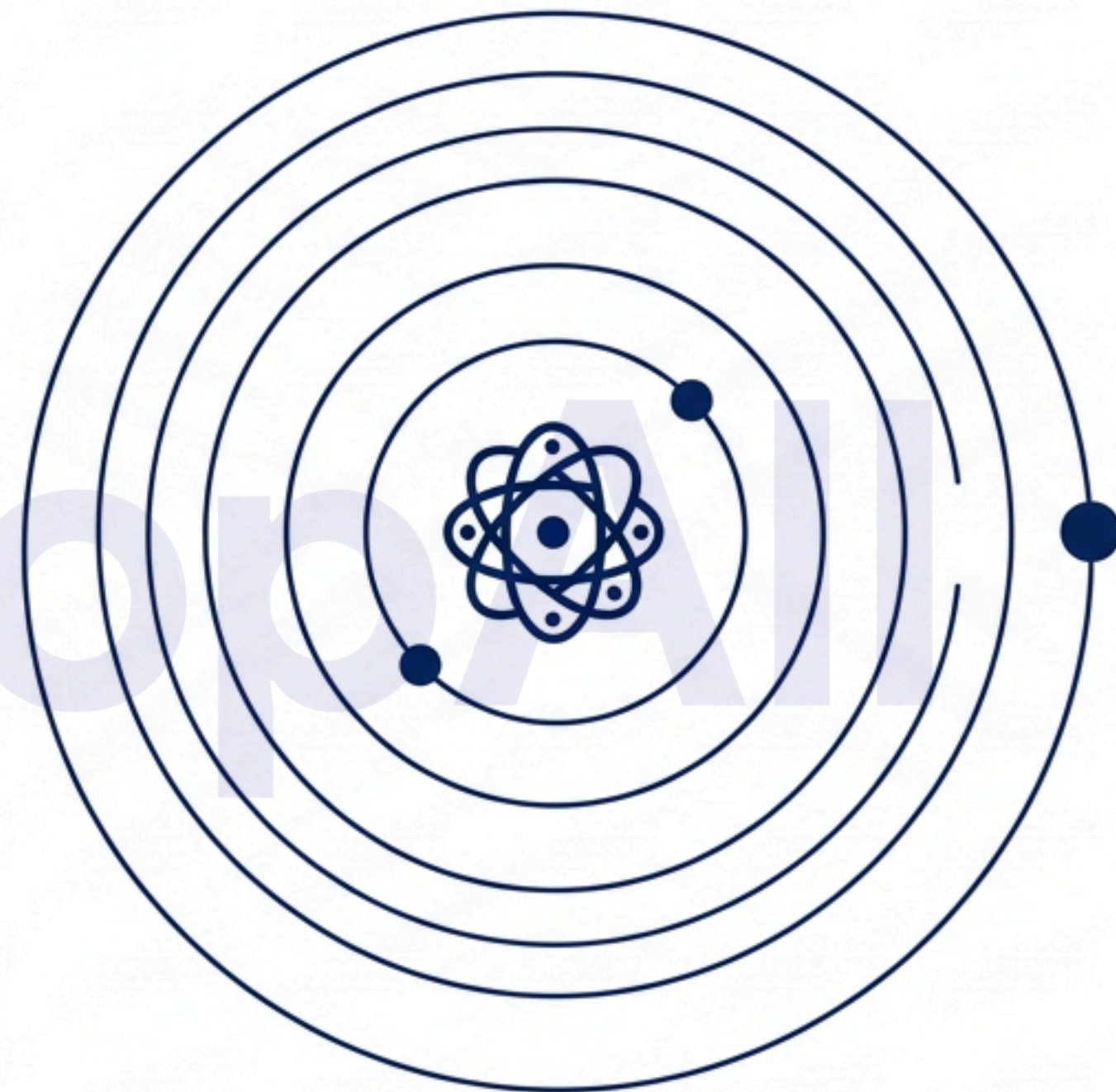
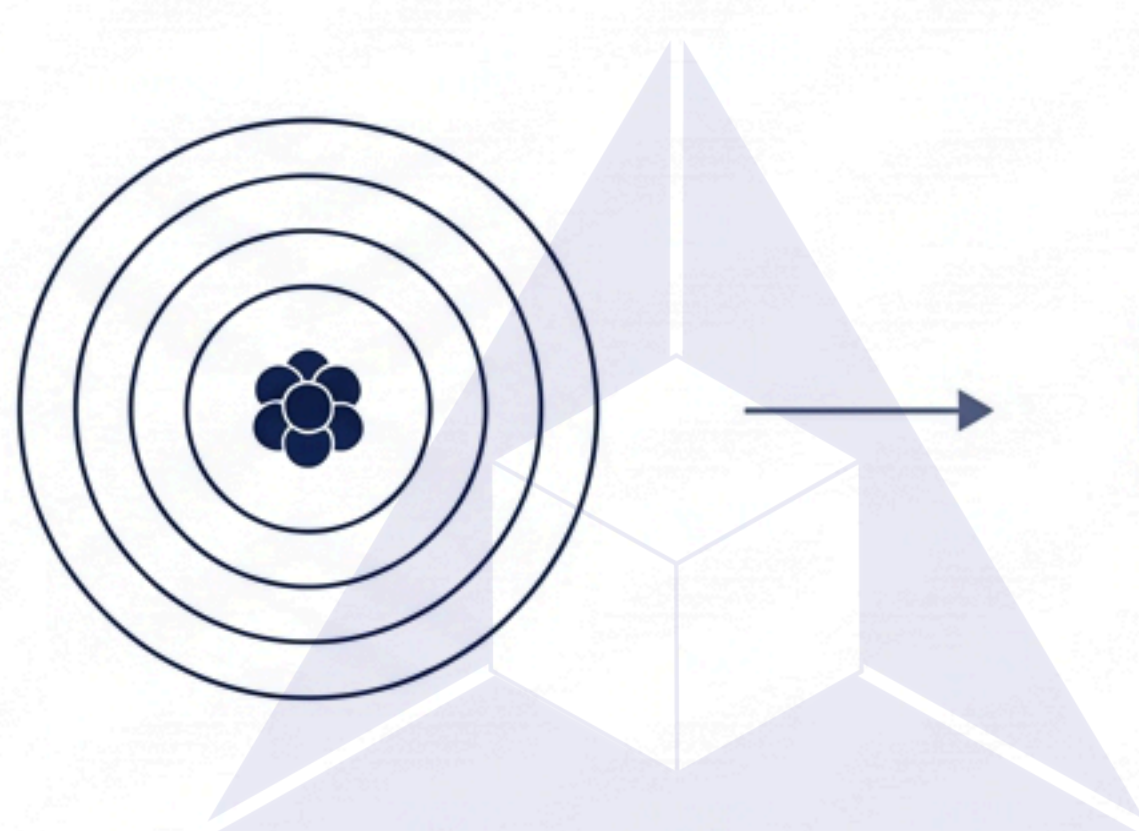


