



Filling of Orbitals

Core Principles of Atomic Architecture
for JEE Class 11

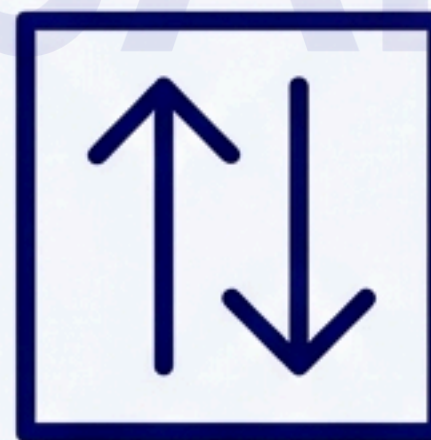
Shell Capacity

$$2n^2$$

Maximum electrons in a principal shell (n).

Orbital Capacity

$$2$$



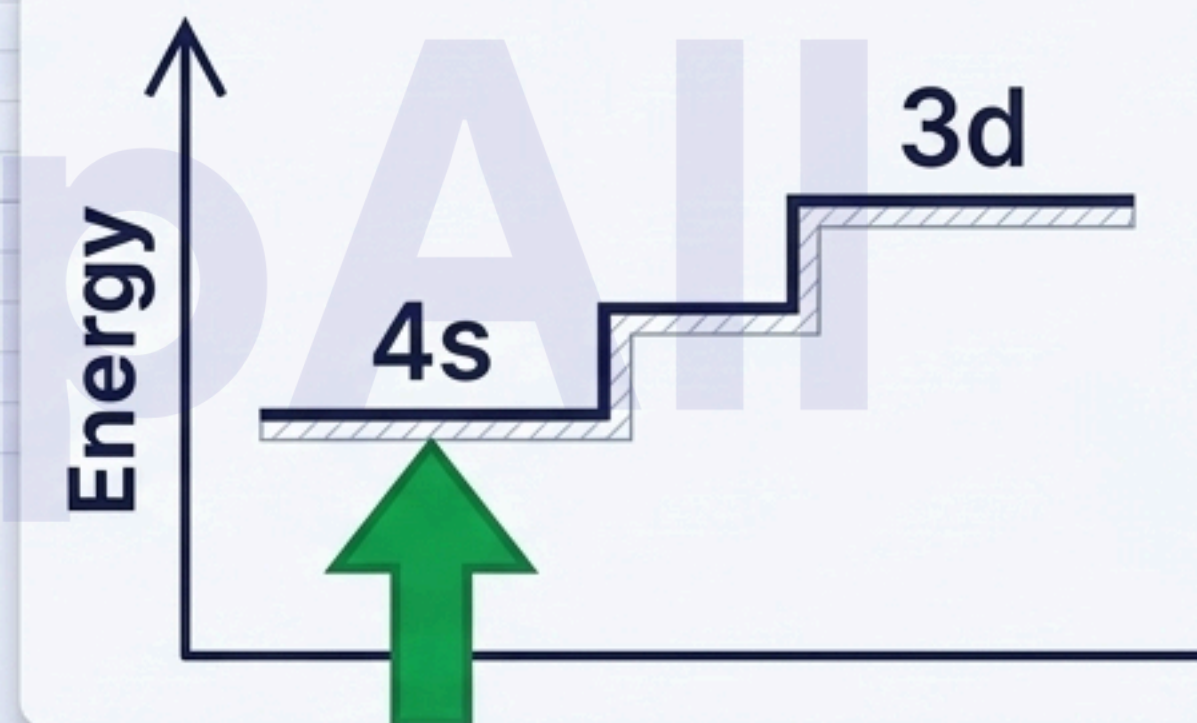
Maximum electrons per individual orbital.

These are the absolute limits of atomic architecture.

Rule 1: Aufbau Principle

Electrons build from the ground up, seeking the lowest energy state first.

