

⚠ JEE Weightage: VERY HIGH

Why Salt Solutions Can Become Acidic or Basic

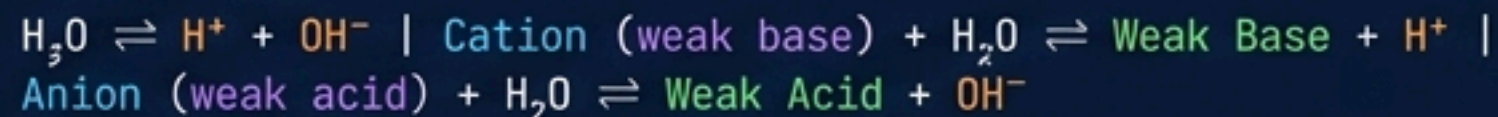
Unlocking the Hydrolysis of Salts



KEY CONCEPT:

Hydrolysis drives solution pH. Cations from weak bases and anions from weak acids react with water to produce H^+ or OH^- ions, respectively, breaking the neutral water equilibrium. The resulting shift dictates whether the solution becomes ACIDIC (excess H^+), BASIC (excess OH^-), or remains NEUTRAL.

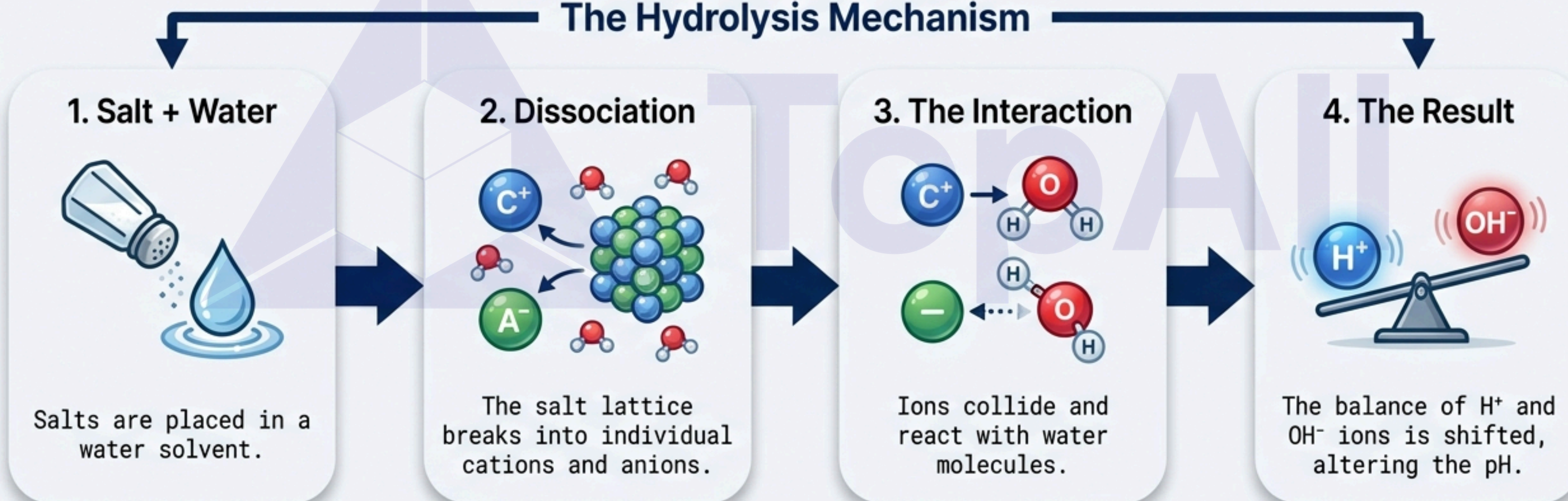
Formula Bank



What is Salt Hydrolysis?

When salts dissolve, they don't just sit there. The cations or anions can interact with water to reform their parent acids or bases.

The Hydrolysis Mechanism



✓ **Key Takeaway:** This interaction disrupts the natural H^+ and OH^- balance of pure water, shifting the pH.