When Atoms Accept Electrons

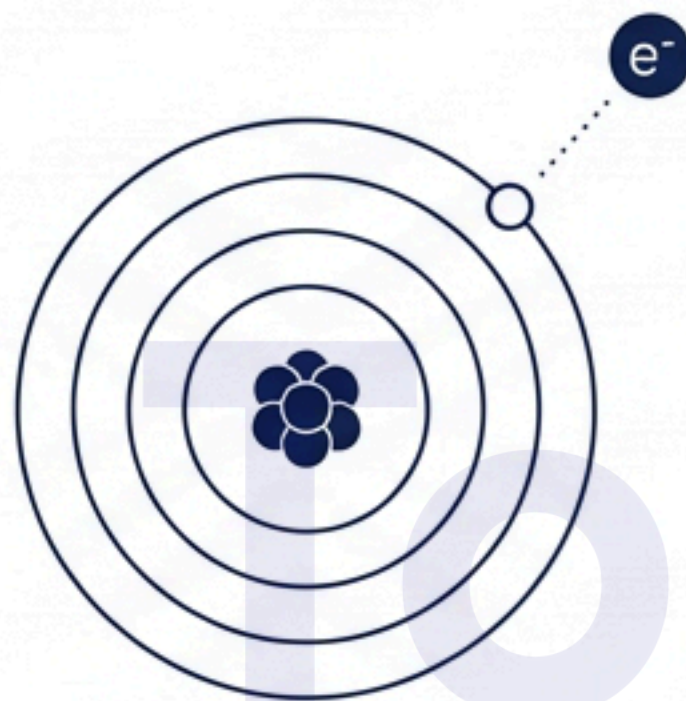
Understanding Electron
Gain Enthalpy ($\Delta e_g H$)



