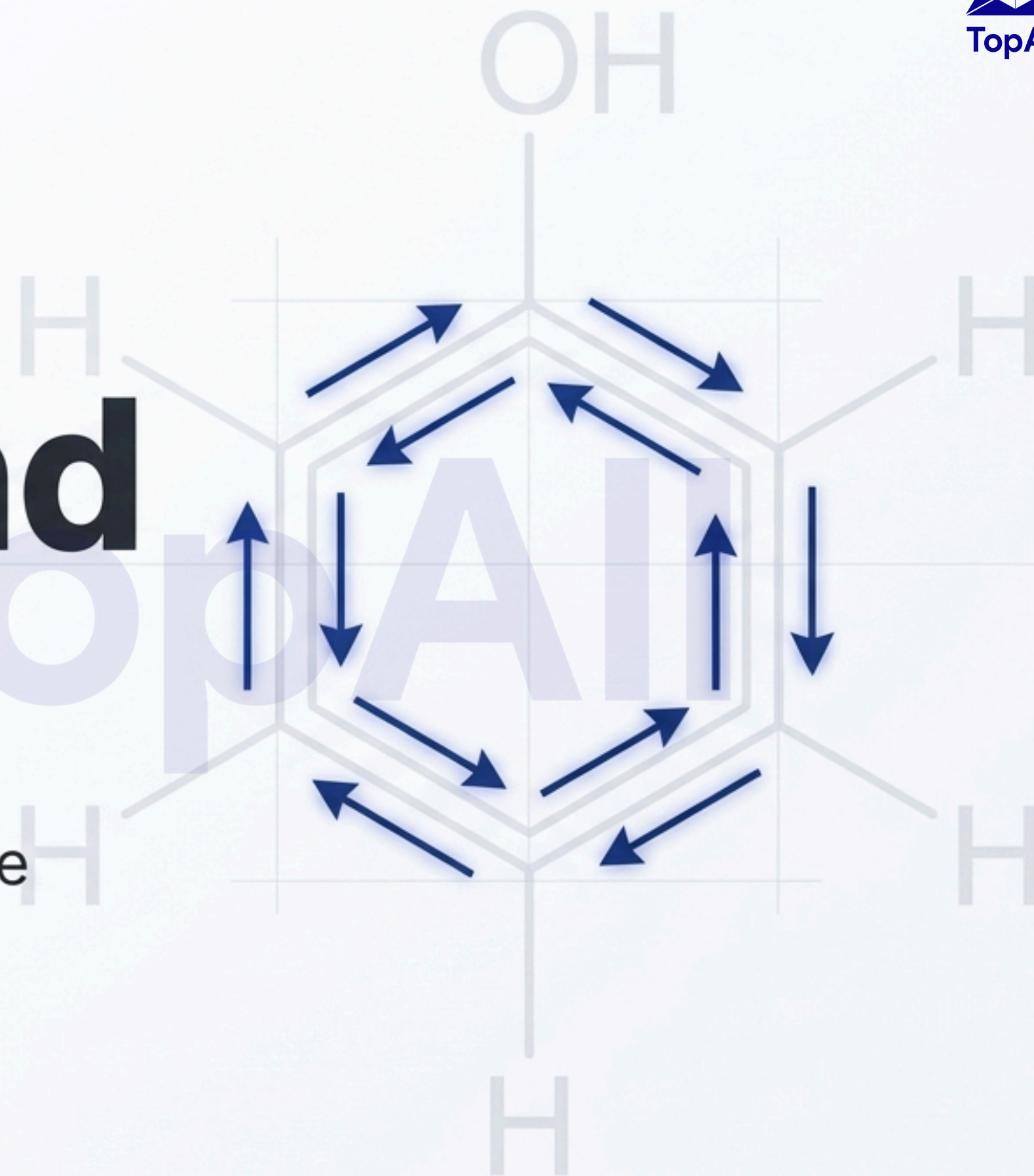


Acidity of Alcohols and Phenols

Understanding the rules of conjugate base stability, electron routing, and charge delocalization.



Key Vocabulary

Brönsted acid

Donates a proton to a stronger base.

Alkoxide

The localized conjugate base of an alcohol (**RO⁻**).

Phenoxide

The resonance-stabilized conjugate base of a phenol (**ArO⁻**).

Resonance stabilisation

Spreading of charge to increase stability.

The Observation: Reaction with Active Metals



Fact Check: Despite this reaction, alcohols are weaker acids than water.



