

UNIT 4 • d- AND *f*-BLOCK ELEMENTS

Trends in Stability of Higher Oxidation States

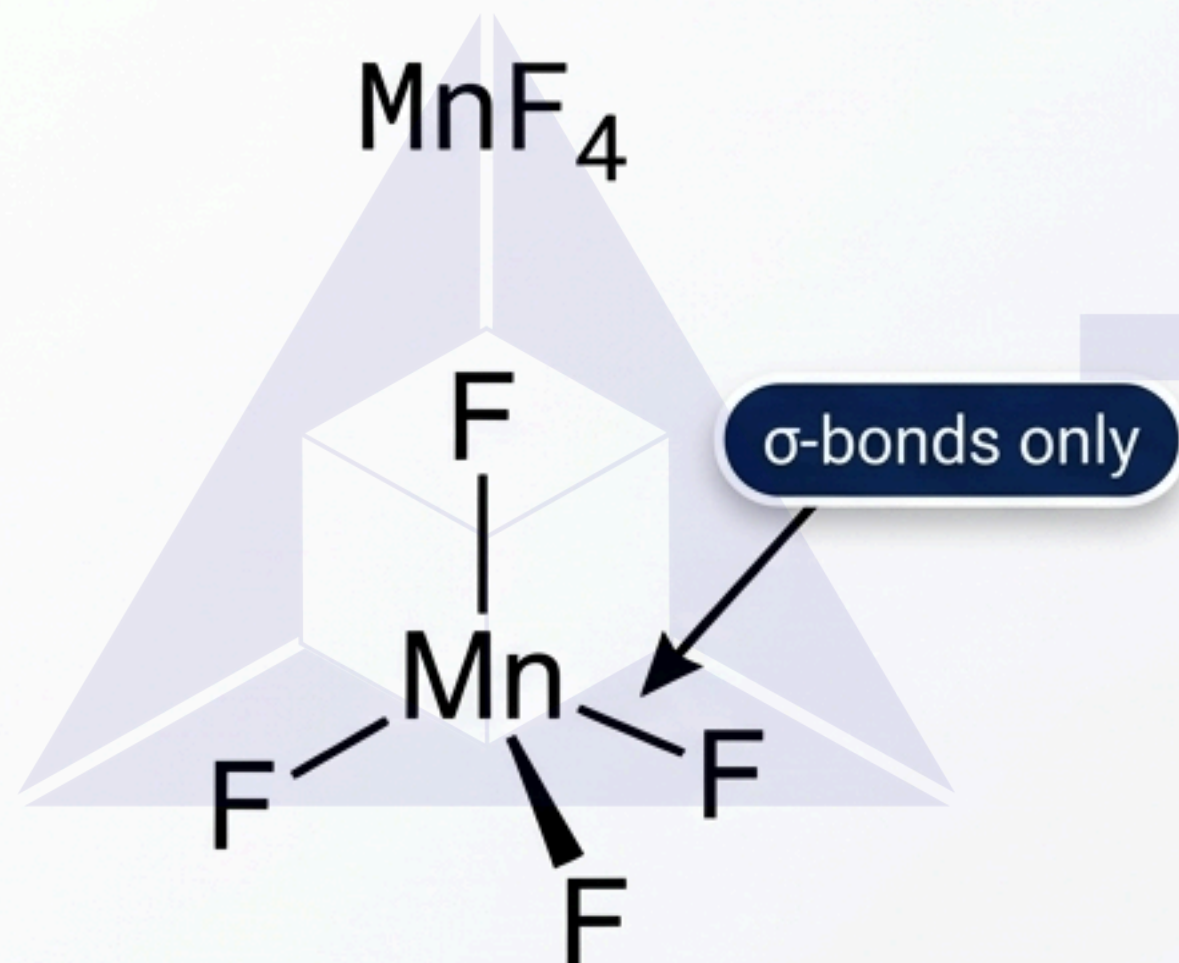
Highest Oxidation Number

The maximum number of electrons a transition metal can lose or share. In Groups 3–7, this corresponds exactly to the sum of s and d electrons (up to Mn).

