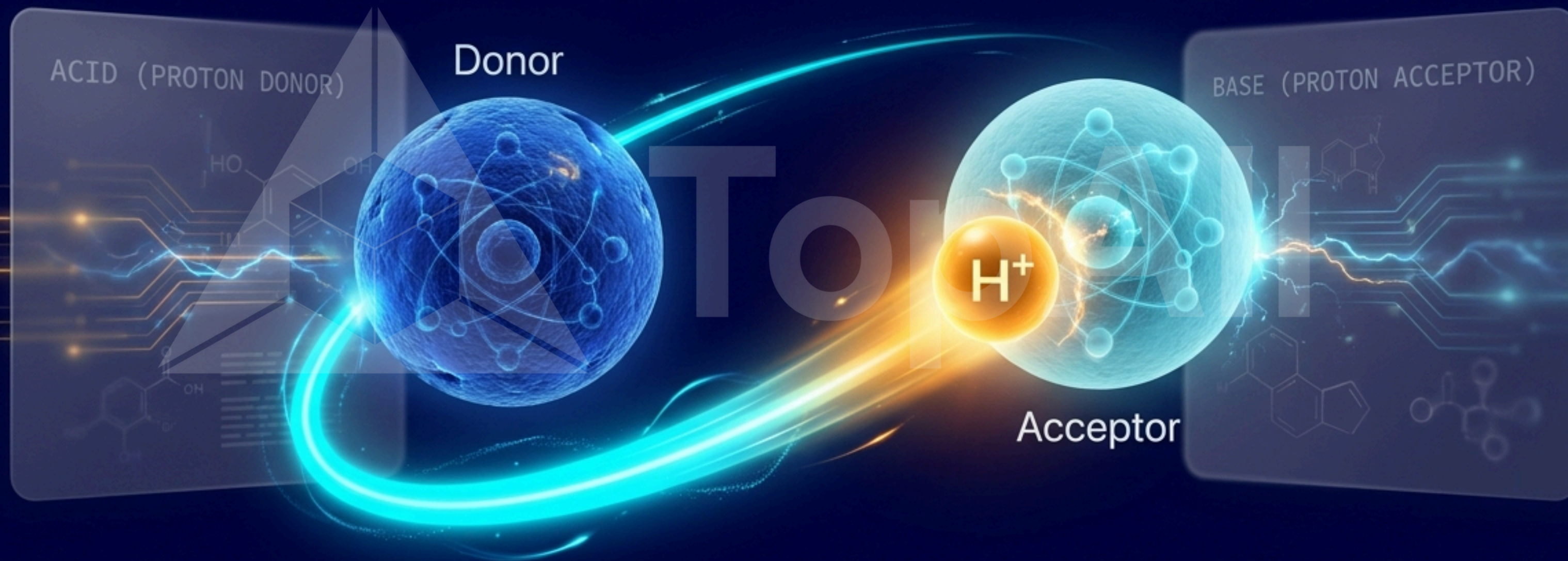


Follow the Proton Transfer

Mastering the Brønsted–Lowry Concept of Acids & Bases



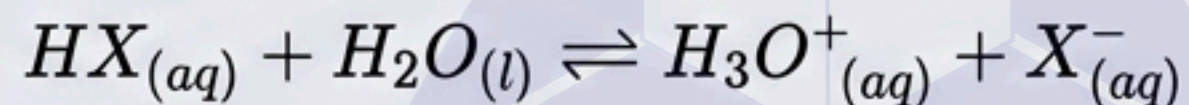
The Brønsted Acid

The Proton Donor

A Brønsted Acid is any species (molecule or ion) capable of donating a hydrogen ion (H^+).