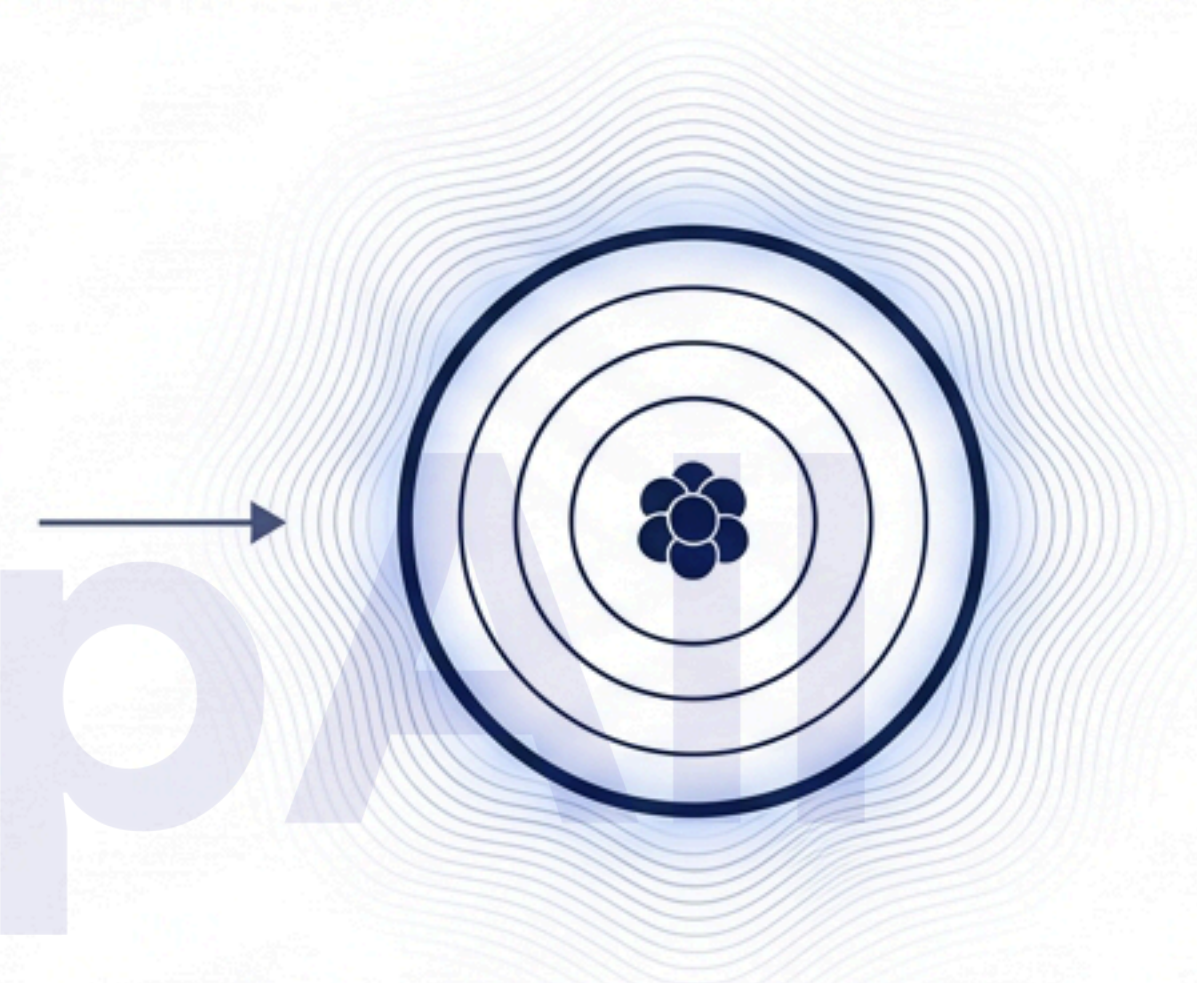
What is Electron Gain Enthalpy?



