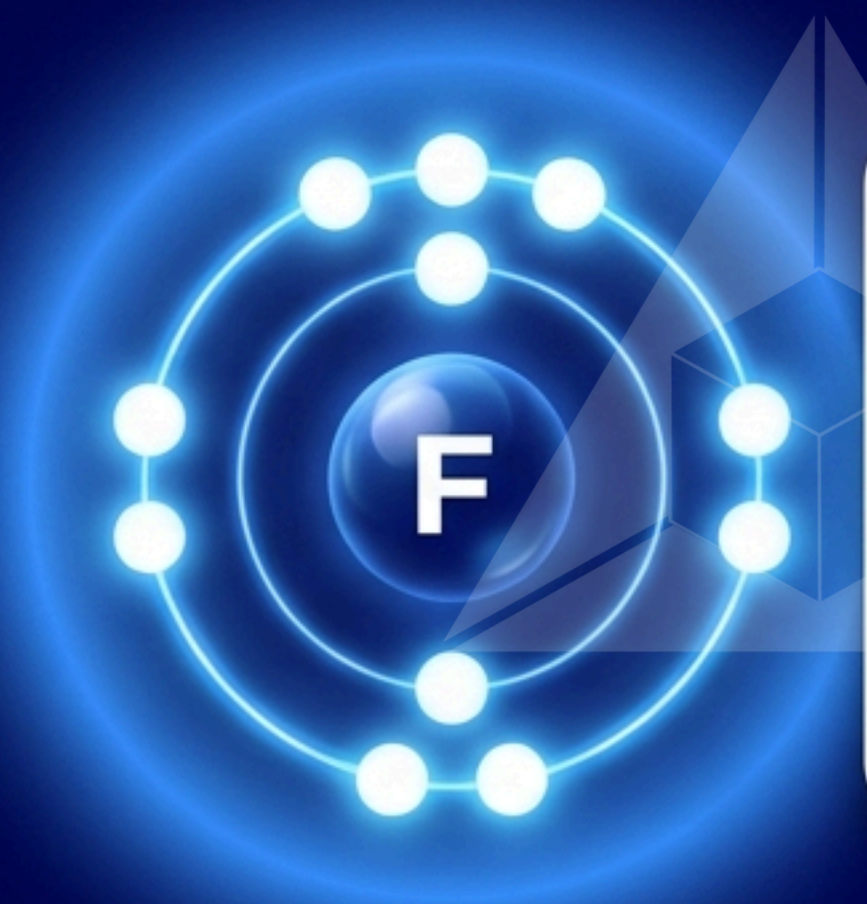


CONCEPT 16



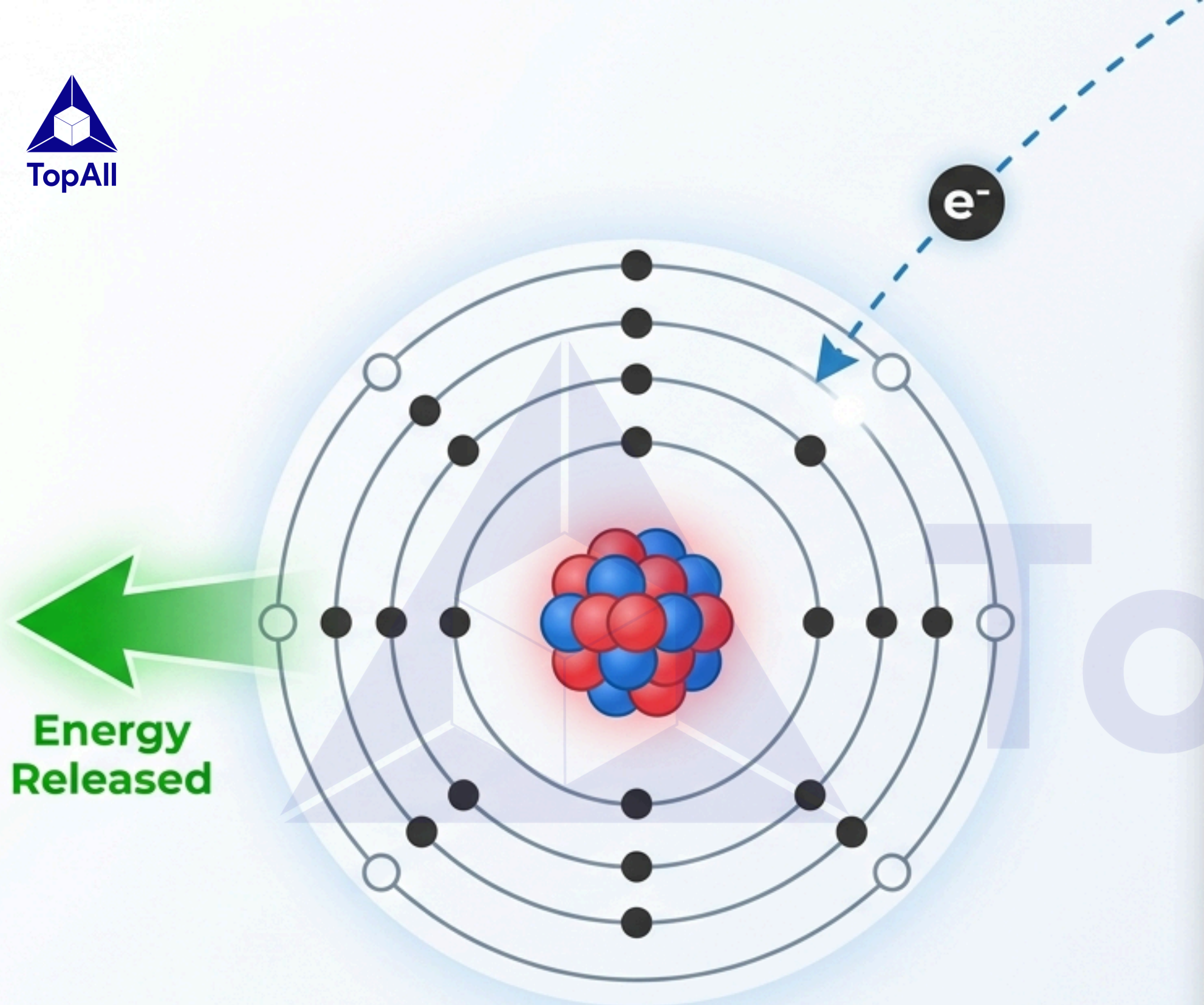
Why Chlorine Beats Fluorine

Unlocking Electron Gain Enthalpy for Advanced Diagnostics



