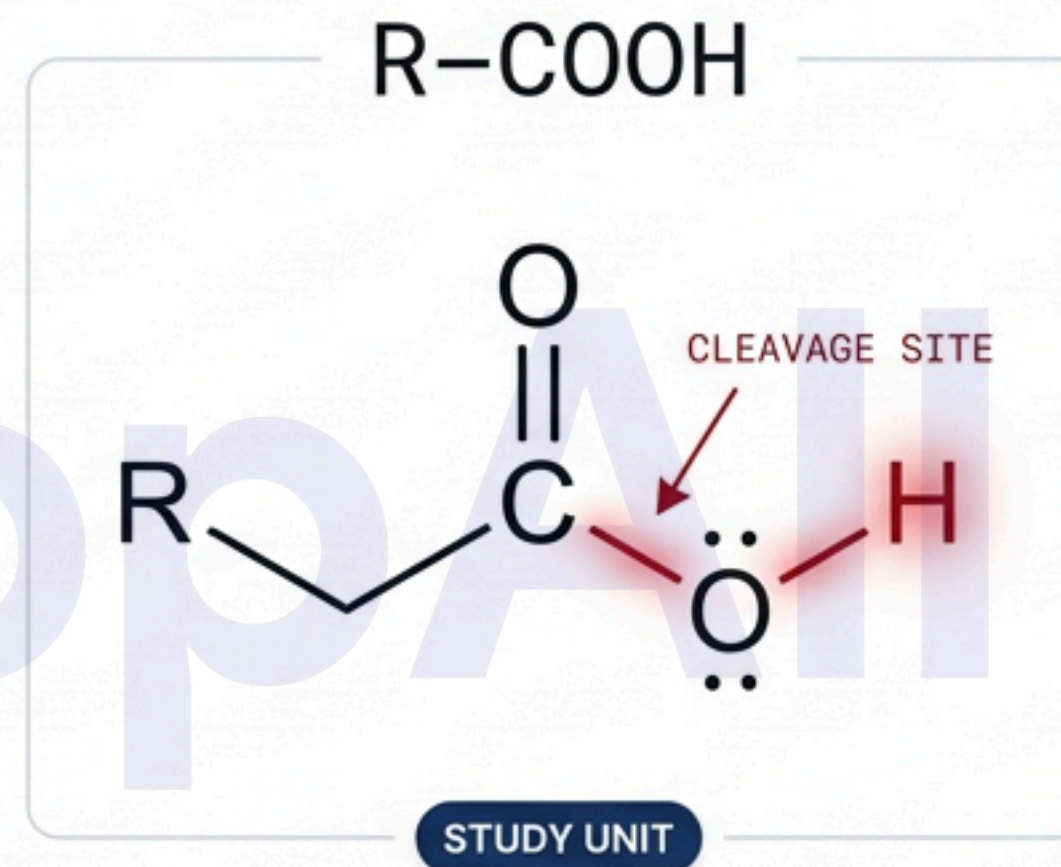


8.9.1 Reactions Involving Cleavage of O–H Bond

Understanding the acidity of carboxylic acids, resonance stabilization, and key chemical diagnostic tests.



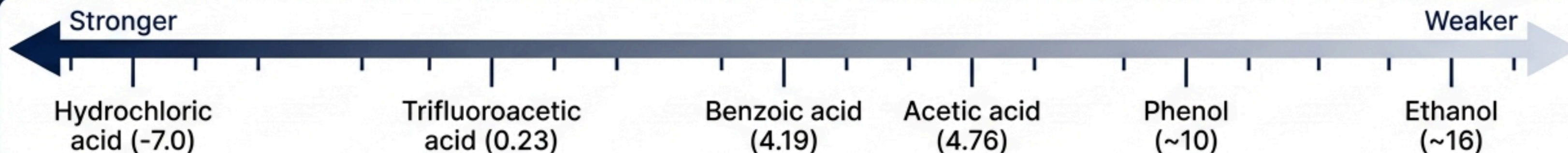
The Acidic Nature of the Carboxyl Group

Carboxylic acids dissociate in water to yield a resonance-stabilised carboxylate anion and a hydronium ion. They are the most acidic organic compounds studied so far, **stronger** than **alcohols** and phenols, but weaker than **mineral acids**.



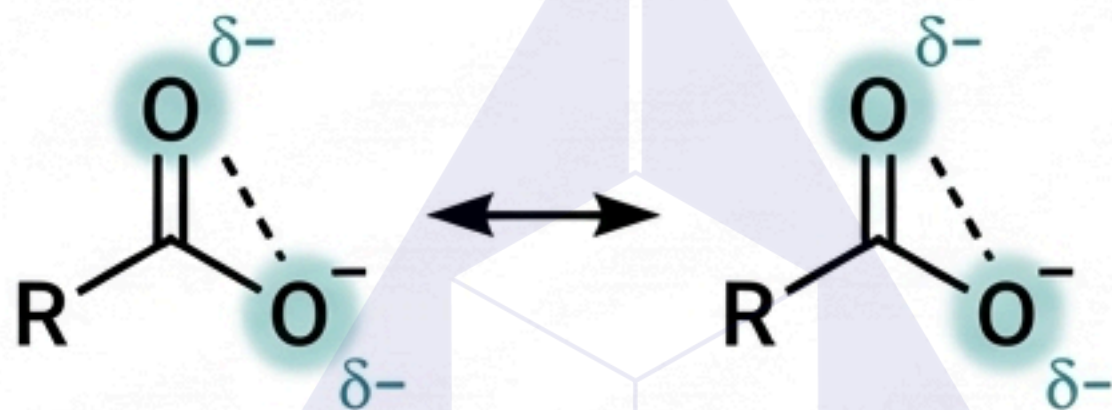
[K_a = Dissociation Constant]

[Smaller pK_a = Stronger Acid]



Why are Carboxylic Acids so Acidic?