Hydrolysis of a Basic Salt

Salt of Weak Acid + Strong Base

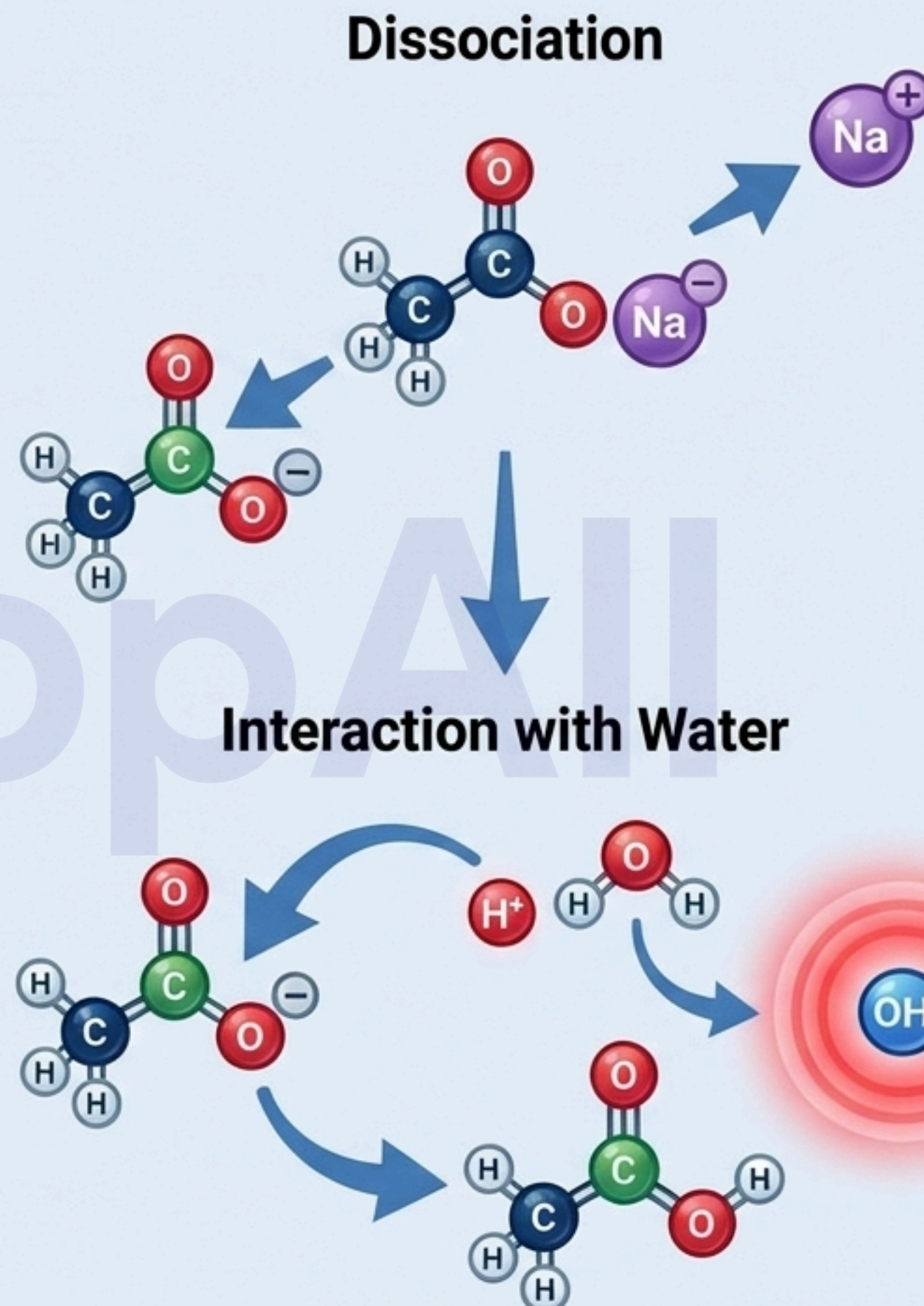
Example: Sodium Acetate (CH_3COONa)

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The acetate ion (from a weak acid) reacts with water to reform acetic acid.