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$$E=mc^2$$



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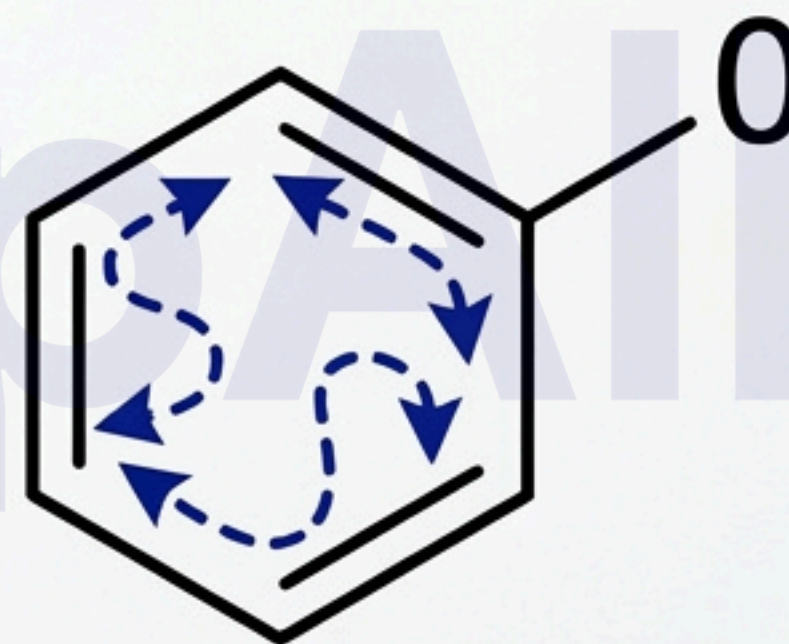
The Mechanism: Alkoxide vs Phenoxide Stability

Localized Charge



Localized charge = Instability

Delocalized Charge



Delocalized charge = Stability

Data Verification: The pKa Scale

Decreasing pKa = Increasing Acidity ↑

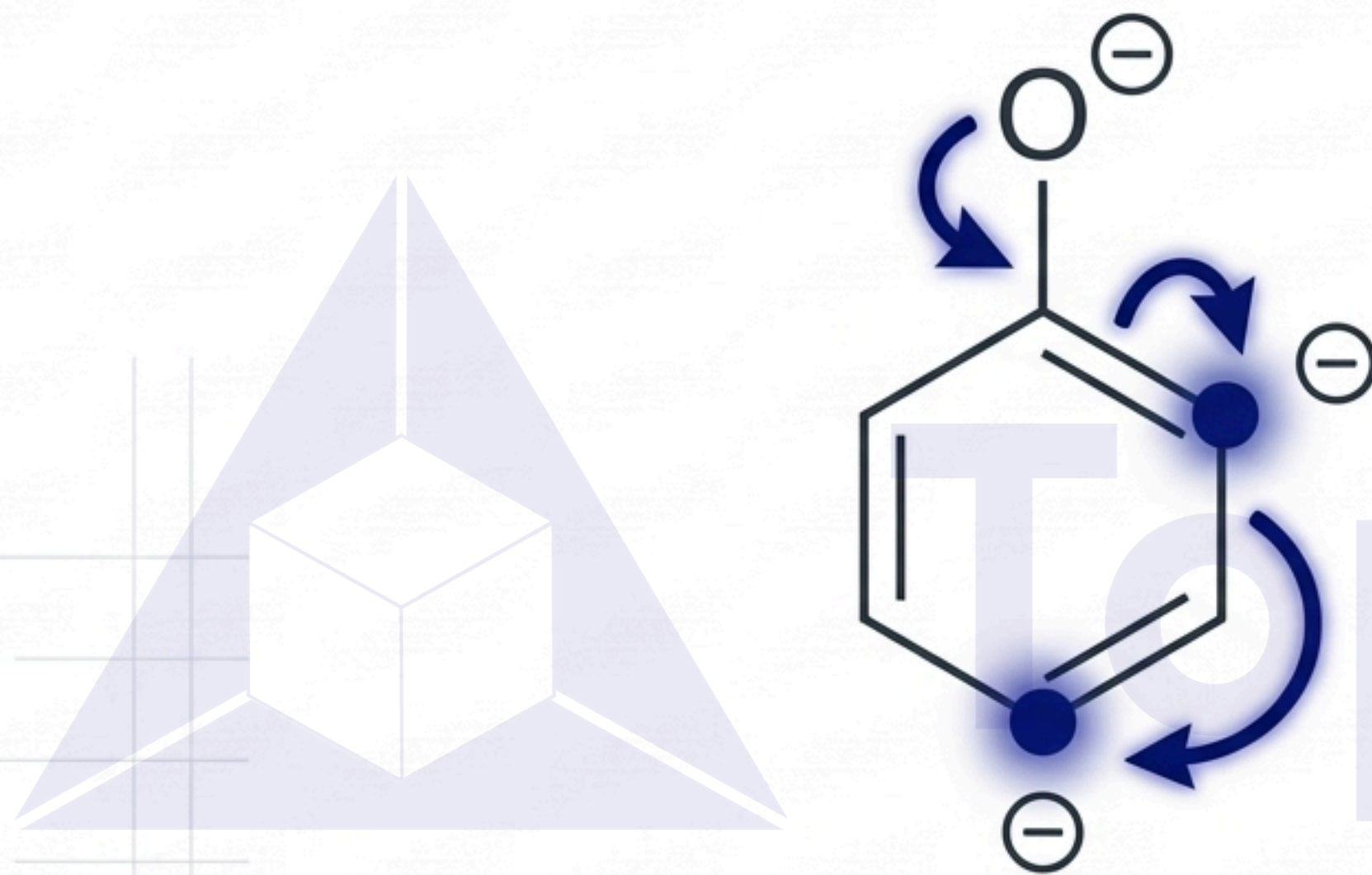
p-Nitrophenol
(pKa = 7.1)