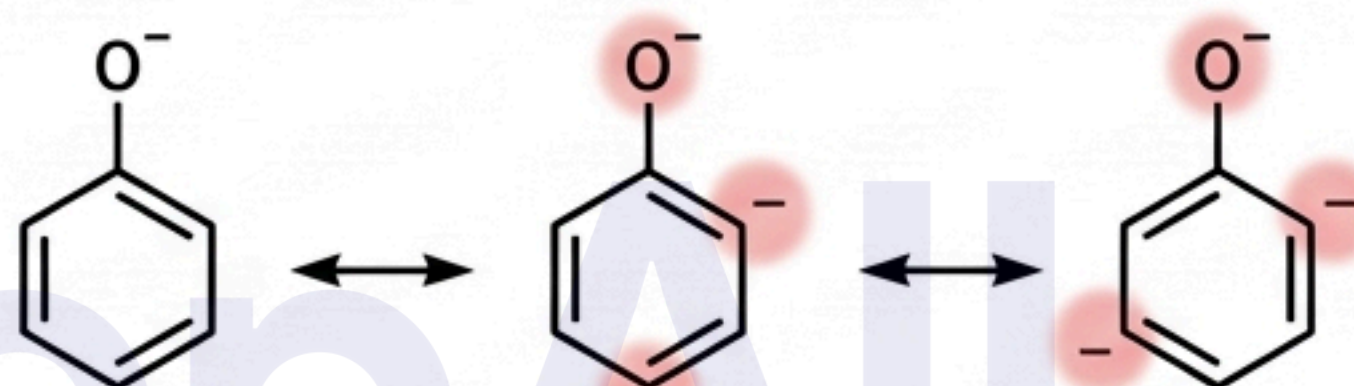
Carboxylate Ion (The Winner)



Negative charge is delocalized over TWO highly electronegative oxygen atoms.

[ Highly Stable]

Phenoxide Ion (The Runner-Up)



Negative charge is localized mostly on one oxygen and less electronegative carbon atoms.
Non-equivalent structures.

[ Less Stable]

The superior resonance stabilization of the carboxylate ion over the phenoxide ion drives the forward dissociation reaction, making carboxylic acids more acidic than phenols.



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$$E=mc^2$$



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Key Highlights

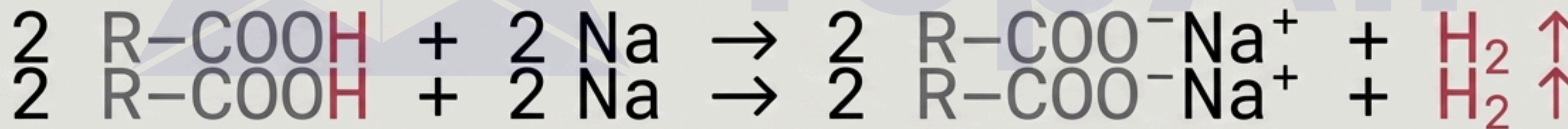
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Cleavage by Electropositive Metals

Like alcohols and phenols, carboxylic acids react with active electropositive metals to form salts and liberate hydrogen gas.

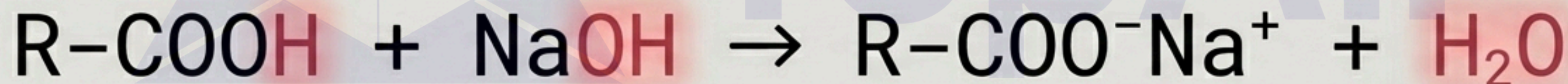
[ Hydrogen Gas Evolution]



[Sodium Carboxylate Salt]

Neutralization with Strong Bases

Similar to phenols, carboxylic acids are acidic enough to react with strong alkalis (like NaOH) to form water-soluble salts and water.



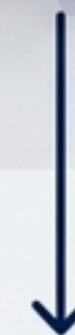
[🔍 Differentiation]

This reaction demonstrates that **carboxylic acids** are more acidic than alcohols (which do NOT react with aqueous NaOH).

Reaction with Weaker Bases (Carbonates)

This is the defining diagnostic reaction. Unlike phenols, carboxylic acids are strong enough to decompose weak bases like carbonates and hydrogencarbonates.

[ Brisk Effervescence of CO₂]



If an unknown organic compound produces brisk effervescence with NaHCO₃, it contains a carboxyl group.

Distinguishing the Carboxyl Group

Functional Group	Na Metal	NaOH (Strong Base)	NaHCO ₃ (Weak Base)
Alcohols	Reacts (✓)	No Reaction (✗)	No Reaction (✗)
Phenols	Reacts (✓)	Reacts (✓)	No Reaction (✗)
Carboxylic Acids	Reacts (✓)	Reacts (✓)	**Reacts (CO₂ ↑) (✓)

The Sodium Bicarbonate (NaHCO₃) Test is the definitive laboratory test to detect the presence of a **carboxyl group** in an organic compound.



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