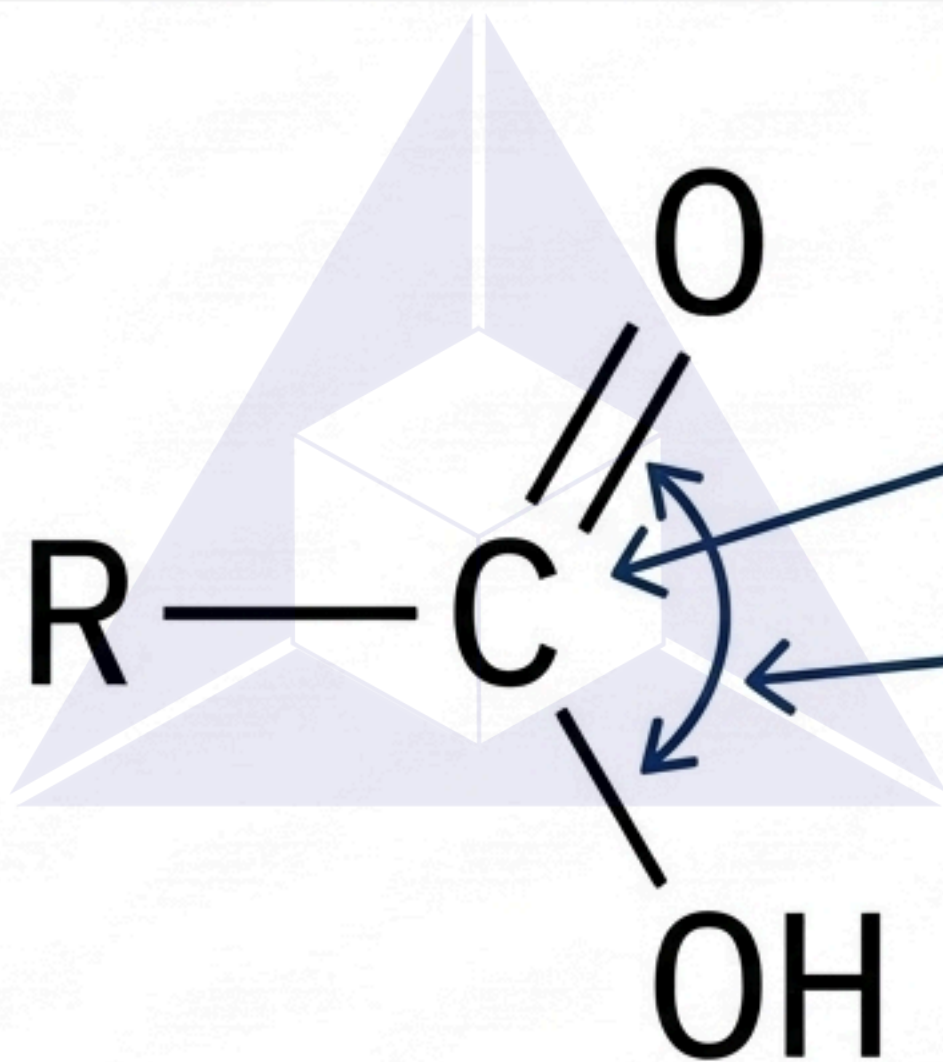
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Key Highlights