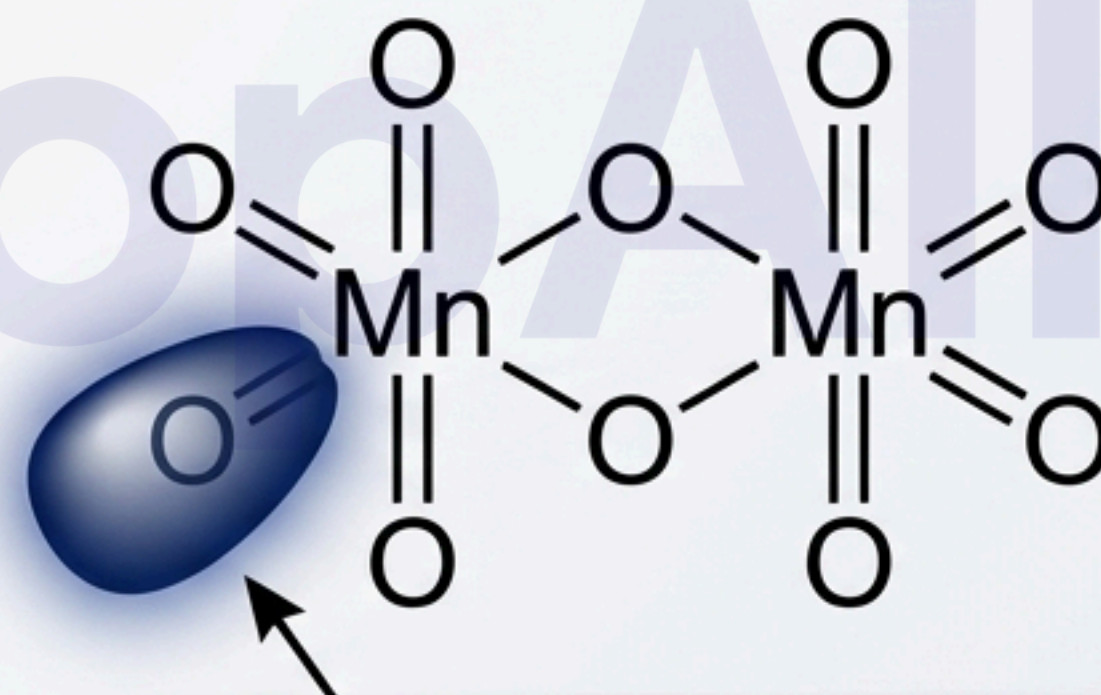
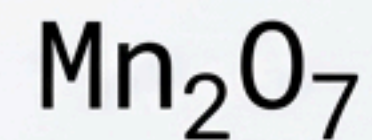
Oxoanion

A polyatomic ion containing oxygen (e.g., $[\text{MO}_4]^{n-}$). Crucial for stabilizing the most extreme high oxidation states in transition metals.

Highest Fluoride (+4)



Highest Oxide (+7)



Multiple bonding capability ($p\pi-d\pi$)



