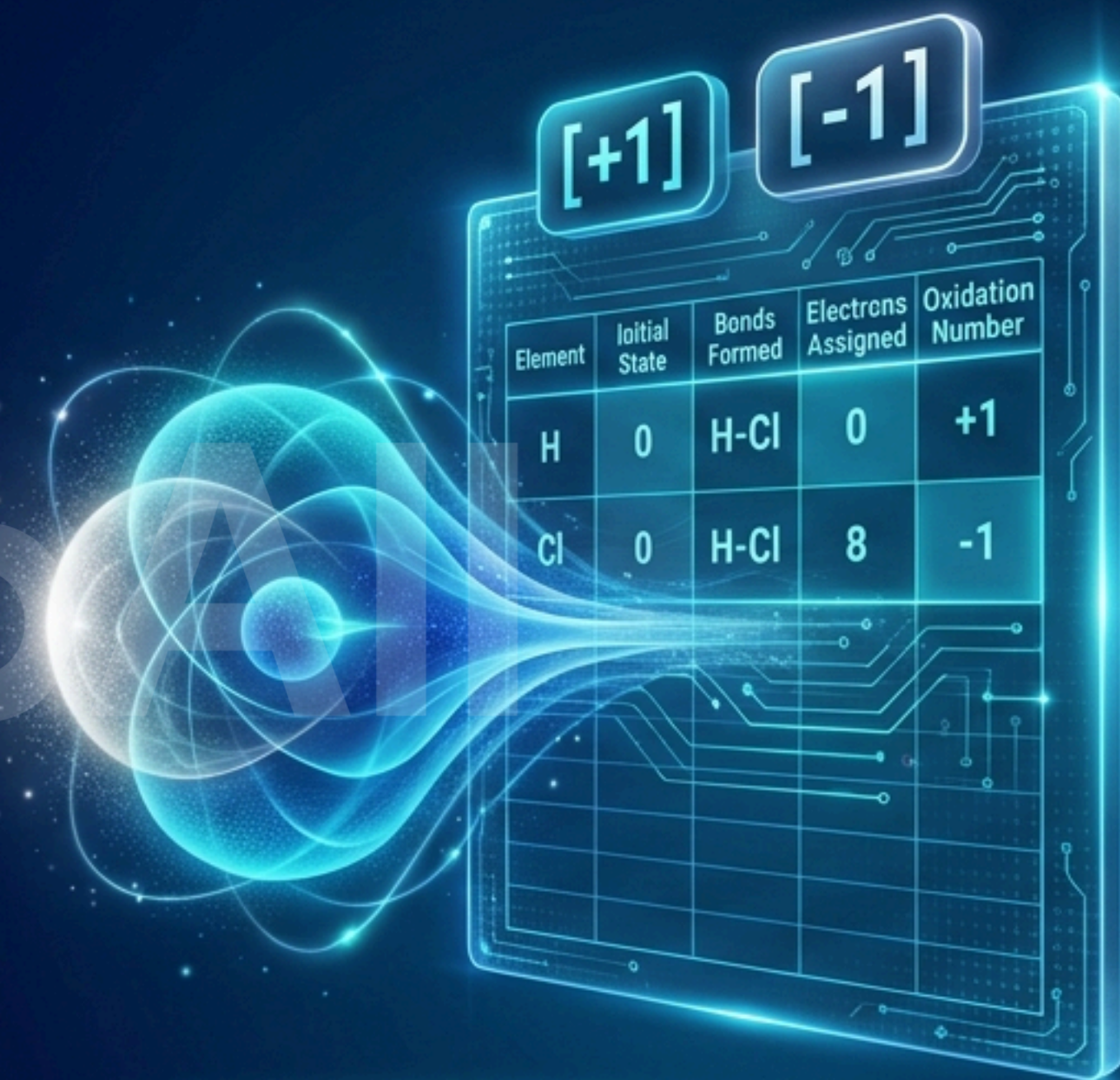


UNIT 7 • REDOX REACTIONS

Oxidation Number: The Chemist's Bookkeeping Tool