✓ **Result:** OH^- Formation = Basic Solution ($\text{pH} > 7$)





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$$E=mc^2$$



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Hydrolysis of an Acidic Salt

Salt of Strong Acid + Weak Base

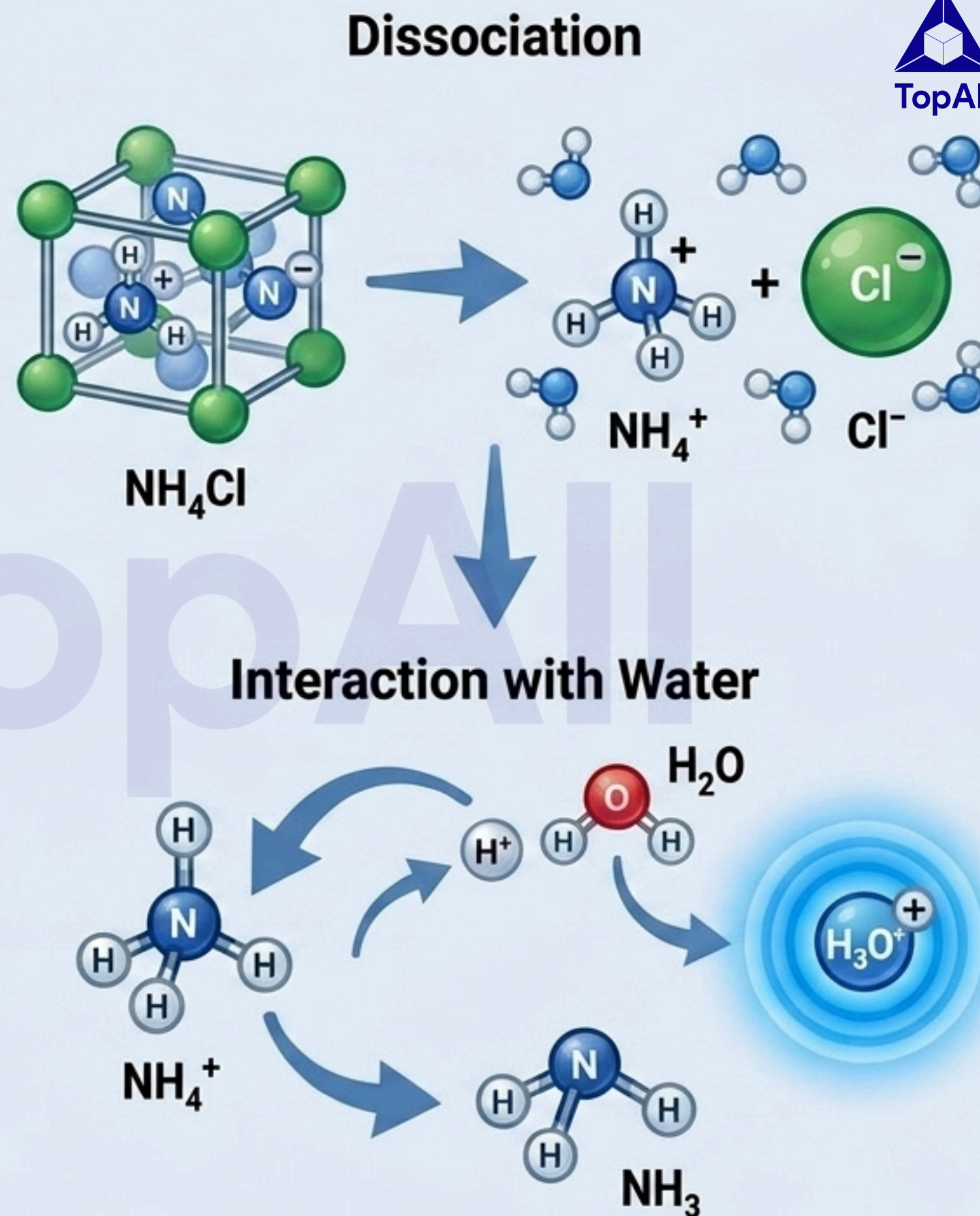
Example: Ammonium Chloride (NH_4Cl)

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The ammonium ion (from a weak base) reacts with water to release hydronium.

✓ **Result:** H_3O^+ Formation = Acidic Solution ($\text{pH} < 7$)



Salt Nature Decision Map

[Strong Acid] + [Strong Base] → **Neutral (pH = 7)** *e.g., NaCl (No Hydrolysis)*

[Weak Acid] + [Strong Base] → **Basic (pH > 7)** *e.g., CH₃COONa*

[Strong Acid] + [Weak Base] → **Acidic (pH < 7)** *e.g., NH₄Cl*

[Weak Acid] + [Weak Base] → **Variable** *Depends on pK_a & pK_b*

JEE Trap Alert ⚠

The Trap



The Common Mistake

Neutralization reactions always create a neutral solution. Therefore, every salt solution has a pH of 7.