Fluorine is the most electronegative element in the periodic table. So why does Chlorine release more energy when gaining an electron?





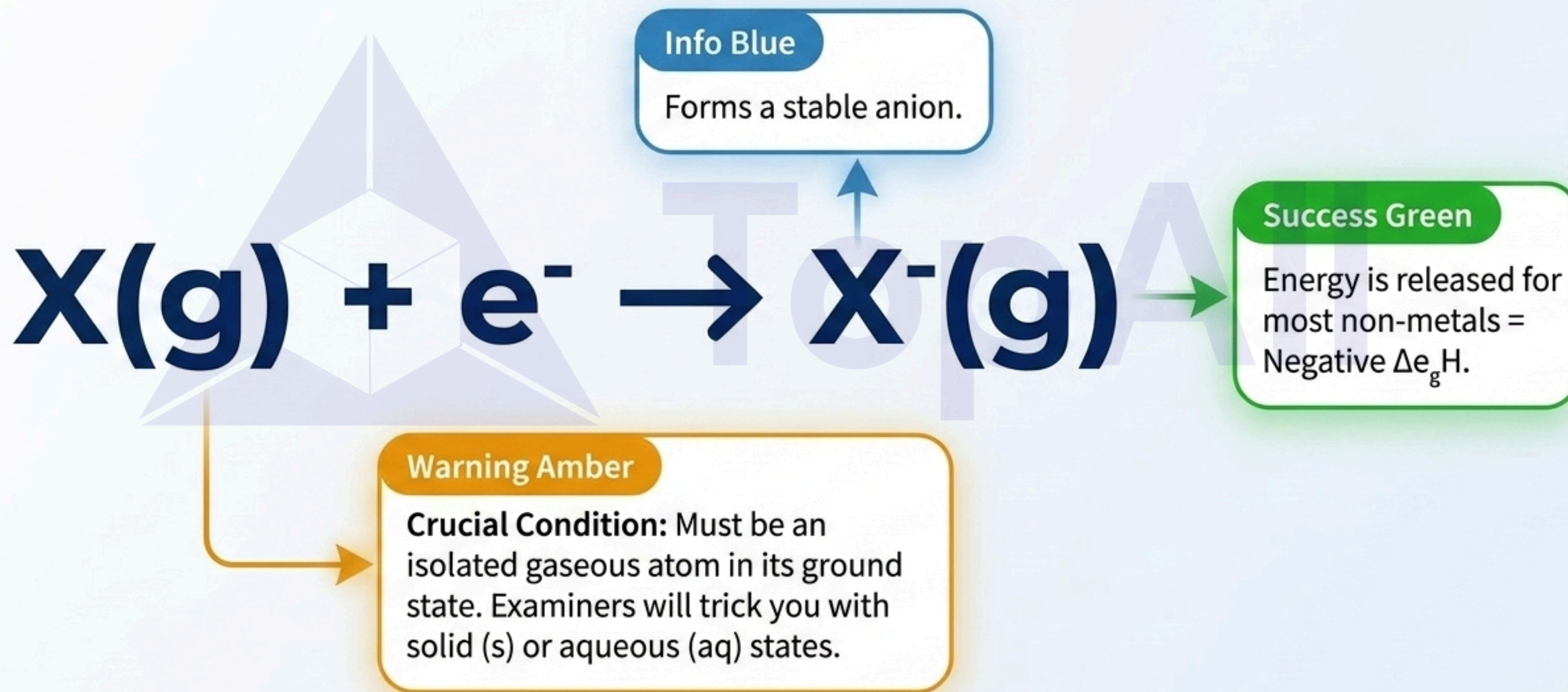
What is Electron Gain Enthalpy?