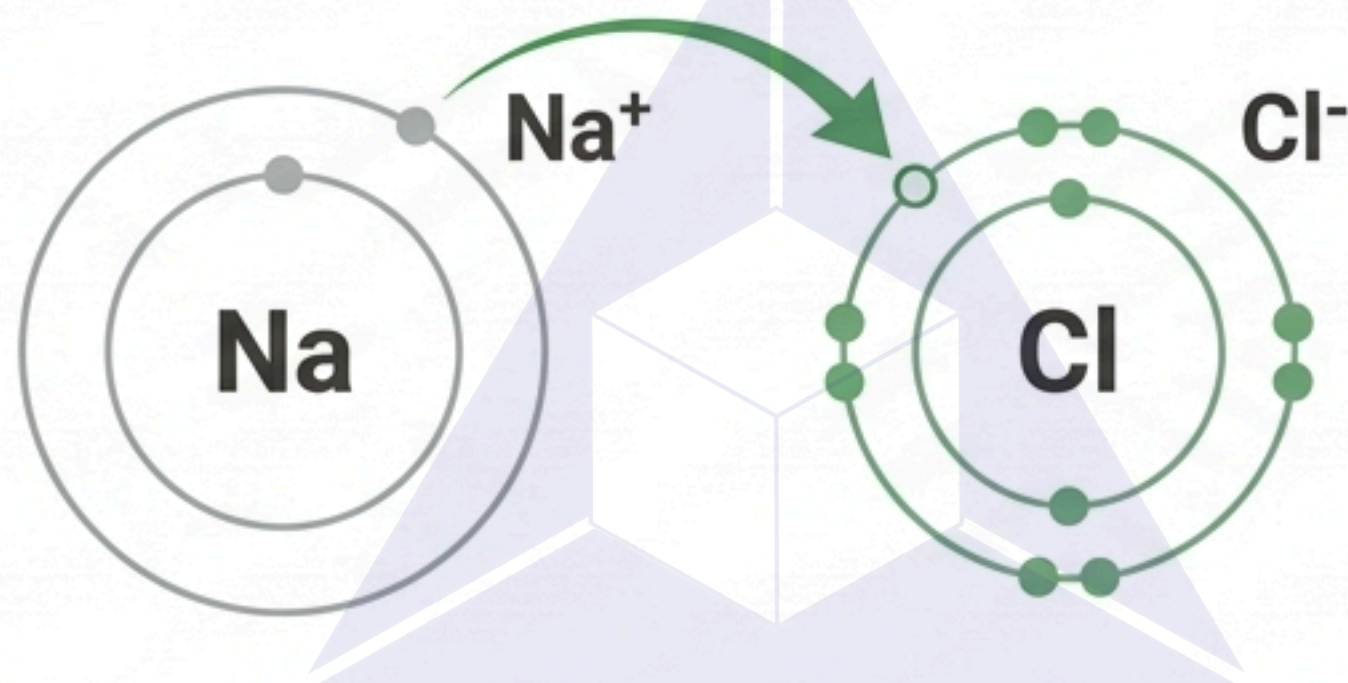
Tracking electron shifts in covalent bonds
using the complete transfer assumption.