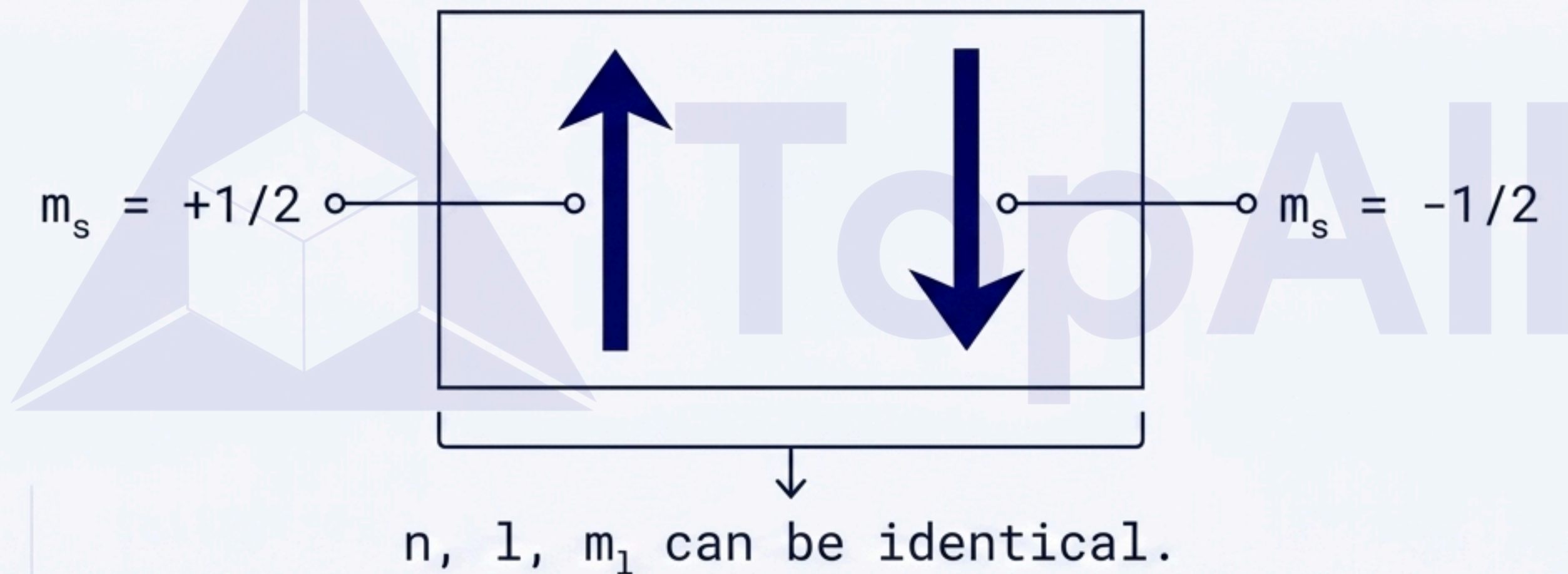
Orbital	n	ℓ	$(n+\ell)$ Score	Result
4s	4	0	4	Fills First ✓
3d	3	2	5	Fills Second



Tie-Breaker: If $(n+\ell)$ scores are equal, the orbital with the lower n value fills first.

Rule 2: Pauli Exclusion Principle

No two electrons in an atom can have the same four quantum numbers.



Conclusion: An orbital holds a maximum of 2 electrons, and they must have opposite spins.



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

$$E=mc^2$$



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Key Highlights

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- » Get Clear Explanations, Not Just Marks
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Rule 3: Hund's Rule of Maximum Multiplicity



Fill degenerate (equal energy) orbitals singly first before pairing.

