

Concept 17

The Atom's Pull on Shared Electrons

Understanding Electronegativity and its Periodic Trends.



The Qualitative Tug-of-War

A qualitative measure of the ability of an atom in a chemical compound to attract shared electrons to itself.



Key Characteristics Checklist



Context-Dependent: Varies depending on the element to which it is bound.



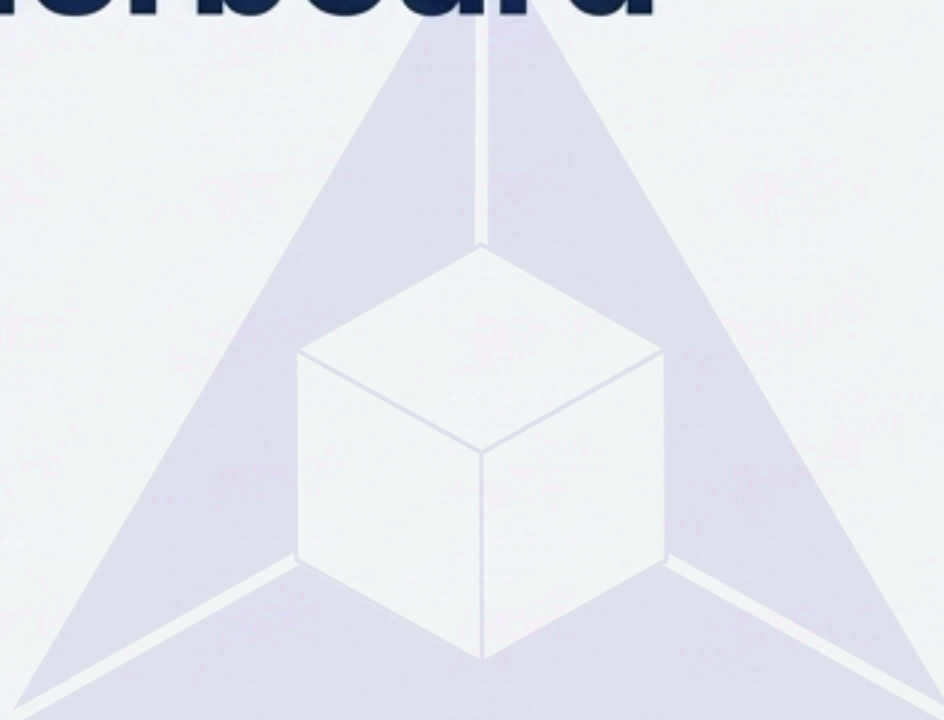
Not a Measurable Quantity: Unlike ionization enthalpy, it is a relative tendency.



Property of Bonded Atoms: Applies exclusively to atoms within a chemical compound.

The Benchmark

The Pauling Scale Leaderboard



Fluorine (F)

4.0

Assigned by Linus Pauling (1922)
as the ultimate standard.

Oxygen (3.5)

Nitrogen (3.0)

Nitrogen (3.0)

Carbon (2.5)

Lithium (1.0)

Note: Other scales exist (Mulliken-Jaffe, Allred-Rochow), but the Pauling scale remains the standard benchmark.



**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



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Across a Period: The Pull Intensifies

Li
(1.0)

Be
(1.5)

B
(2.0)

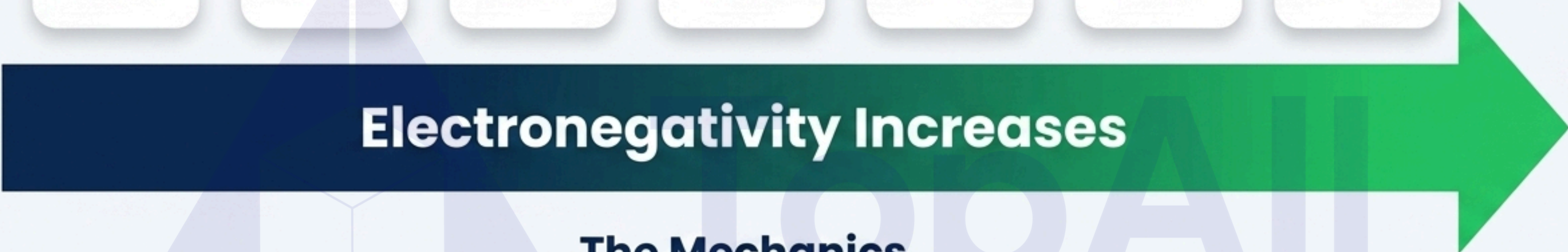
C
(2.5)