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

$$E=mc^2$$



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Key Highlights

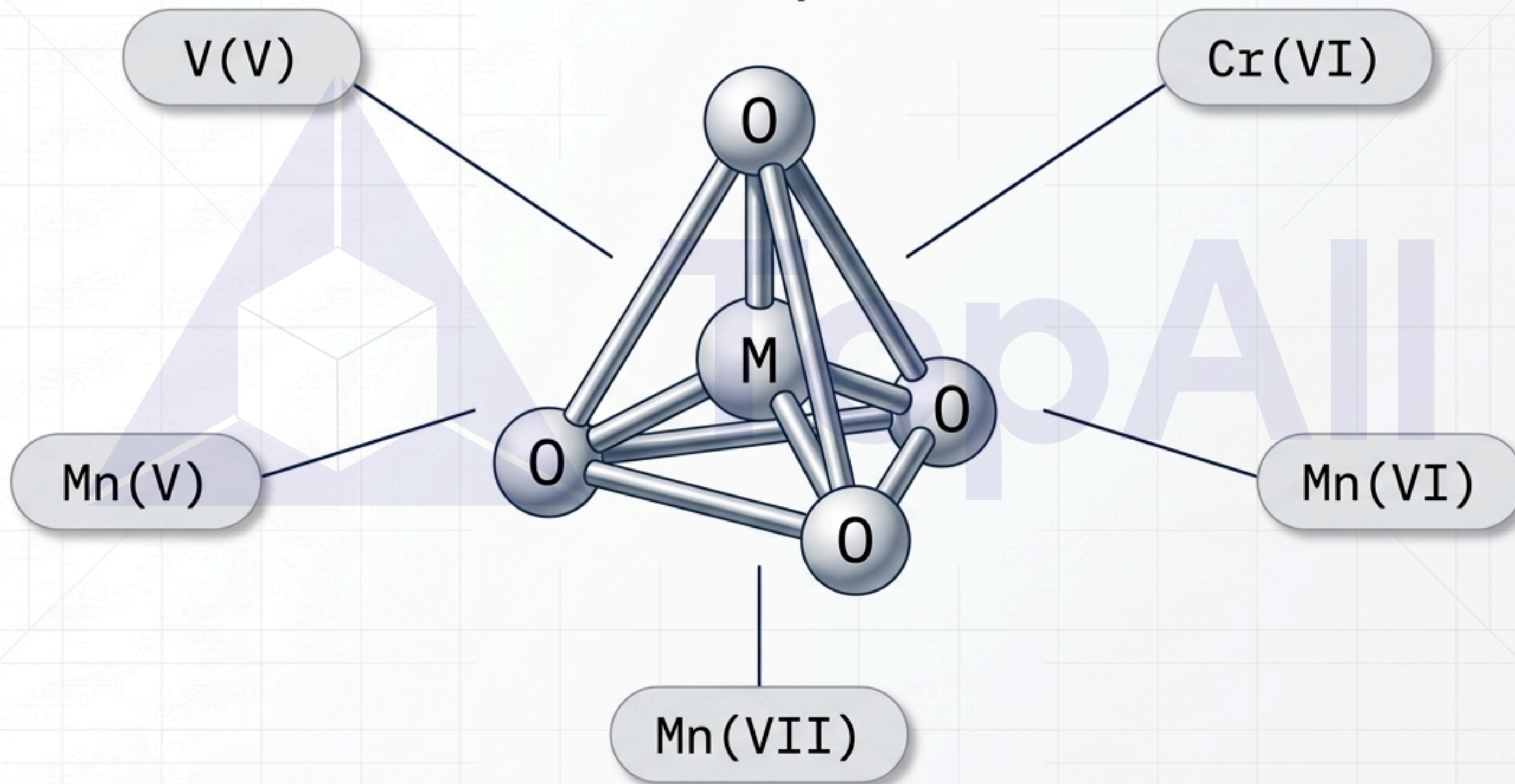
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Diagnostic Showdown



Fluorine's ability to stabilize high states is driven by high lattice energy or high bond enthalpy. But it hits a ceiling: it cannot push Manganese past MnF_4 (+4).



JEE Trap Alert: The Electronegativity Illusion

Watch for this assumption

Fluorine stabilizes the highest oxidation states because it is the most electronegative element.

The Diagnostic Reality

Oxygen beats Fluorine because Oxygen can form multiple bonds ($p\pi-d\pi$) to metals, creating a superior stabilizing effect despite being slightly less electronegative.

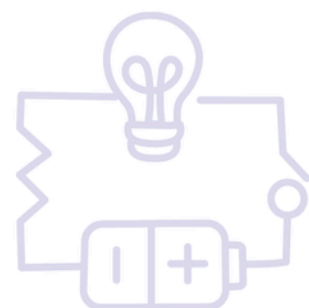
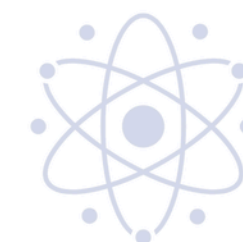
Key Takeaways

- The maximum oxidation state matches the group number up to Manganese (Groups 3–7), corresponding to the sum of s and d electrons.
- Oxygen's ability to form multiple bonds makes it chemically superior to Fluorine in stabilizing these maximum oxidation states (e.g., Mn_2O_7 vs MnF_4).



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