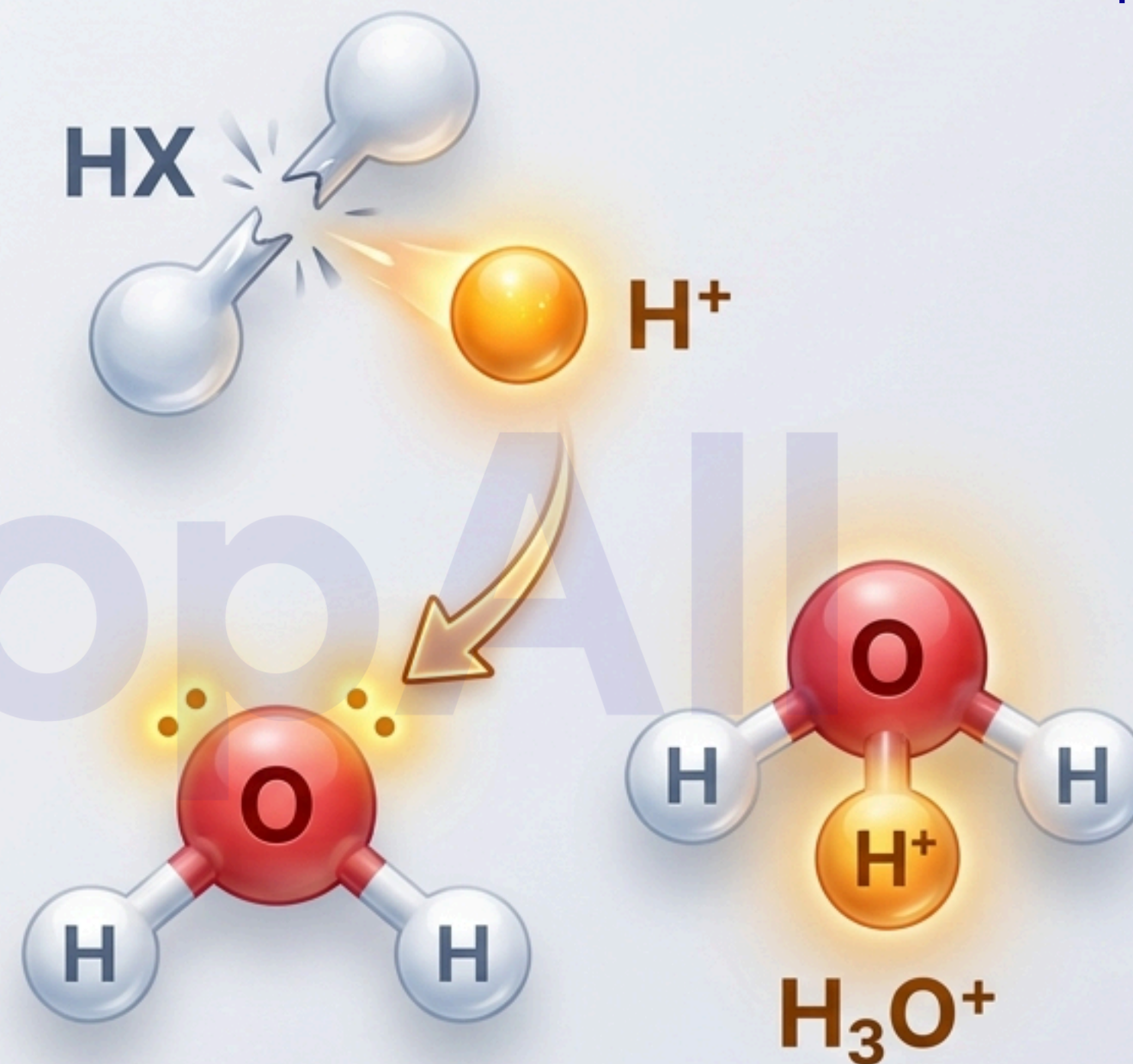
Formula Bank

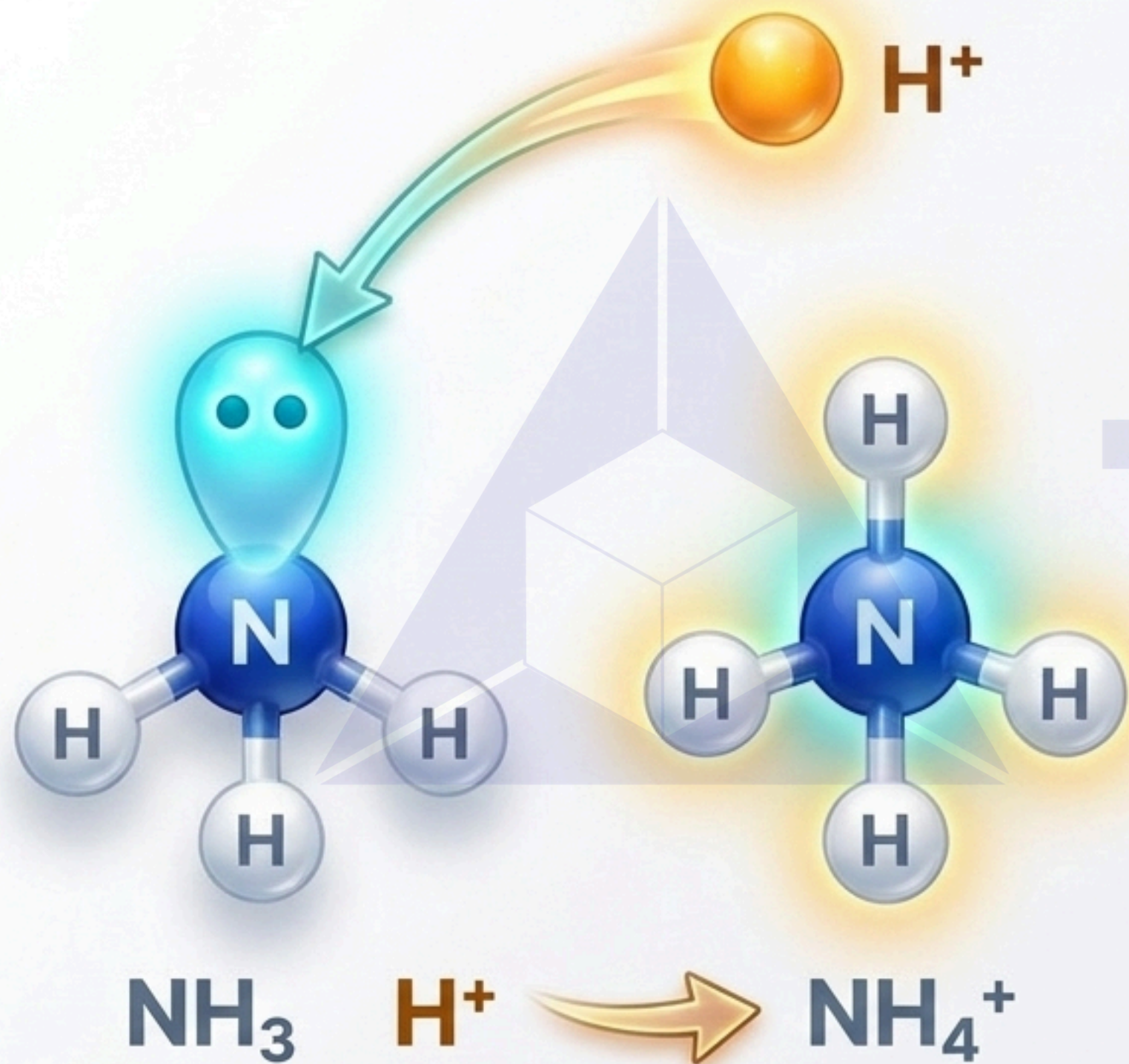
General Dissociation:



Here, HX forces its proton onto water.

- **The 'Bare Proton':** An H^+ ion is a bare proton with a minuscule size ($\sim 10^{-15}$ m radius) and intense electric field. It cannot exist freely in aqueous solutions.
- **Hydration:** It instantly binds to a water molecule's lone pair to give a trigonal pyramidal Hydronium Ion (H_3O^+).