The enthalpy change ($\Delta_e H$) that accompanies the addition of an electron to a neutral gaseous atom to form a negative ion.

This thermodynamic metric provides a direct measure of the ease with which an atom adds an electron to form an anion.

The Anatomy of the Reaction

Precision matters in chemical thermodynamics.





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

$$E=mc^2$$



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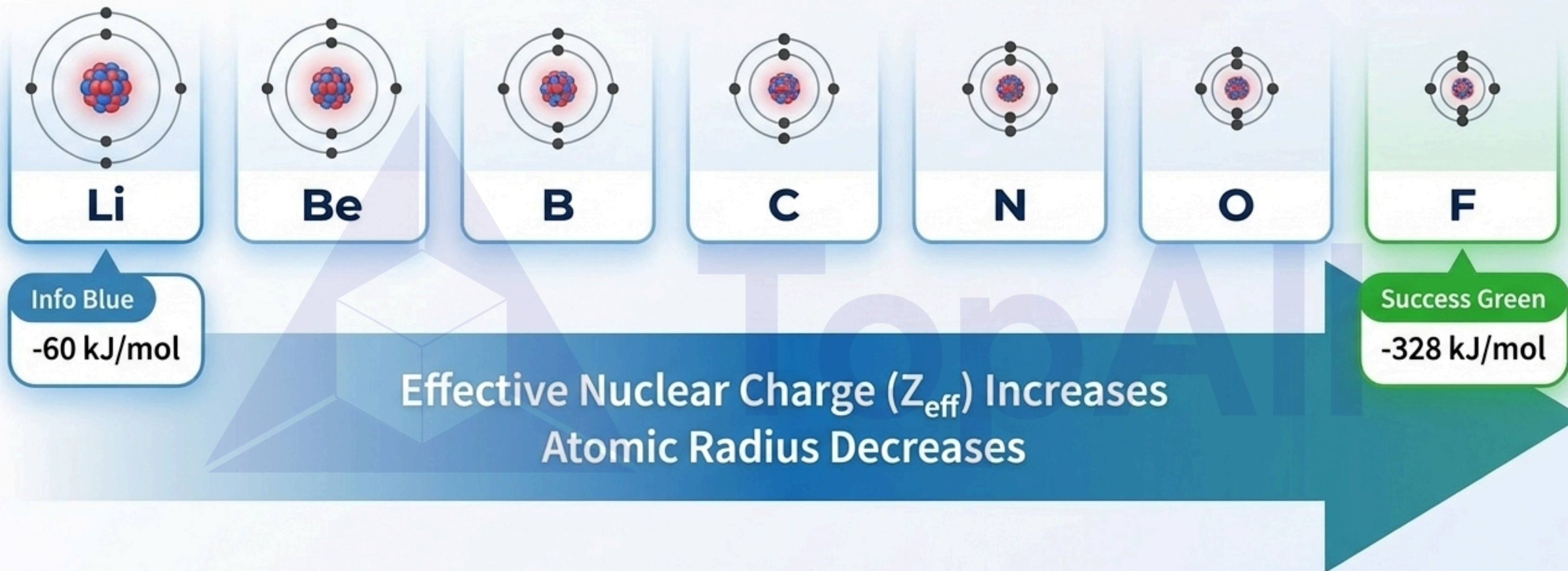
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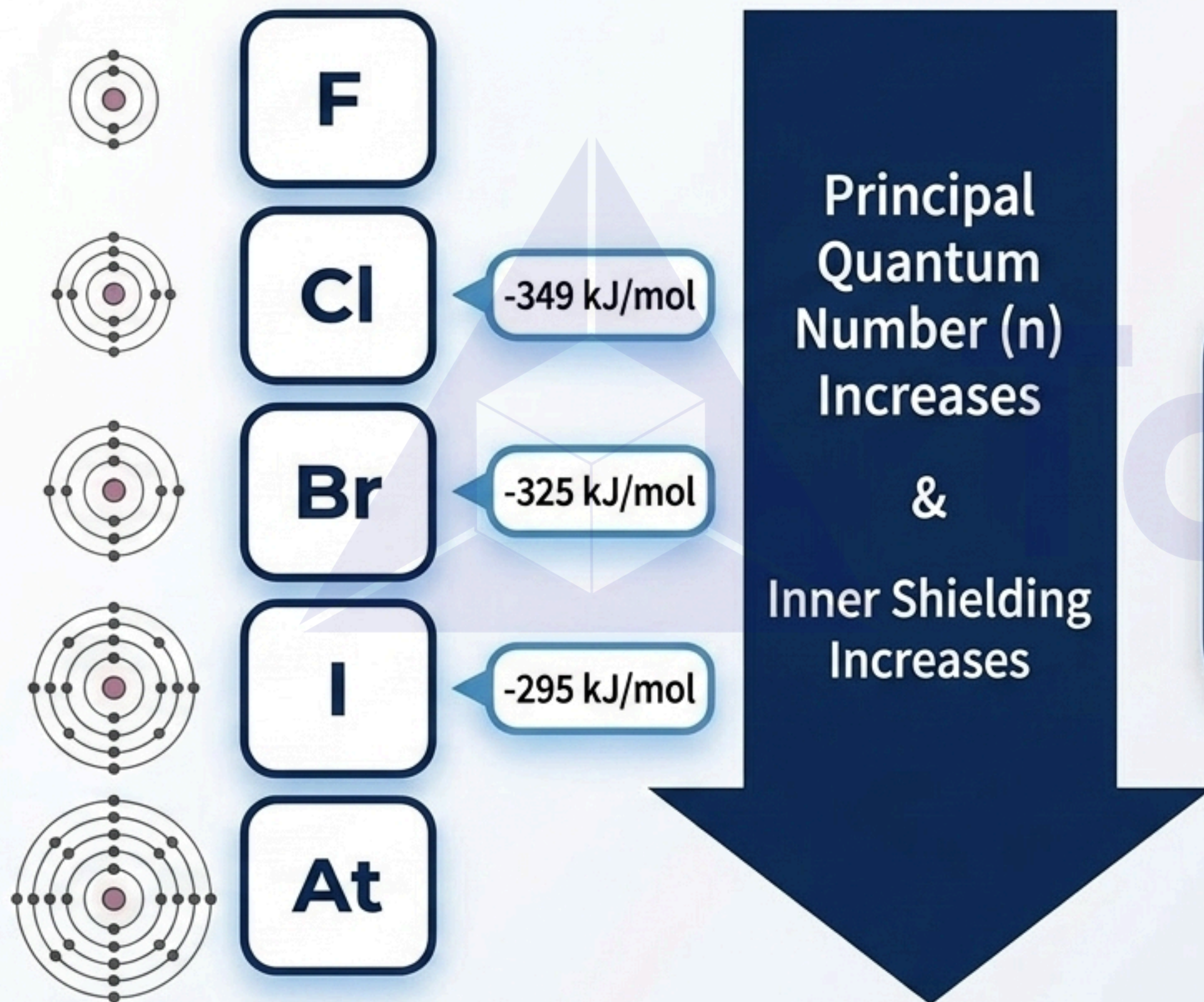


