HIGH SCHOOL CHEMISTRY

CHAPTER 3

Set 2: Electron Configurations

Free Sample

Sample pages from the full Electron Configurations study set. Try them, then get the whole set.

Try it, then get the whole set

7	5	★	✓
files in the full set	sample sections	Honors kept separate	answers included

- Sample pages from the notes, revision sheets, traps, practice, flashcards and lab skills
- Answers included for every sample question
- Honors material clearly marked so Regular students can skip it

For high school chemistry, Regular and Honors. Chapter 3: Electrons and the Periodic Table.

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FREE SAMPLE · SET 2 OF 3

Try Electron Configurations before you buy

This free sampler shows pages from six of the seven files in the full **Electron Configurations** study set. If you like how these pages teach, the full set gives you the whole topic, start to finish.

7	5	★	✓
files in the full set	sample sections	Honors kept separate	answers for everything

What's in the full Electron Configurations set

File	What it does for you
1 · Complete Study Notes	Seven lessons that teach the whole topic in plain words, with worked examples and quick checks.
2 · Quick Revision Sheets	The topic on a few pages: tables, flowcharts, memory tricks and a one-page cheat sheet.
3 · Exam Traps and Mistakes	The mistakes that cost students points, and how to dodge each one.
4 · Practice Question Bank	Questions by lesson, easy to hard, with full worked answers and a separate Honors section.
5 · Quizzes and Unit Test	Quizzes and a full unit test with a fully explained answer key.
6 · Glossary and Flashcards	Every key term defined, plus cut-out flashcards.
7 · Lab Skills for Tests	What tests ask about an orbital board for the filling rules and a magnet test for unpaired electrons, with test-style questions and answers.

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NOTE | Regular or Honors?

Honors material sits in blue boxes marked ★ HONORS . Regular students can skip every one of them and still master the topic.

SAMPLE 1 From the Complete Study Notes

SAMPLE PAGE | FREE SAMPLE

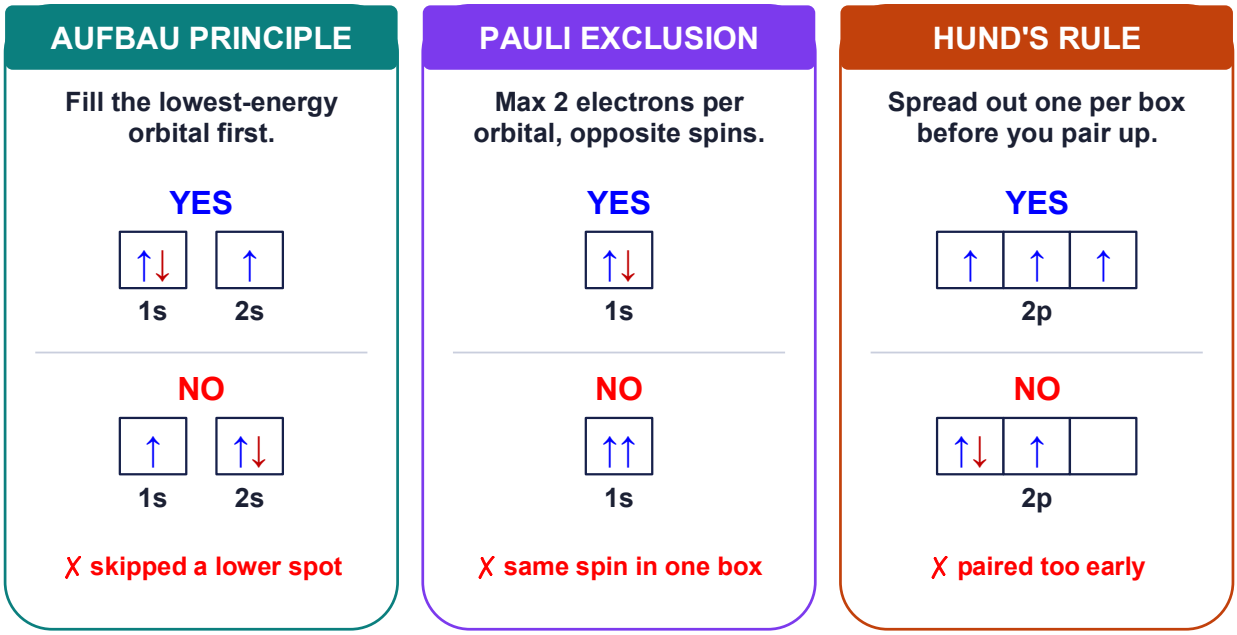
This page is taken from Complete Study Notes, one of the seven files in the full Electron Configurations set.