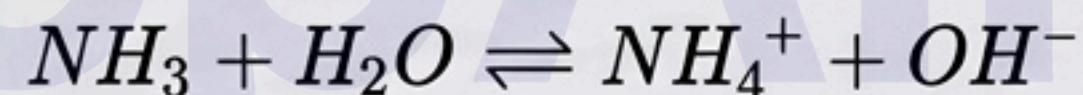
The Brønsted Base

The Proton Acceptor

A Brønsted Base is any species capable of accepting a hydrogen ion (H^+), bypassing the Arrhenius limitation of requiring an OH^- group.

Formula Bank

General Reaction:



Here, Ammonia (NH_3) catches a proton from water.

- **The Requirement:** To accept a proton, the base must have at least one lone pair of electrons (e.g., the Nitrogen in ammonia).
- **Broader Scope:** This explains why species like NH_3 act as bases despite having zero hydroxyl groups to give.



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Conjugate Acid-Base Pairs

Difference of exactly one proton (H^+)

Every reaction is a **two-way street**. When an acid donates, it becomes a base. When a base accepts, it becomes an acid.

Conjugate Base

- Formed when an **Acid donates** a proton.
- Has **one less** H^+ than its acid.
- Example: F^- is the conjugate base of HF .
- Example: SO_4^{2-} is the conjugate base of HSO_4^- .

Conjugate Acid

- Formed when a **Base accepts** a proton.
- Has **one extra** H^+ than its base.
- Example: NH_4^+ is the conjugate acid of NH_3 .
- Example: H_2O is the conjugate acid of OH^- .

Exam Snapshot

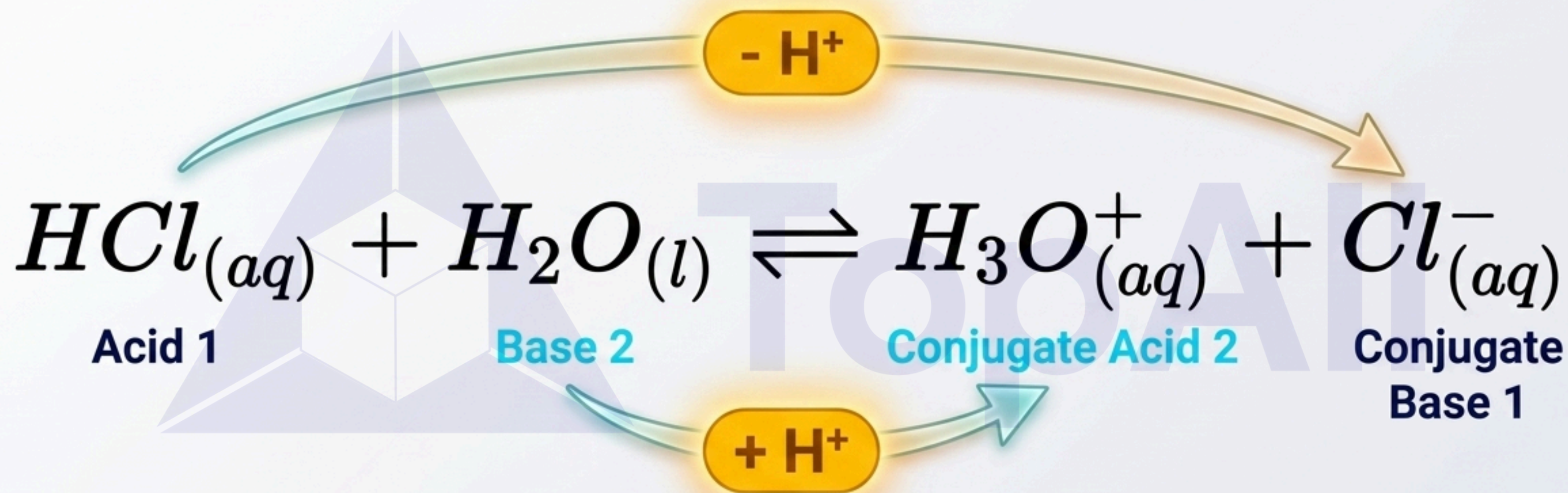
The Inverse Strength Rule (Highly Tested)

- Strong Acid $\rightarrow$ Very Weak Conjugate Base (e.g., $HCl \rightarrow Cl^-$)
- Strong Base $\rightarrow$ Very Weak Conjugate Acid

If an acid easily throws away a proton, its resulting conjugate base will be terrible at taking it back.