N
(3.0)

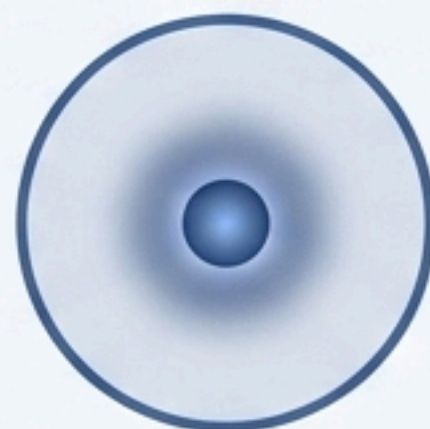
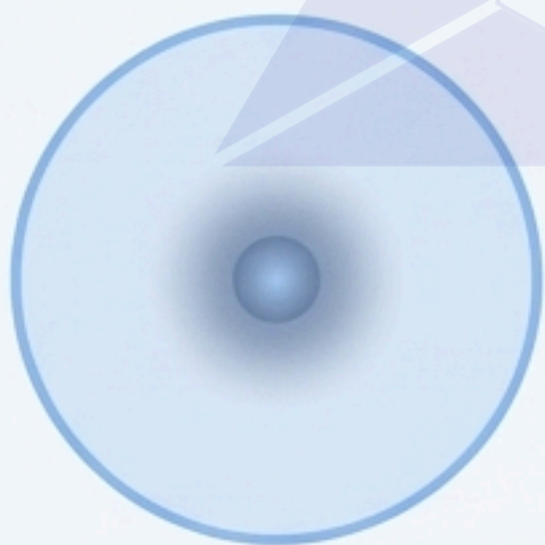
O
(3.5)

F
(4.0)