Rule 3: Hund's rule

DEFINITION | Hund's rule

Hund's rule states that when electrons fill orbitals of **equal energy**, they go **one per orbital, with the same spin**, before any of them pair up.

Think of passengers getting on an empty bus. Nobody sits next to a stranger while there is still an empty double seat. **Electrons spread out first, then pair up.** Hund's rule matters inside a p, d or f sublevel, where several orbitals share the same energy.



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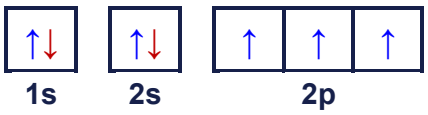
One rule each: **Aufbau** fills the lowest energy first, **Pauli** allows two electrons per orbital with opposite spins (↑↓), and **Hund** puts one electron in each equal box before any pair up.

WORKED EXAMPLE | Orbital diagram for nitrogen

Configuration: $1s^2\ 2s^2\ 2p^3$ (7 electrons)



The three 2p electrons go **one per box** with the same spin (Hund's rule). **Nitrogen has 3 unpaired electrons.**

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SAMPLE 2 From the Quick Revision Sheets

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This page is taken from Quick Revision Sheets, one of the seven files in the full Electron Configurations set.

Four sublevels, one table

Sublevel	Orbitals	Max electrons	First level that has it
s	1	**2**	n = 1
p	3	**6**	n = 2
d	5	**10**	n = 3
f	7	**14**	n = 4

MEMORY TRICK | 1, 3, 5, 7

The orbitals go up by the **odd numbers**: s 1, p 3, d 5, f 7. **Double** each one for the electrons: 2, 6, 10, 14.

The filling order

FORMULA | Learn this line

1s 2s 2p 3s 3p 4s 3d 4p 5s 4d 5p 6s 4f 5d 6p 7s 5f 6d 7p

Exam trap: 4s fills before 3d, because 4s is lower in energy.

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SAMPLE 3 From Exam Traps and Mistakes

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These traps are taken from Exam Traps and Mistakes, one of the seven files in the full Electron Configurations set.

EXAM TRAP 7 | Filling 3d before 4s

✗ WHAT STUDENTS WRITE	✓ WHAT EARNS THE POINTS
"After 3p comes 3d, because all of level 3 fills before level 4. Titanium is [Ar] $3d^4$."	**4s is lower in energy than 3d**, so it fills first: 3p → **4s** → **3d** → 4p. Titanium is **[Ar] $4s^2$ $3d^2$**.

Why it's wrong: From n = 3 on, the levels overlap. The filling order follows energy, not the level number.

MEMORY TRICK **The d block runs one row behind: row 4 fills 3d.**

EXAM TRAP 19 | Adding electrons to make a cation

✗ WHAT STUDENTS WRITE	✓ WHAT EARNS THE POINTS
"Potassium gains one electron to become K^+: [Ar] $4s^2$."	A **+** charge means electrons were **lost**. Potassium (19) loses its 4s electron, so K^+ has **18** electrons: **$1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^6$**, the same as [Ar].

Why it's wrong: Electrons are negative, so taking them away leaves the particle positive. Students who read "plus" as "add" get every cation backwards.

MEMORY TRICK **Plus = lost. Minus = gained.**

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EXAM TRAP 23 | Counting d electrons as valence electrons

✗ WHAT STUDENTS WRITE	✓ WHAT EARNS THE POINTS
"Gallium has 13 valence electrons: $4s^2\ 3d^{10}\ 4p^1$."	Valence electrons are in the **highest level only**. For gallium that is n = 4: $4s^2\ 4p^1$ = **3 valence electrons**. The $3d^{10}$ is in level 3, so it is **core**.

Why it's wrong: 3d is written between 4s and 4p, so it looks like part of the outer level. Check the level number, not the position in the line.

MEMORY TRICK **Main groups: valence = last digit of the group number.**

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SAMPLE 4 From the Practice Question Bank

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These questions are taken from Practice Question Bank, one of the seven files in the full Electron Configurations set.

Answer the four questions below. Then check your answers in the box under them.

Q43 A student wrote the configuration of cobalt (Z = 27) as $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^9$. The electrons add up to 27. Explain the error and write the correct configuration.

Q74 How many valence electrons does **tin** (Sn, [Kr] $5s^2\ 4d^{10}\ 5p^2$) have?

A. 2
B. 4
C. 14
D. 12

Q83 L2 Which element has the ground-state configuration [Ar] $4s^2\ 3d^1$?