Step 1: Neutral Gaseous Atom



Step 2: Electron Added



Step 3: Anion Formed + Enthalpy Change

It is a quantitative measure of the ease with which an atom adds an electron to form an anion.

The Chemical Equation



Neutral atom in an isolated gaseous ground state.

$X(g)$

+

e^-

$\rightarrow$

$X^-(g)$

Enthalpy change ($\Delta_e H$) occurs here (measured in kJ mol^{-1}).

The added electron.

The resulting gaseous anion.

The Energy Balance: Negative vs. Positive



Negative Enthalpy (Energy Released)

- **Process:** Exothermic.
- **Mechanism:** Energy is released when the electron is added.
- **Meaning:** The atom actively wants the electron.



Positive Enthalpy (Energy Supplied)

- **Process:** Endothermic.
- **Mechanism:** Energy must be forced or supplied to add the electron.
- **Meaning:** The atom strongly resists the new electron.



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$$E=mc^2$$



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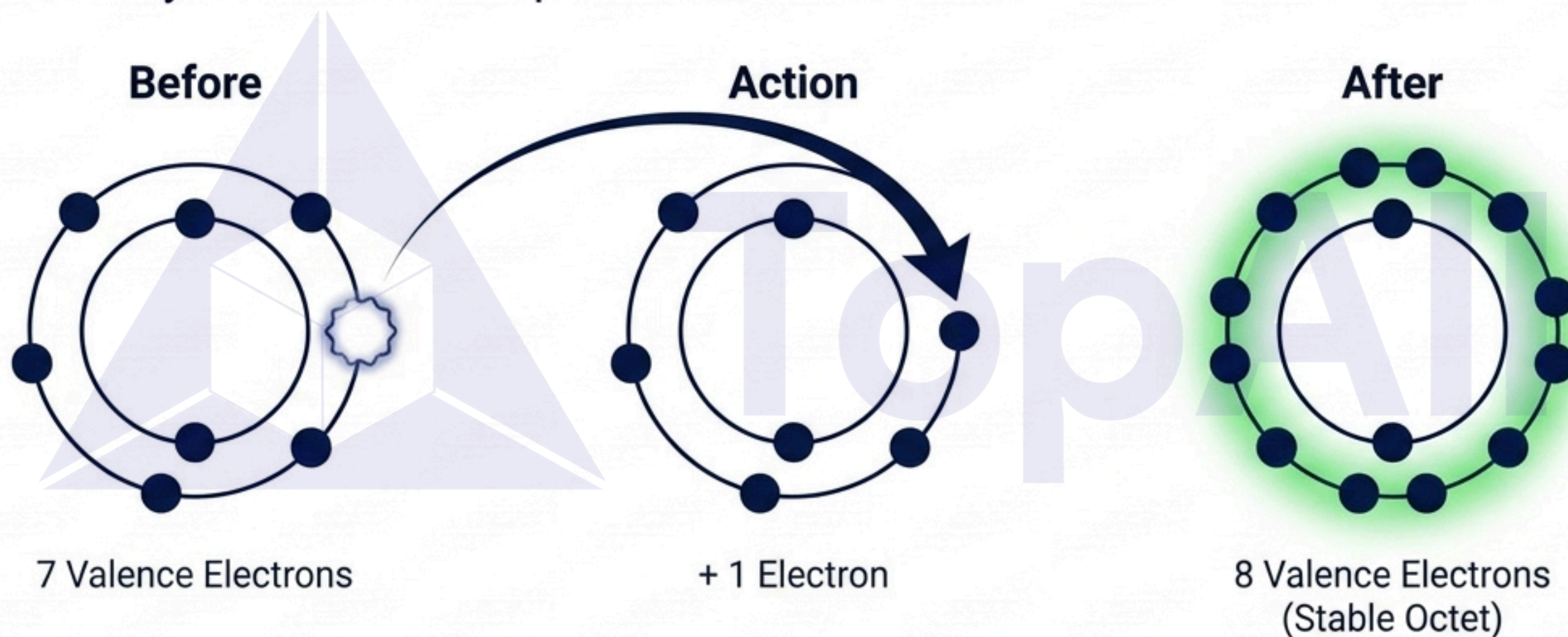


The Halogens: Eager to Accept

Group 17

Stable Configuration

Group 17 elements have highly negative electron gain enthalpies because they are exactly one electron away from structural perfection.