p³

Right vs. Wrong

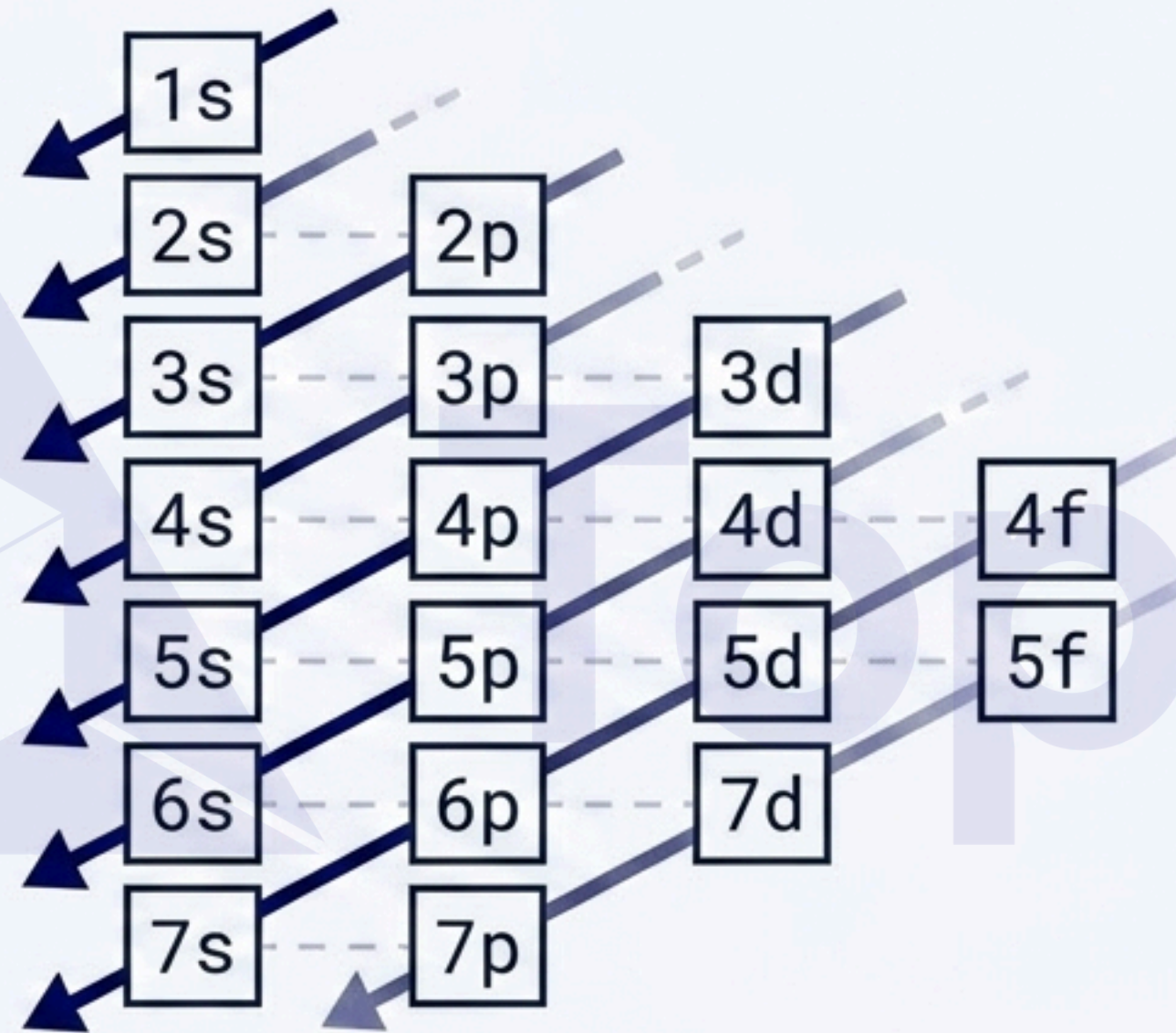


Maximum exchange energy & symmetry.



Exam Trap: Do not pair electrons too early! Degenerate orbitals must be singly occupied first.