Cresols (pKa ~ 10.1 - 10.2)
Phenol (pKa = 10.0)

Ethanol
(pKa = 15.9)

**Phenol is a
million times
more acidic
than ethanol.**

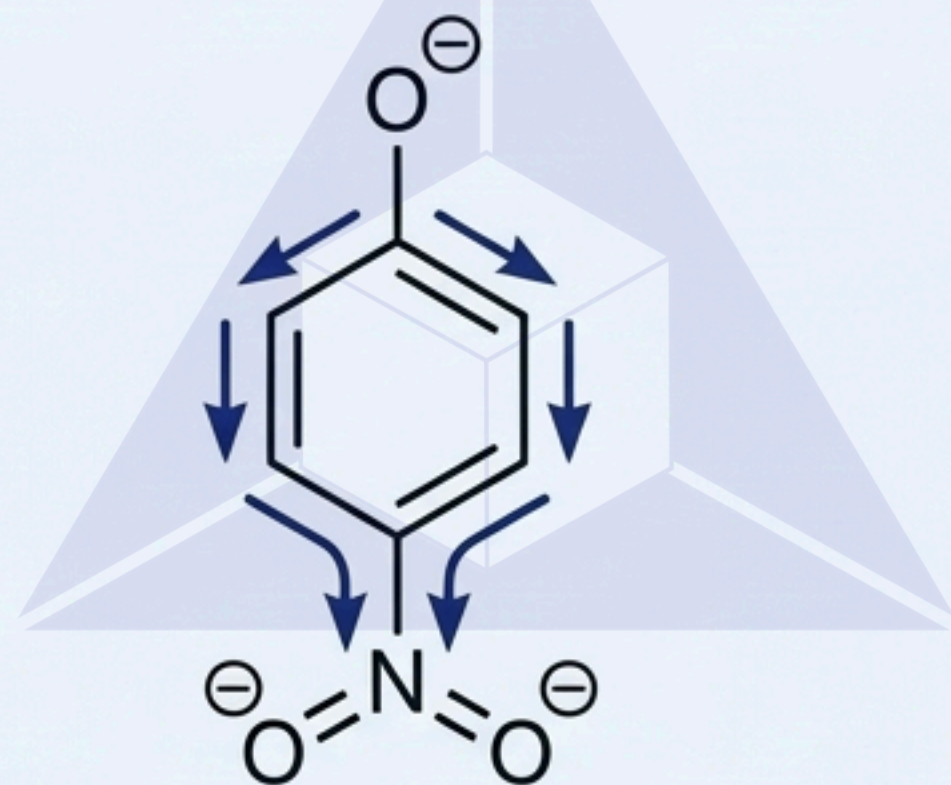
The Resonance Pathway: Ortho & Para Spotlight



Charge Delocalization is not uniform. As electron density moves through the ring, the negative charge naturally lands on the **ortho** and **para** positions. Substituents placed here dictate the stability of the entire molecule.