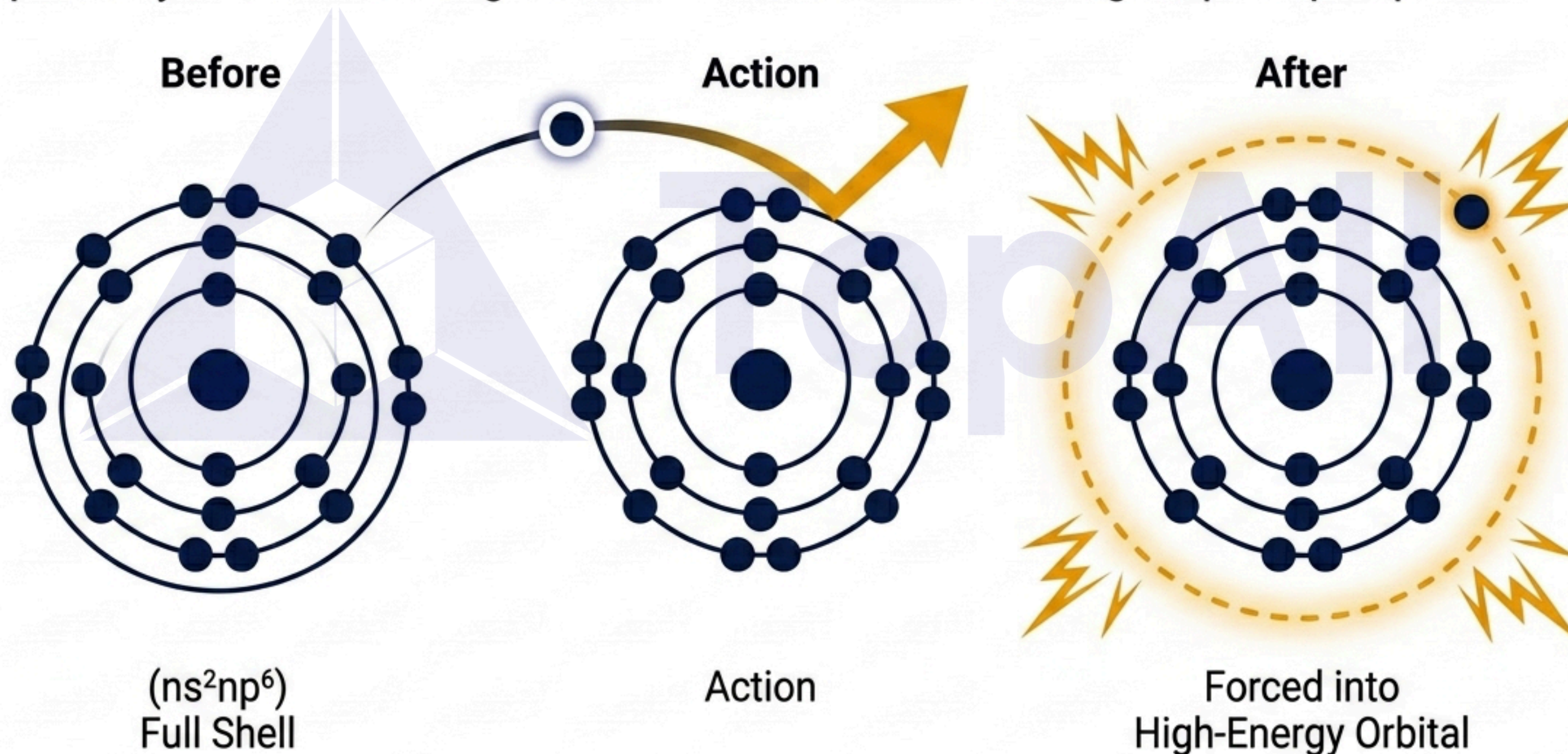


Adding one electron allows them to attain a highly stable, closed-shell noble gas electronic configuration.

Noble Gases: Forced Entry

Highly Unstable State

Noble gases exhibit large positive electron gain enthalpies. Because their valence shells are already perfectly full, an incoming electron must enter the next higher principal quantum level.