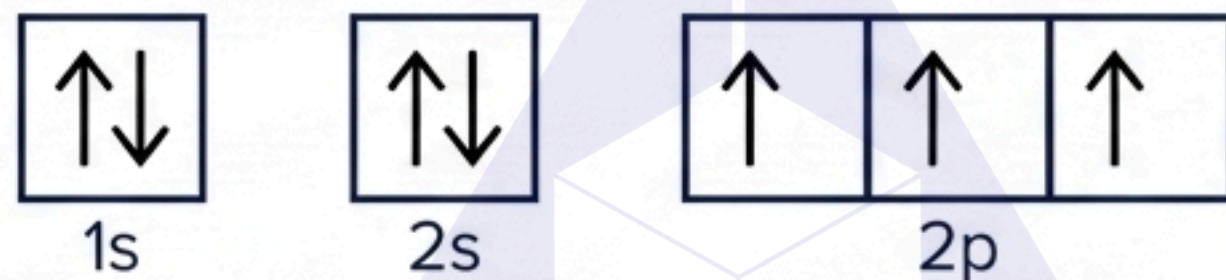
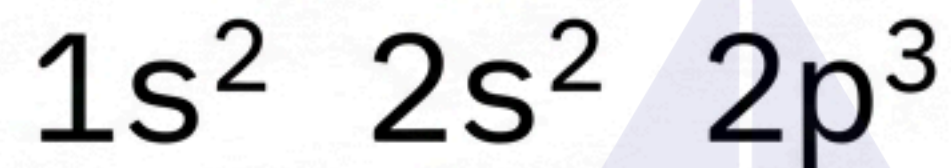
The Master Sequence



1s → 2s → 2p → 3s → 3p → 4s → 3d → 4p → ...

Applying the Blueprint

Nitrogen (Z=7)



← Hund's Rule in action.

Sodium (Z=11)



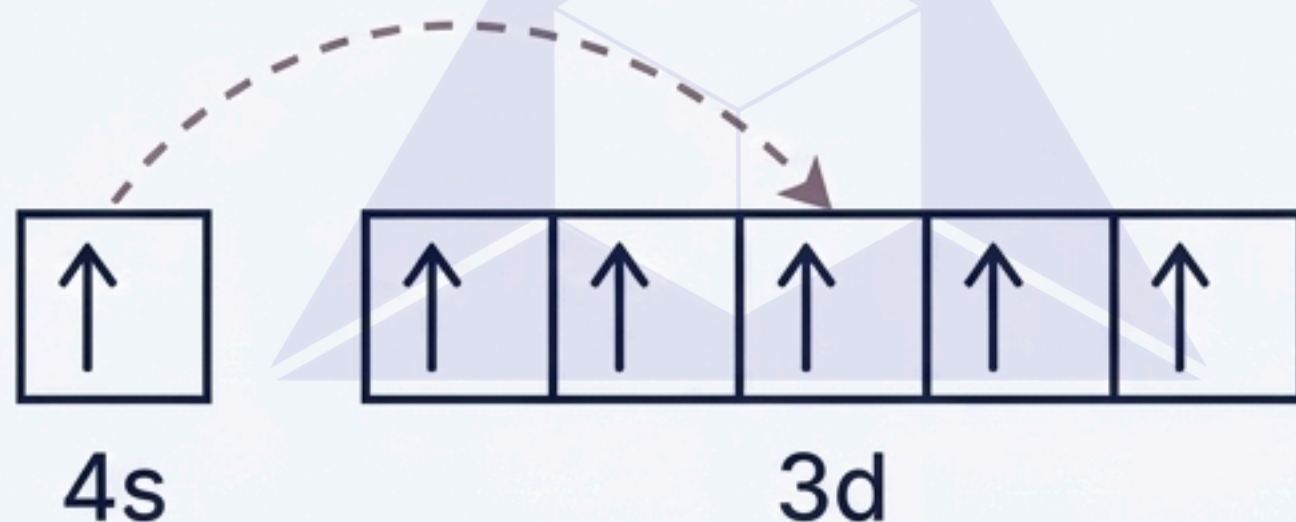
← Core electrons bundled for efficiency.