Horizontal Trend: The Pull of the Nucleus



As atoms get smaller and nuclear charge increases, the added electron is pulled closer to the nucleus.
Result: Electron Gain Enthalpy becomes **MORE NEGATIVE** across a period.

Vertical Trend: The Shielding Effect



As atomic size increases down a group, the added electron is further from the nucleus and shielded by inner core electrons.
Result: Electron Gain Enthalpy generally becomes **LESS NEGATIVE**.

EXCEPTION

The Anomaly: Why Chlorine > Fluorine

Fluorine (n=2)



Electron-Electron
Repulsion

$$\Delta_e H = -328 \text{ kJ/mol}$$

Chlorine (n=3)



Spacious
accommodation
/Low Repulsion

$$\Delta_e H = -349 \text{ kJ/mol}$$

When an electron is added to **F**, it enters the extremely **compact** n=2 quantum level, suffering intense repulsion from existing electrons. In **Cl** (n=3), the larger region of space **minimizes repulsion, allowing more energy to be released.**

Sign Convention: Enthalpy vs. Affinity

Don't lose crucial marks to a minus sign.

$\Delta_e H$ (Electron Gain Enthalpy)



A **Thermodynamic** convention. If energy is released during the addition of an electron, the sign is **NEGATIVE (-)**.

A_e (Electron Affinity)



An **Absolute value** convention. If energy is released during the addition of an electron, the affinity is **POSITIVE (+)**.

$$\Delta_e H = -A_e - 5/2RT$$



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