A. scandium
B. titanium
C. calcium
D. yttrium

Q93 L2 ★ HONORS An electron is in a **3d** orbital. Give its values of n and l.

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ANSWER KEY | Answers

Q43 **$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^7$**

$$2 + 2 + 6 + 2 + 6 + 2 + 7 = 27$$

The student skipped 4s. The 4s sublevel is lower in energy than 3d, so it takes 2 electrons first and only 7 are left for 3d. A correct total does not prove a correct order.

Q74 **B**

$$5s^2 + 5p^2 : 2 + 2 = 4$$

Only n = 5 counts: 5s² 5p². Choice C wrongly adds the ten 4d electrons.

Q83 **A**

$$18 + 2 + 1 = 21$$

Z = 21 is scandium, the first element of the d block.

Q93 ★ HONORS **n = 3, l = 2**

The number is n. The letter gives l: s = 0, p = 1, d = 2, f = 3.

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SAMPLE 5 Flashcards and Lab Skills

SAMPLE PAGE | FREE SAMPLE

This page is taken from Glossary and Flashcards and Lab Skills for Tests, two of the seven files in the full Electron Configurations set.

Front	Back
Orbital	A region around the nucleus where an electron is likely to be found. Every orbital holds at most two electrons.
Aufbau principle	Electrons fill the lowest-energy orbitals first, then climb to higher ones. *Aufbau* is German for "building up".
Valence electrons	The electrons in an atom's highest occupied energy level. For a main-group element, count the s and p electrons with the largest n.

Data Set A · Orbital Board: Testing the Three Filling Rules

What the class did: Each group was given an element and built its ground state on an orbital board. The group counted out one bead per electron, then placed the beads one at a time from the bottom of the board up, using a blue bead for each first electron in a box and a red bead for each second. The group recorded the beads used, the configuration and the number of unpaired electrons, and the teacher checked each board.

Trial	Element (Z)	Beads used	Configuration recorded	Unpaired	Teacher check
1	Boron (5)	3 blue, 2 red	$1s^2 2s^2 2p^1$	1	Correct
2	Fluorine (9)	5 blue, 4 red	$1s^2 2s^2 2p^5$	1	Correct
3	Helium (2)	2 blue	$1s^2$	0	**Not correct**
4	Lithium (3)	2 blue, 1 red	$1s^3$	1	**Not correct**
5	Nitrogen (7)	4 blue, 3 red	$1s^2 2s^2 2p^3$	1	**Not correct**
6	Potassium (19)	10 blue, 9 red	$1s^2 2s^2 2p^6 3s^2 3p^6 3d^1$	1	**Not correct**

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Trial	Element (Z)	Beads used	Configuration recorded	Unpaired	Teacher check
7	Scandium (21)	11 blue, 10 red	[Ar] $4s^2 3d^1$	1	Correct
8	Vanadium (23)	13 blue, 10 red	[Ar] $4s^2 3d^3$	3	Correct

Questions

A1 For each trial marked not correct, name the filling rule that was broken: Aufbau, Pauli or Hund.

A2 Write the correct configuration and the correct number of unpaired electrons for each trial marked not correct.

A3 In every correct trial, compare (number of blue beads − number of red beads) with the number of unpaired electrons. What do you notice? Use this to explain how Trial 5's bead counts already show a mistake.

ANSWER KEY | What the data show

A1 Trial 3: Pauli. Trial 4: Pauli. Trial 5: Hund. Trial 6: Aufbau. Trial 3 has two electrons with the same spin (two blue beads) in one box. Trial 4 has three electrons in one box. Trial 5 paired a 2p electron while another 2p box was empty. Trial 6 filled 3d before the lower 4s.

A2 Helium: $1s^2$, 0 unpaired (one blue, one red). Lithium: $1s^2 2s^1$, 1 unpaired. Nitrogen: $1s^2 2s^2 2p^3$, 3 unpaired. Potassium: $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$, 1 unpaired. Trial 5 wrote the right configuration but placed the beads wrong, so its unpaired count was wrong.

A3 Blue − red = unpaired electrons. Boron 3 − 2 = 1, fluorine 5 − 4 = 1, scandium 11 − 10 = 1, vanadium 13 − 10 = 3. Every full box has one blue and one red, so only the lone blue beads are left over. Nitrogen has 3 unpaired electrons, so a correct board needs 5 blue and 2 red. Trial 5 used 4 blue and 3 red, so one box was paired too early.

The full file also has a magnet test for unpaired electrons, sources of error and test-style lab questions, all with answers.

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Get the Full Electron Configurations Set

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