Electronegativity Increases



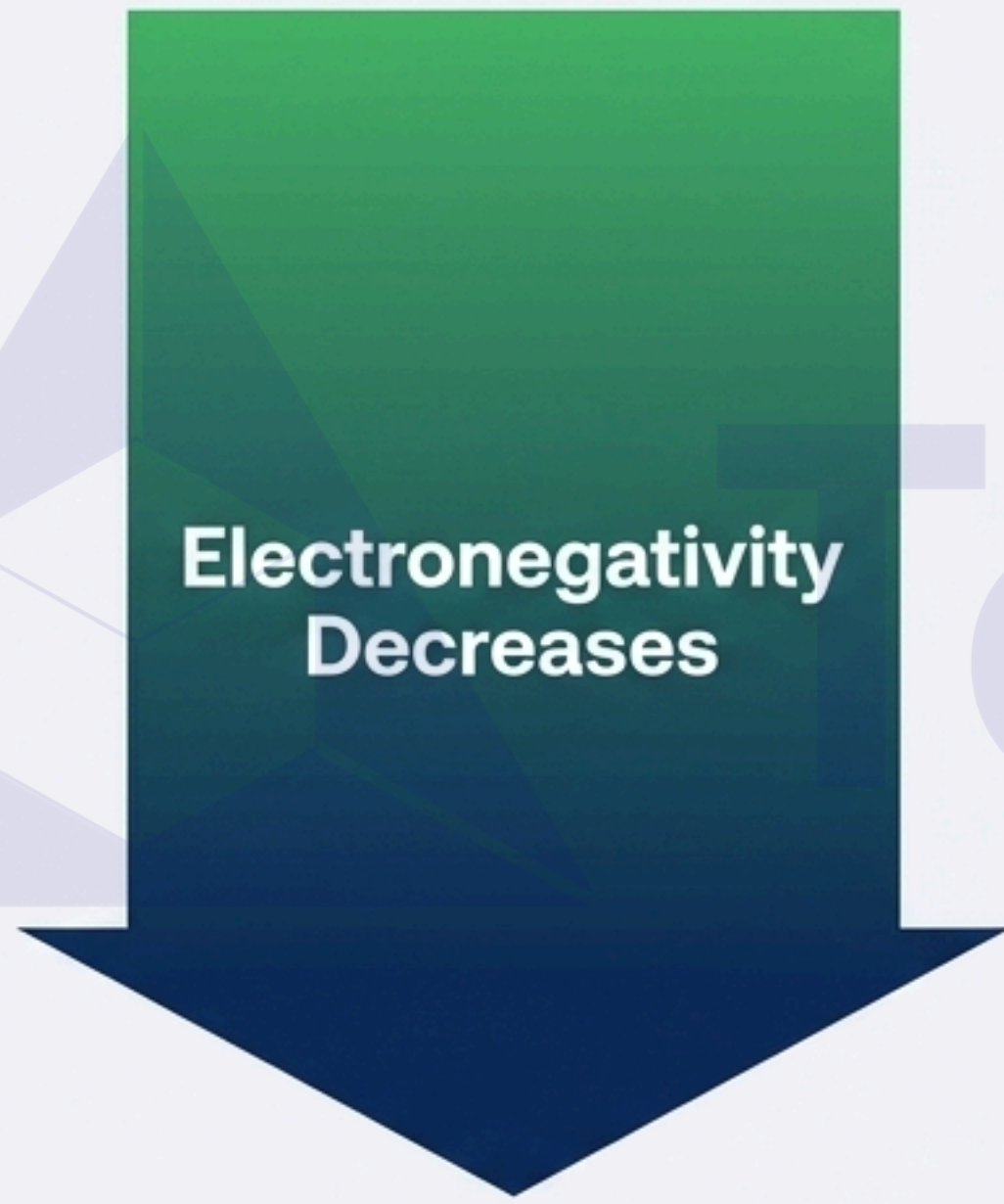
The Mechanics



As atomic radius decreases across a period, the effective nuclear charge increases, intensifying the attraction between outer electrons and the nucleus.

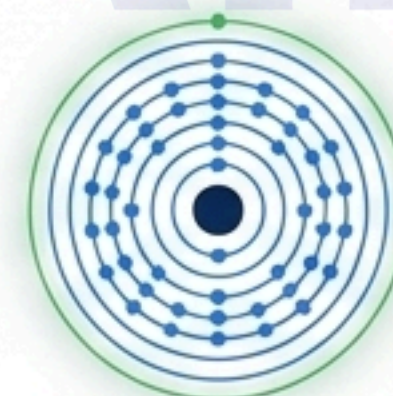
Down a Group: The Pull Weakens

F (4.0)
↓
Cl (3.0)
↓
Br (2.8)
↓
I (2.5)
↓
At (2.2)