Exam Traps: The Exceptions

Chromium (Cr, Z=24)

~~Expected: [Ar] 4s² 3d⁴~~

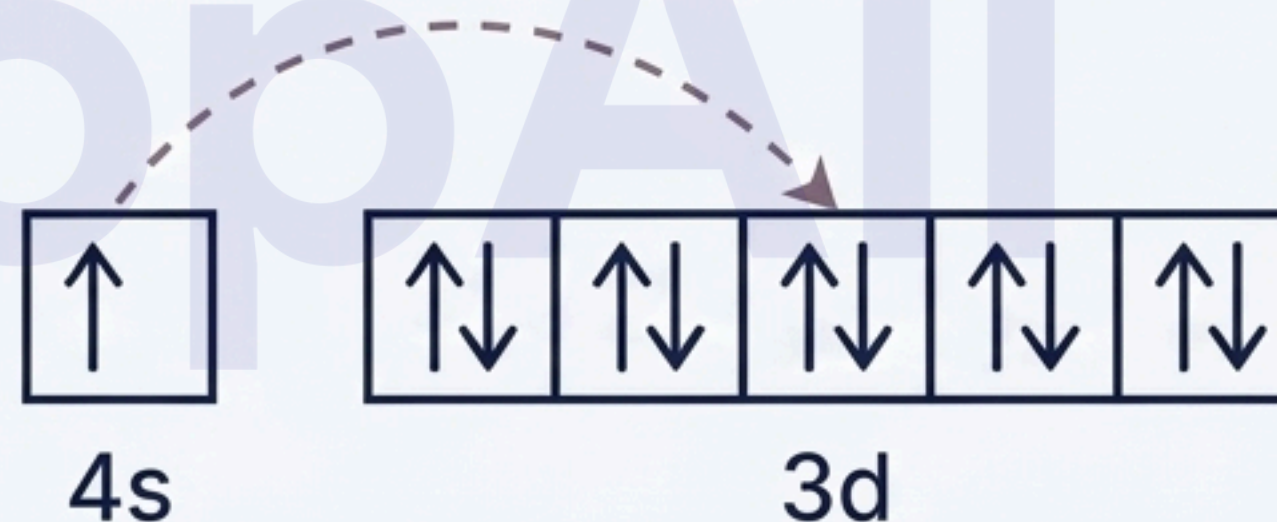
Actual: [Ar] 4s¹ 3d⁵



Copper (Cu, Z=29)

~~Expected: [Ar] 4s² 3d⁹~~

Actual: [Ar] 4s¹ 3d¹⁰

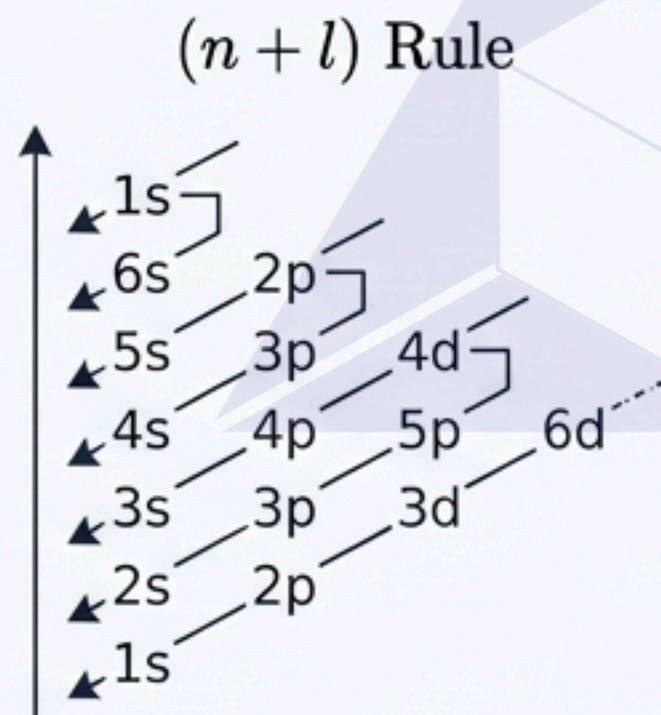


Why? Symmetrical distribution and maximum exchange energy stabilize exactly **half-filled (d⁵)** and **fully-filled (d¹⁰)** subshells.

Key Takeaways: The Quantum Blueprint

1. Aufbau Principle

Lowest Energy First.



2. Pauli Principle

Max 2 per Orbital,
Opposite Spins.



3. Hund's Rule

Singly First, Then Pair.



Master these three codes to construct any electron configuration.



You've Learned the Theory.

Now Let's Test It.

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