Element	Initial State	Bonds Formed	Electrons Assigned	Oxidation Number
H	0	H-Cl	0	+1
Cl	0	H-Cl	8	-1

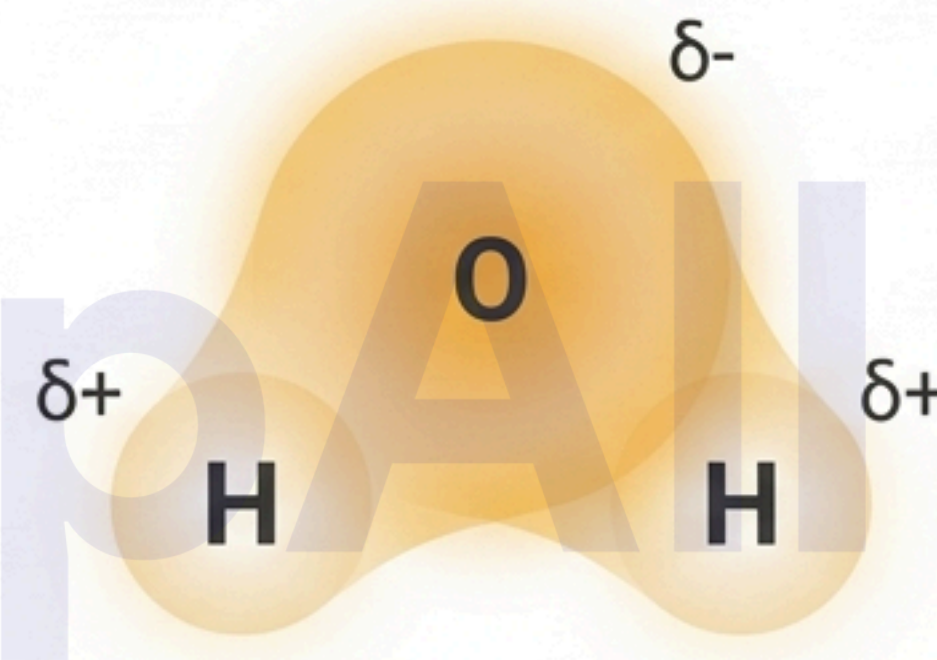
The Covalent Conundrum

Ionic Compounds (e.g., NaCl)



Real charges exist (Na^+ , Cl^-).
Redox is easy to see and track.

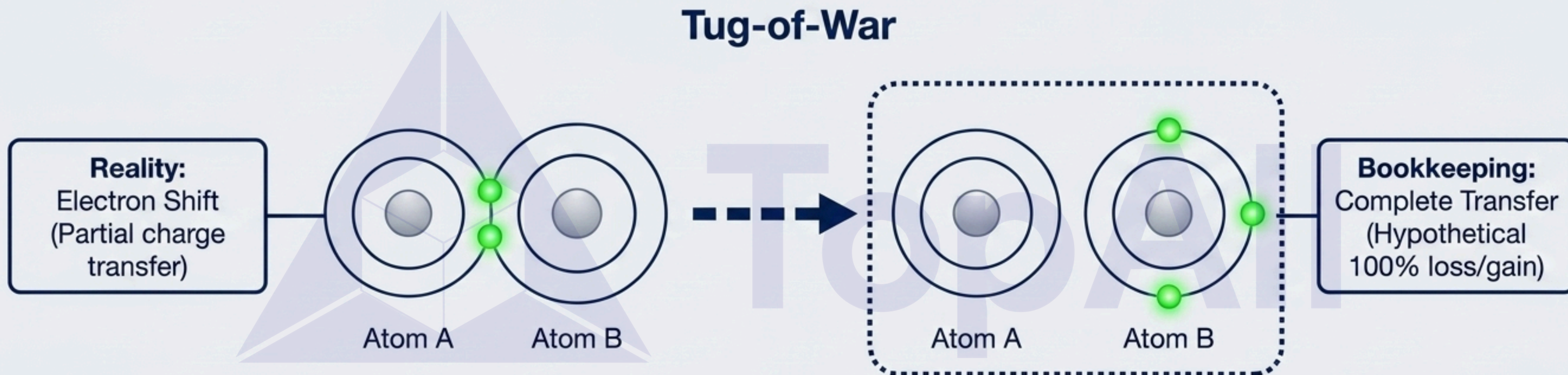
Covalent Compounds (e.g., H_2O)



No complete loss or gain. Only partial charges.
How do we define oxidation here?