Electron Gain Enthalpies (kJ mol^{-1})

Group 1	Group 16	Group 17	Group 0
H (-73)			He (+48)
Li (-60)	O (-141)	F (-328)	Ne (+116)
Na (-53)	S (-200)	Cl (-349)	Ar (+96)
K (-48)	Se (-195)	Br (-325)	Kr (+96)
Rb (-47)	Te (-190)	I (-295)	Xe (+77)
Cs (-46)	Po (-174)	At (-270)	Rn (+68)

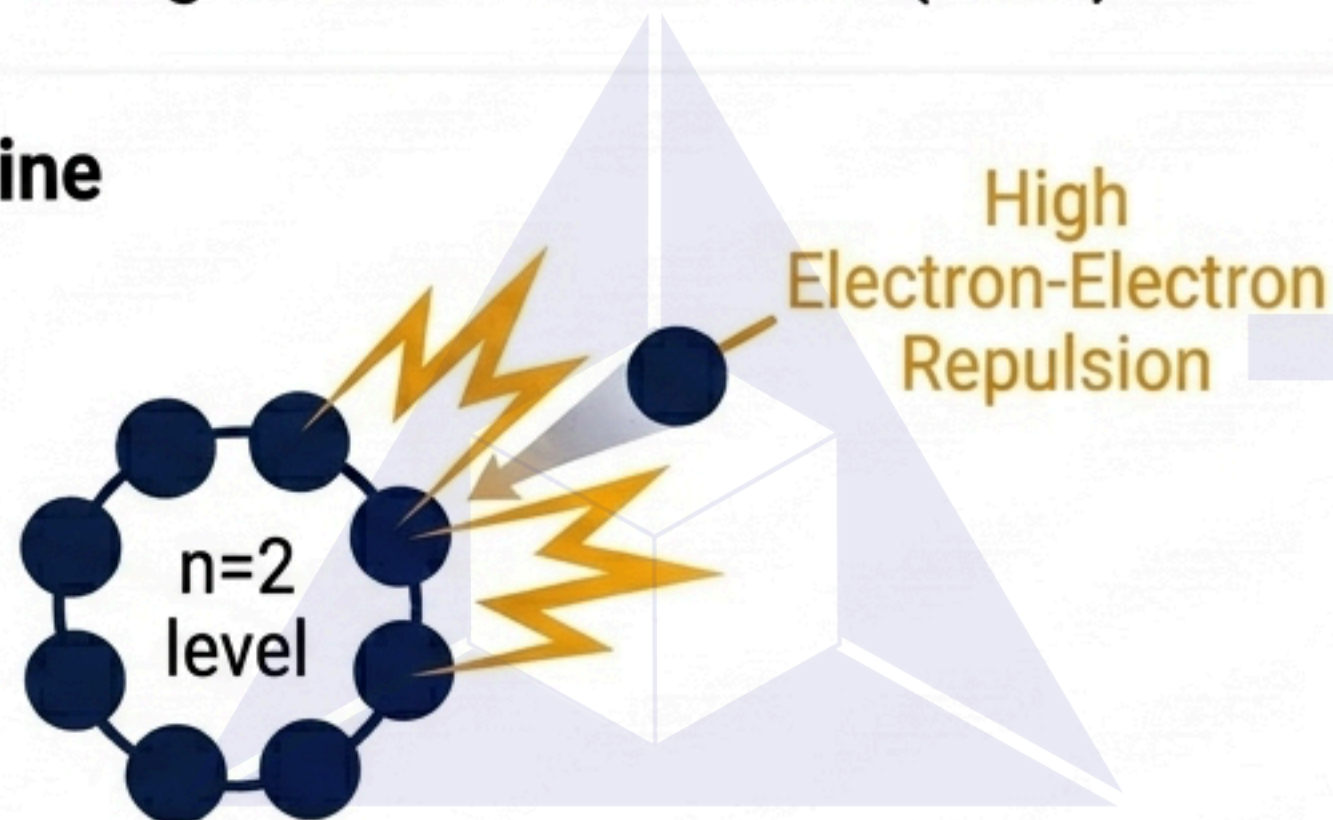
General Trend: Values become less negative down a group (larger size), and more negative across a period (left to right).