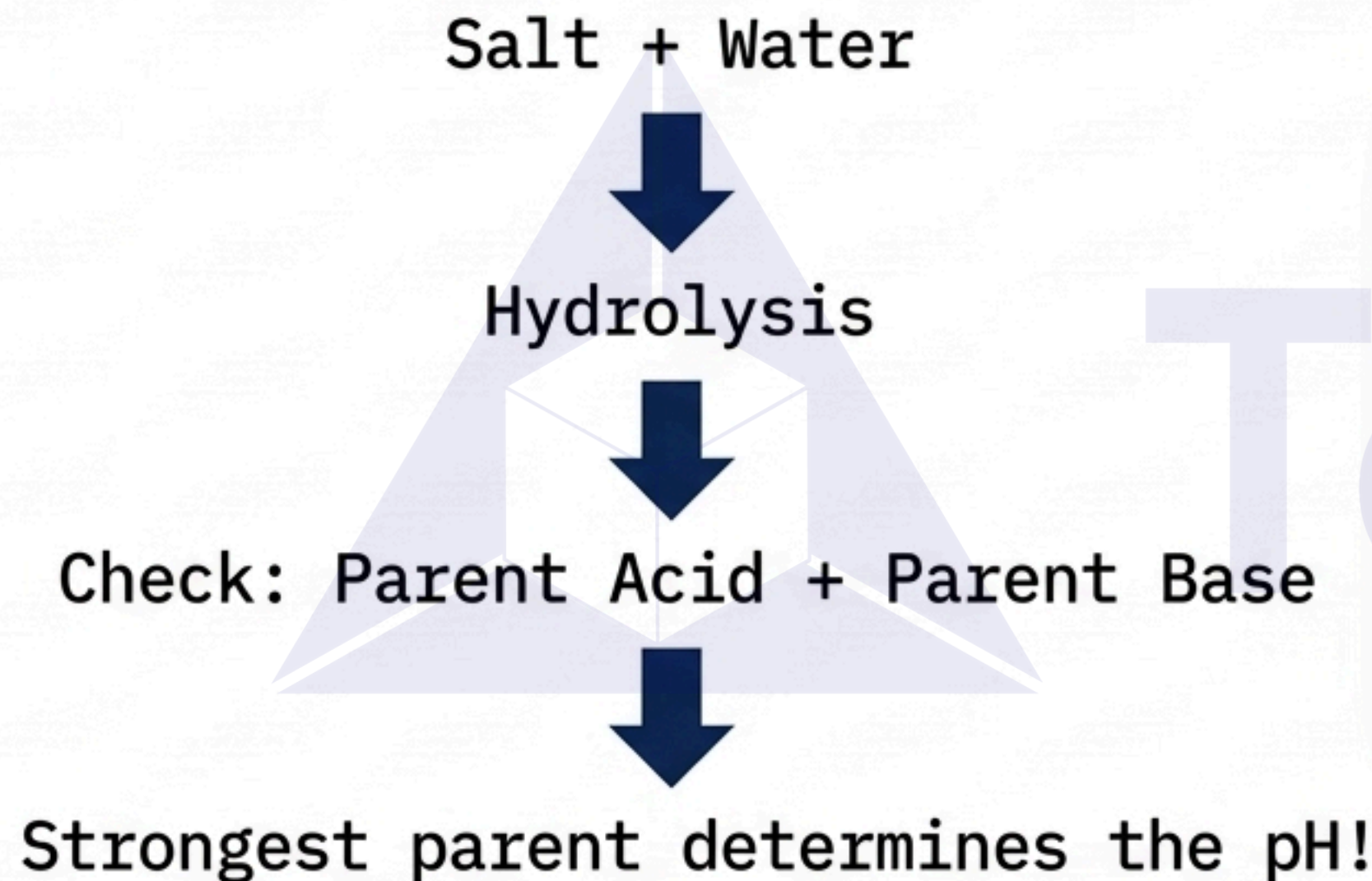
The Truth



The Actual Mechanism

Salt behaviour depends entirely on parent acid and base strength. Only salts of Strong Acids + Strong Strong Bases are truly neutral. Weak ions undergo hydrolysis!

Exam Snapshot Revision Card



For Weak Acid + Weak Base
Salts:

$$\text{pH} = 7 + \frac{1}{2}(\text{pK}_a - \text{pK}_b)$$

If a salt contains an ion from a weak acid or weak base,
that ion *will* react with water.



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