Tracking the Reaction

Example: Hydrochloric Acid in Water



- Pair 1: HCl / Cl^- (Differs by exactly one H^+)
- Pair 2: H_2O / H_3O^+ (Differs by exactly one H^+)

Amphiprotic Species

The Shape-Shifters (e.g., Water)

Some species (like H_2O , HCO_3^- , HSO_4^-) can act as both an acid and a base, depending on the chemical environment.

Water as a Base (Receiver)

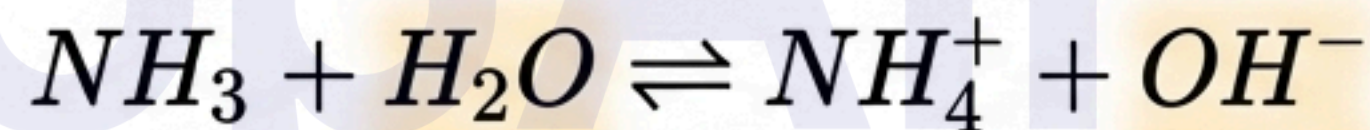
Reacting with an Acid (HCl):



Water accepts a proton to become Hydronium.

Water as an Acid (Spender)

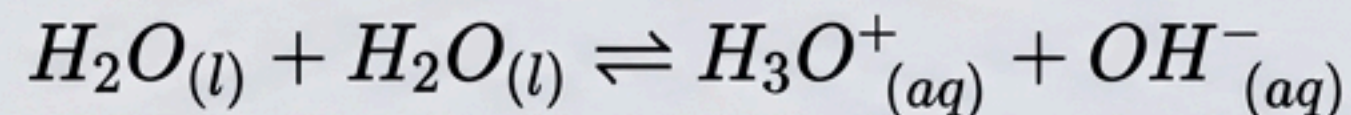
Reacting with a Base (NH_3):



Water donates a proton to become Hydroxide.

Auto-Ionization:

Pure water even reacts with itself!



JEE Trap Alert !

Track the Movement, Not the Formula

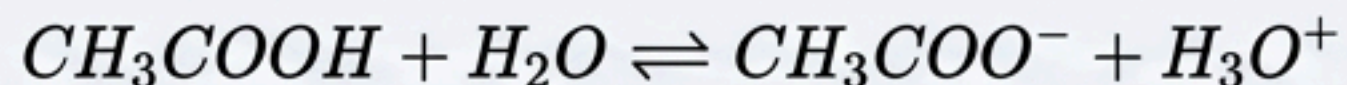
The Trap: Assuming any compound with an 'OH' in its formula will act as a base, or any compound with an 'H' is strictly an acid.

The Reality: The ultimate role of a species is defined purely by whether it gave away an H^+ or caught one in a specific reaction.

The 'OH' Illusion

CH_3COOH (Acetic Acid)

- **Illusion:** Ends in OH . Must be a base?
- **Reality:** In water, it donates the H^+ attached to the oxygen. It is a Brønsted Acid.



The 'H' Illusion

HCO_3^- (Bicarbonate)

- **Illusion:** Starts with H . Must just be an acid?
- **Reality:** It is Amphoteric. It can donate H^+ (becoming CO_3^{2-}) OR accept H^+ (becoming H_2CO_3).

Key Takeaways:

Always draw the reaction. Overcome the Arrhenius mindset. Follow the proton transaction.



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