The Solution: We need a tracking system—a mathematical model to keep tabs on these partial electron shifts.

The Core Bookkeeping Assumption



Formula Bank

The Rule: It is always assumed that there is a complete transfer of the electron pair from the less electronegative atom to the more electronegative atom.



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$$E=mc^2$$



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Key Highlights

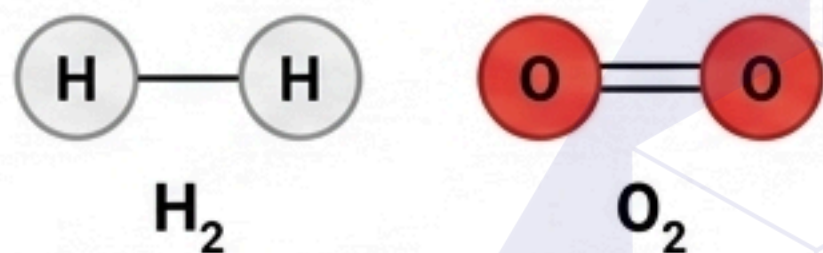
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Transaction 1: The Formation of Water



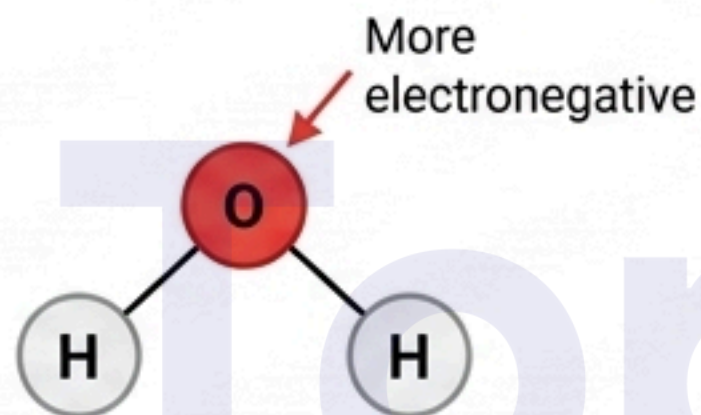
Start State



Ledger: Pure elements

[0] [0]