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A Strictly Planar Geometry

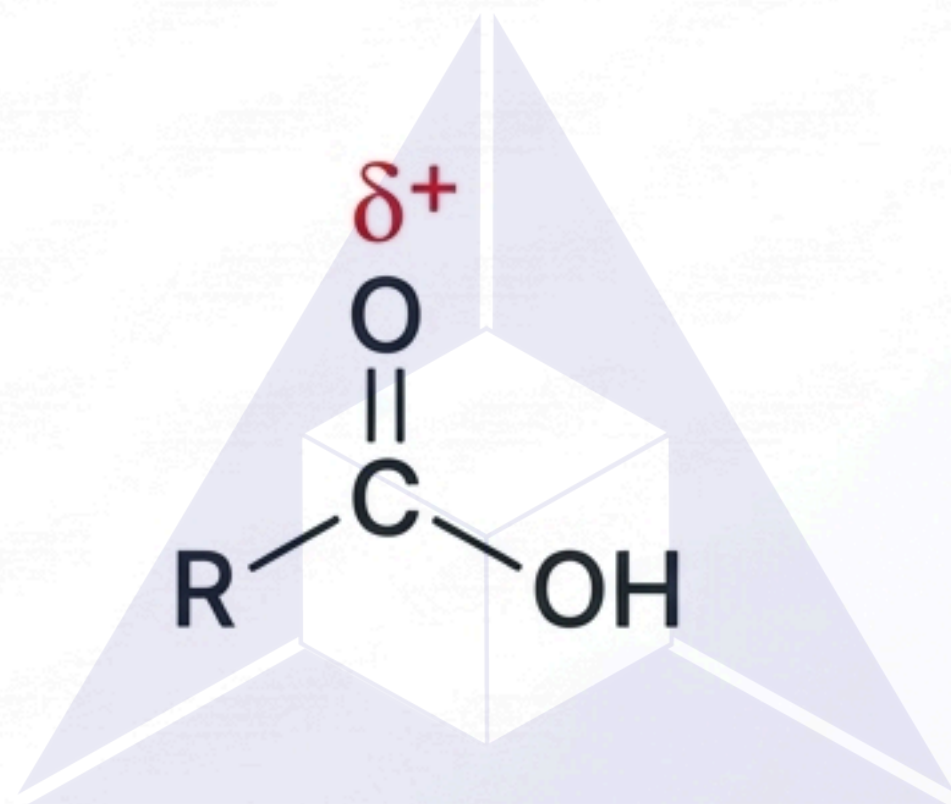


1. sp^2 hybridised

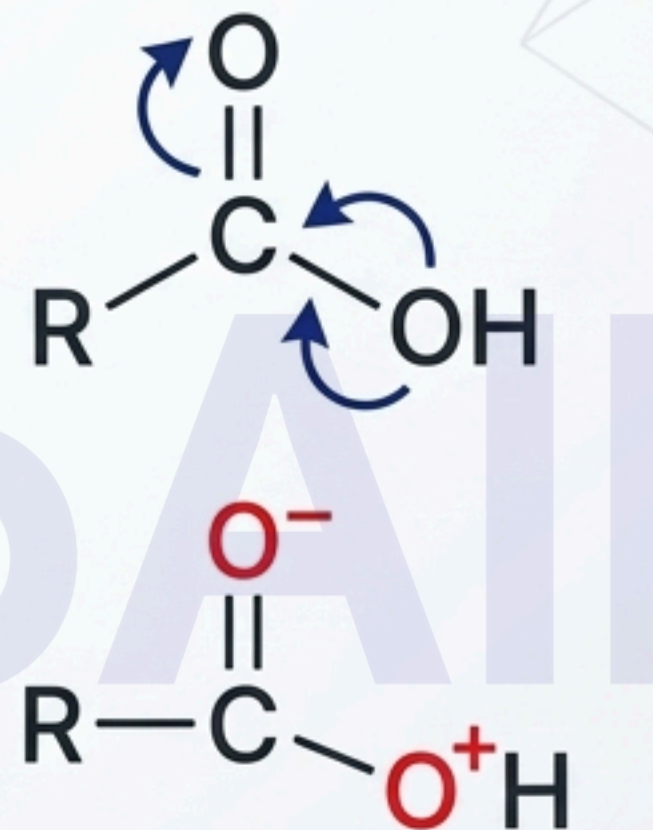
2. $\approx 120^\circ$ bond angles

3. All atoms lie perfectly in the same plane

Electron Donation Dilutes Positive Character



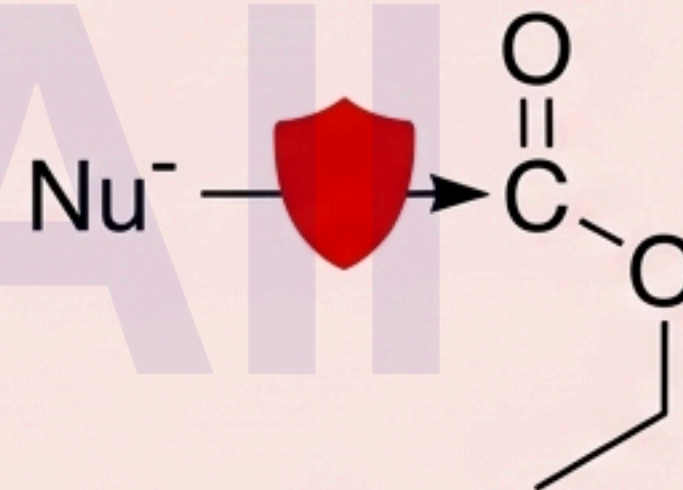
Standard neutral state. The carbonyl carbon exhibits a partial positive charge (δ^+).



Internal electron donation from the -OH oxygen fills the carbon's electron deficiency.

Watch for this common exam trap!

Do not assume a carboxyl carbon is just as electrophilic as a plain carbonyl carbon (like those in aldehydes or ketones). It is LESS electrophilic.



Because the adjacent -OH oxygen donates its lone pair via resonance, it internally satisfies the carbon's need for electrons. This internal sharing makes the carbon significantly less attractive to outside nucleophiles.

Key Takeaways

Form: The carboxyl group features a trigonal planar geometry with sp^2 hybridization and $\approx 120^\circ$ bond angles.

Function: Resonance stabilization from the hydroxyl oxygen heavily dilutes the positive character of the carboxyl carbon, making it much less electrophilic than standard carbonyls.



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