The Anomaly: Fluorine vs. Chlorine

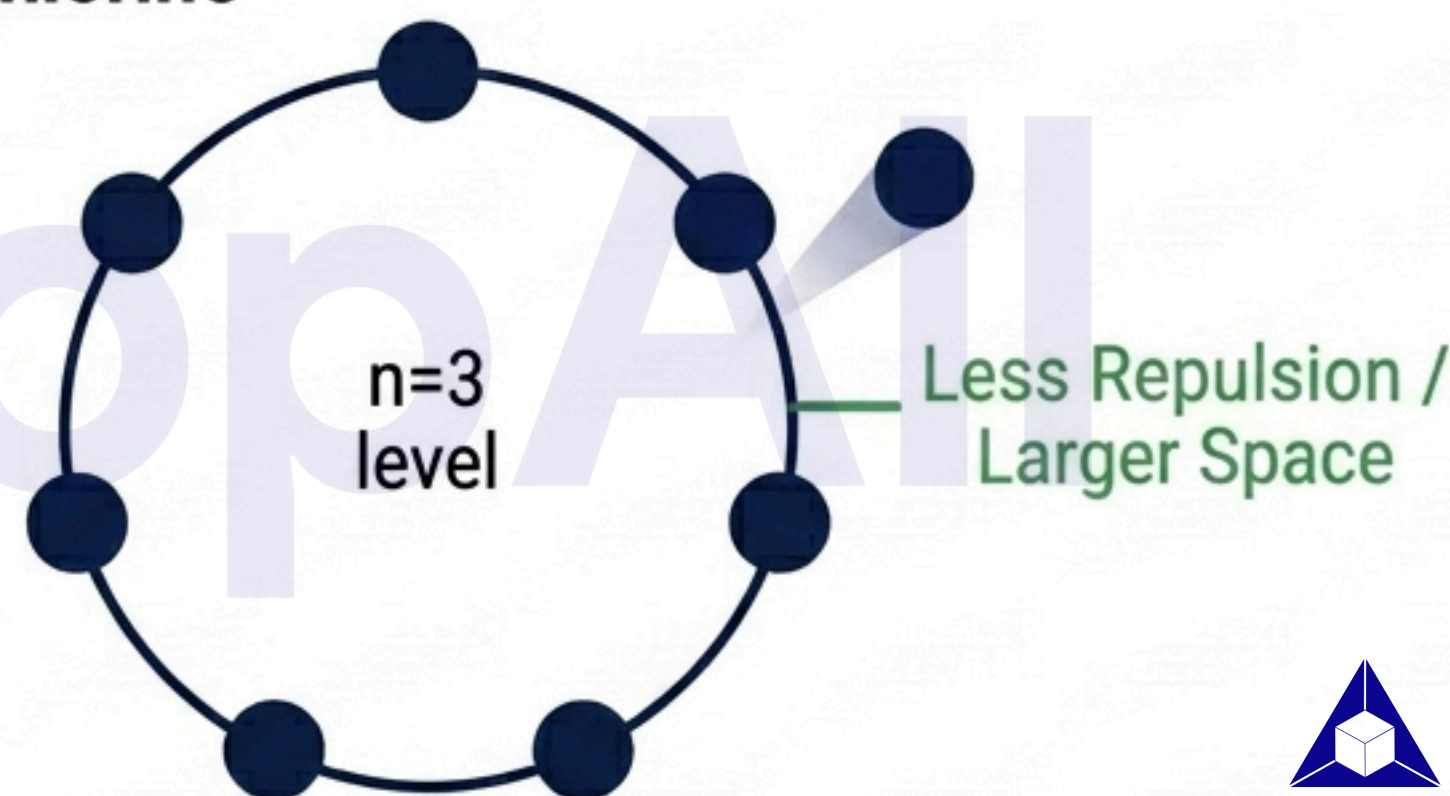
Exception to the Trend

Based on general trends, Fluorine should have the most negative value. Yet Chlorine (-349) is more negative than Fluorine (-328).

Fluorine



Chlorine



The added electron in Fluorine suffers significant repulsion in the compact $n=2$ level. Chlorine's $n=3$ level provides more space, making it easier to accommodate the new electron.



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