Applying the Rule



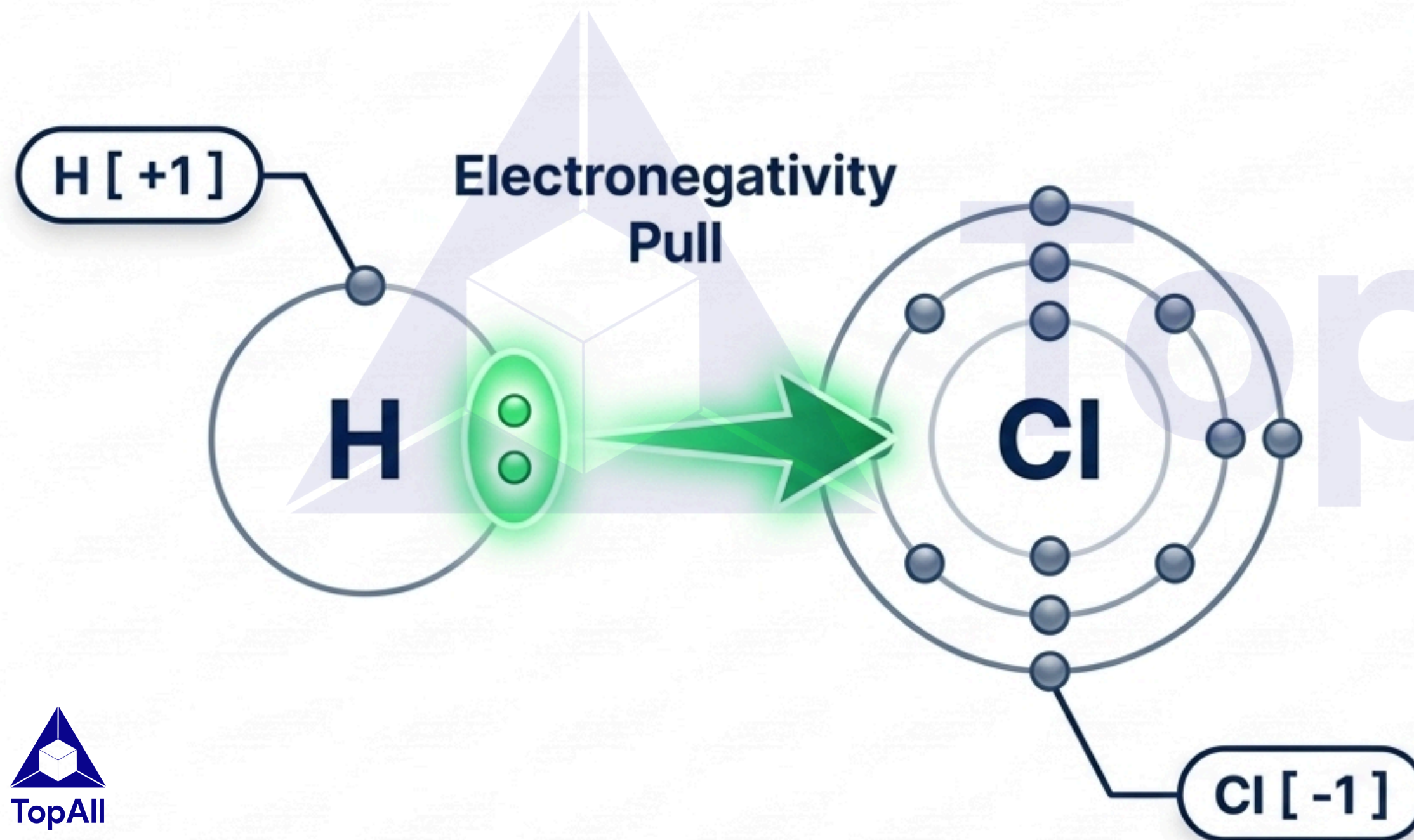
Oxygen hypothetically "takes" the shared electron from both Hydrogens.

Final Ledger

1	Hydrogen:	[+1]	(Oxidized)
2	Oxygen:	[-2]	(Reduced)

Even though H_2O is covalent, assigning hypothetical charges allows us to cleanly track exactly what was oxidized and reduced.

Transaction 2: Hydrogen Chloride



Exam Snapshot

Concept: Halogens (Cl, Br, I) have an oxidation number of -1 when paired with less electronegative elements (like H).

Crucial Exception: When paired with Oxygen (which is more electronegative), halogens will have positive oxidation numbers. The ledger flips!

Transaction 3: The Carbon Inversion



Reactant: **Methane (CH₄)**

Carbon is more electronegative than Hydrogen. Carbon “takes” 4 electrons.

Product: **Carbon Tetrachloride (CCl₄)**

Carbon is less electronegative than Chlorine. Carbon “loses” 4 electrons.

C Ledger: [-4]



C Ledger: [+4]

The oxidation state of an element depends entirely on its bonding environment. Here, Carbon’s ledger swung from -4 all the way to +4.

The Ultimate Proof: Fractional Oxidation States

JEE Trap Alert

The Trap: Thinking oxidation number = real physical charge.

The Paradox: We sometimes calculate **fractional numbers** (e.g., Carbon in C_3O_2 is $+4/3$). Electrons cannot be transferred in fractions!

The Reality Matrix

[+2]



[+2]

[0]

$$\frac{(+2 + 0 + 2)}{3} = \left[\frac{+4}{3} \right] \longrightarrow (\text{An Average!})$$

Fractional oxidation states are just statistical averages of multiple atoms in different bonding environments. To find the reality, always draw the structure!



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