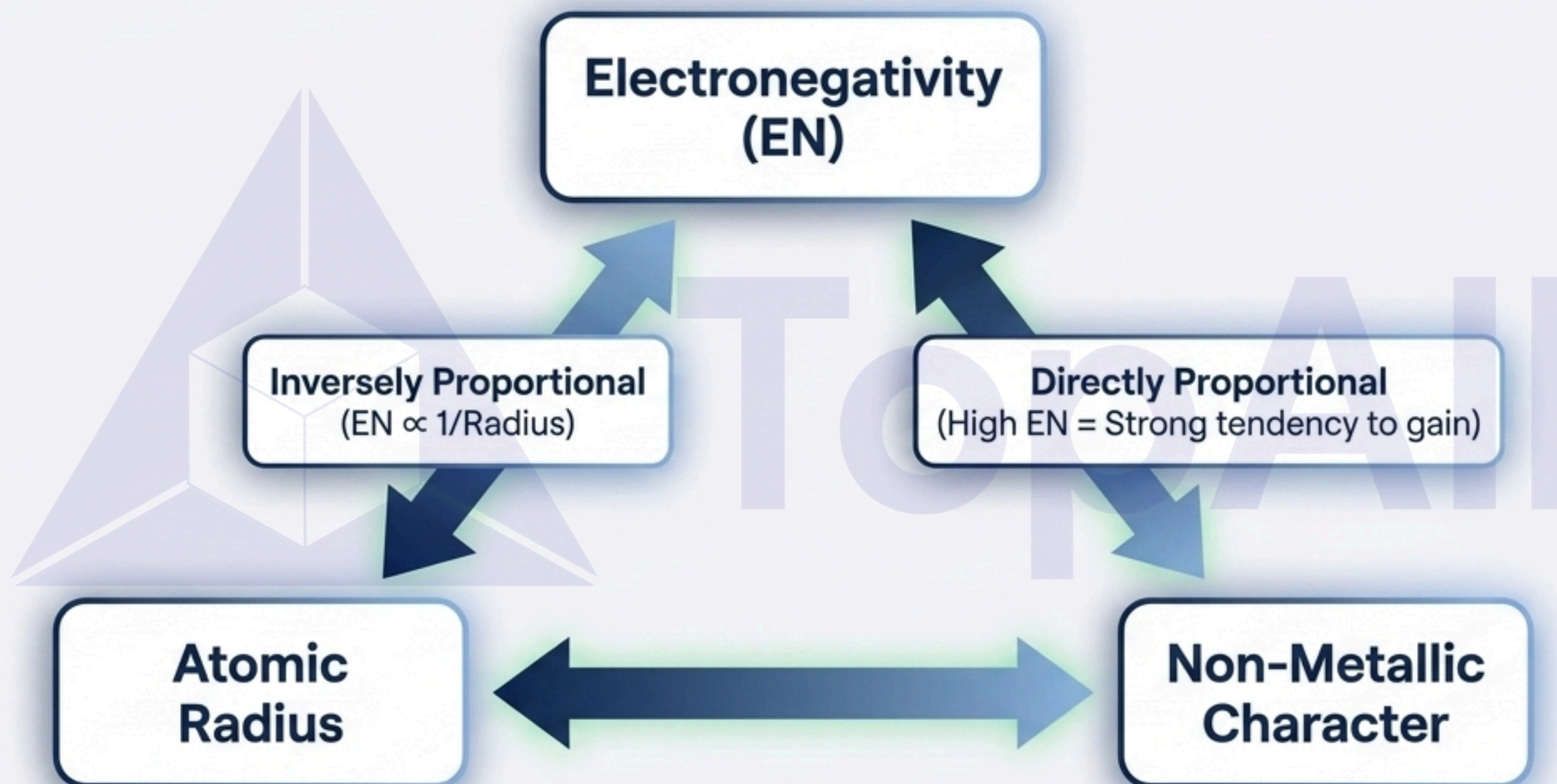
Electronegativity
Decreases

The Mechanics

F**Br****At**

As atomic radius increases down a group, added inner electron shells shield the nucleus, **significantly weakening** its pull on shared outer electrons.

The Grand Periodic Web



These are not separate trends to memorize. They are different expressions of the exact same underlying physics: the effective pull of the nucleus on valence electrons.

Electronegativity vs. Electron Gain Enthalpy ($\Delta_{\text{eg}}H$)

	Electronegativity	Electron Gain Enthalpy ($\Delta_{\text{eg}}H$)
Nature	Qualitative relative tendency.	Quantitative measurable energy change.
Target	Pulls on a shared pair of electrons in a compound.	Adds a single electron to an isolated neutral gaseous atom.
Units	Unitless (Pauling Scale).	Measured in kJ/mol.

CRITICAL: Do not confuse the two! One describes behavior inside a chemical bond; the other describes the thermodynamics of an isolated atom.



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