The Substituent Effect

Electron-Withdrawing (e.g., $-\text{NO}_2$)



Stabilizes the phenoxide $\rightarrow$ Increases Acidity.

Electron-Releasing (e.g., $-\text{CH}_3$)

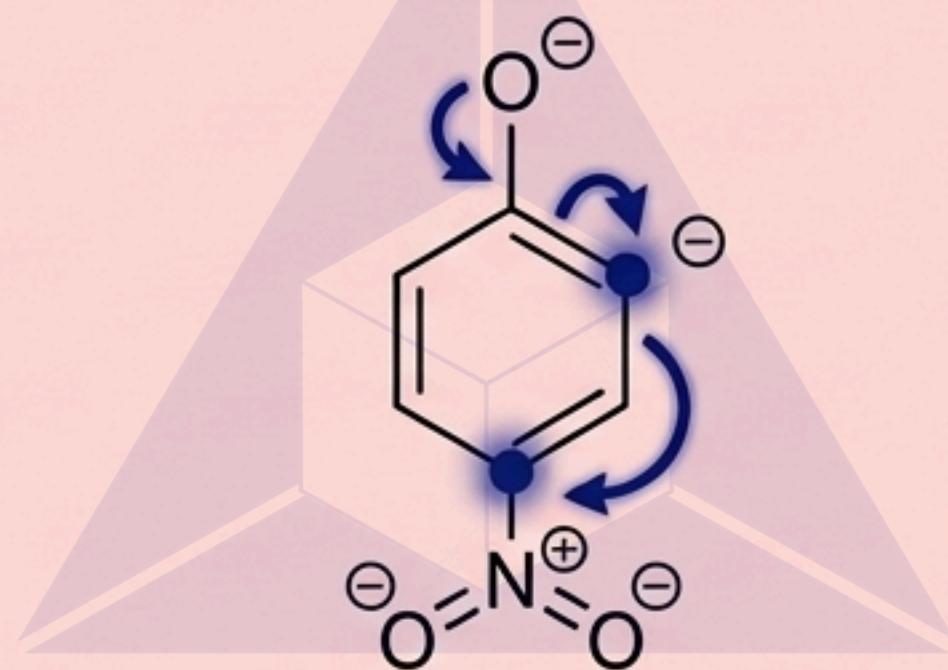


Destabilizes the phenoxide $\rightarrow$ Decreases Acidity.

JEE Trap Alert: Watch for this routing failure.

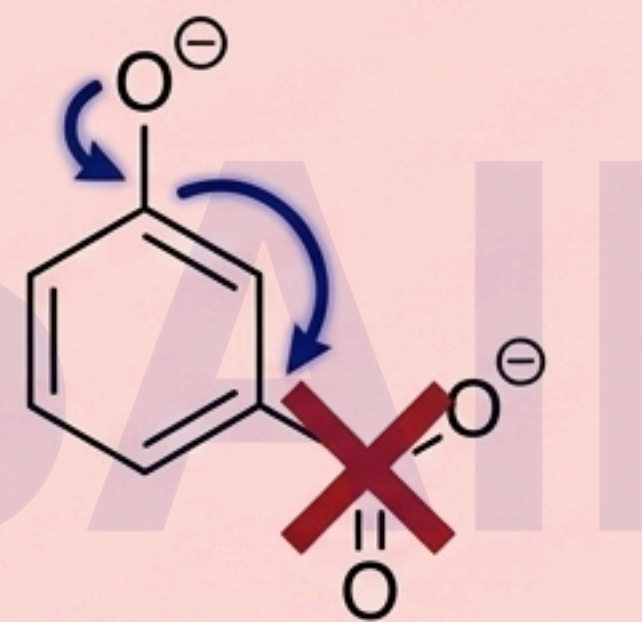
The Architecture of Charge

Path A (o-/p-nitrophenol)



(The drain works)
pKa = 7.1 - 7.2

Path B (m-nitrophenol)



(Missing the drain)
pKa = 8.3

m-nitrophenol is **LESS** acidic than ortho/para isomers because the meta position cannot delocalize the negative charge onto the nitro group through resonance.

Key Takeaways

- **The Conjugate Base Rule:** Acidity is dictated entirely by the stability of the resulting anion. Resonance-delocalized phenoxides are millions of times more acidic than localized alkoxides.
- **The Substituent Routing Rule:** Electron-withdrawing groups (like -NO_2) increase acidity, but only reach maximum effectiveness when positioned at ortho or para locations where they can successfully capture routed resonance charge.



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