



Electron Configuration Explorer

Companion worksheet — use the interactive tool to complete each part. All problems use representative (main-group) elements only.

Name: _____ Date: _____

Key rules

Aufbau principle	electrons fill the lowest-energy orbitals first
Hund's rule	electrons fill EVERY orbital in a subshell singly before any pairing up
Pauli exclusion principle	each orbital holds at most 2 electrons, and they must have opposite spins

Part A — Explore & record

Choose 3 different representative elements (blue or orange on the table) in Explore mode. Record all three written representations for each.

Element 1

Element chosen: _____

Full electron configuration: _____

Noble gas configuration: _____

Valence configuration & count: _____ → _____ valence e^-

Sketch the orbital notation here (lines and arrows):

Element 2

Element chosen: _____

Full electron configuration: _____

Noble gas configuration: _____

Valence configuration & count: _____ → _____ valence e^-

Sketch the orbital notation here (lines and arrows):



Element 3

Element chosen: _____

Full electron configuration: _____

Noble gas configuration: _____

Valence configuration & count: _____ → _____ valence e⁻

Sketch the orbital notation here (lines and arrows):

Part A wrap-up

Which of your three elements had the most valence electrons? Which had the fewest? Do you notice any connection between valence electron count and where the element sits on the periodic table?



Part B — Practice by hand

Work out each element's configurations on paper first. Then switch to Explore mode and check yourself.

Tip: None of these elements have exceptions — standard Aufbau filling works perfectly for all of them.

Oxygen (O)

Show your work:

Noble gas config: _____ Valence e^- : _____

Silicon (Si)

Show your work:

Noble gas config: _____ Valence e^- : _____

Potassium (K)

Show your work:

Noble gas config: _____ Valence e^- : _____

Iodine (I)

Show your work:

Noble gas config: _____ Valence e^- : _____



Part C — Draw the orbital notation

Using lines and arrows (not boxes), draw the full orbital notation for each element below. Follow Hund's rule!

Carbon (C) — 6 electrons



Fluorine (F) — 9 electrons



Compare your two diagrams above:

Carbon's 2p orbitals end up with 2 unpaired electrons, while Fluorine's 2p orbitals end up with only 1 unpaired electron. Explain why, using Hund's rule.



Reflection

How does an element's block (s, p, d, or f) relate to which subshell fills last for that element? Why might chemists prefer noble gas notation over full configuration for an element like Iodine?

Vocabulary check

Term	In your own words
Valence electron	
Representative element	
Noble gas core	

**TEACHER ANSWER KEY — remove or skip this page before printing for students****Part B**

Oxygen (O, Z=8): $1s^2 2s^2 2p^4 \rightarrow [\text{He}] 2s^2 2p^4 \rightarrow 6$ valence e^-

Silicon (Si, Z=14): $1s^2 2s^2 2p^6 3s^2 3p^2 \rightarrow [\text{Ne}] 3s^2 3p^2 \rightarrow 4$ valence e^-

Potassium (K, Z=19): $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 \rightarrow [\text{Ar}] 4s^1 \rightarrow 1$ valence e^-

Iodine (I, Z=53): $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^5 \rightarrow [\text{Kr}] 5s^2 4d^{10} 5p^5 \rightarrow 5s^2 5p^5 = 7$ valence e^- (the $4d^{10}$ is not counted — it's not in the highest shell)

Part C

Carbon: $1s(\uparrow\downarrow) 2s(\uparrow\downarrow) 2p(\uparrow \uparrow _)$ — 2 of the 3 p orbitals hold one unpaired electron each.

Fluorine: $1s(\uparrow\downarrow) 2s(\uparrow\downarrow) 2p(\uparrow\downarrow \uparrow\downarrow \uparrow)$ — with 5 electrons in 2p, Hund's rule fills all three orbitals singly first (3 electrons), then pairs up starting from the left (2 more electrons), leaving exactly 1 orbital unpaired.

Explanation: Hund's rule requires every orbital in a subshell to get one electron before any orbital gets a second. Carbon only has enough p electrons (2) to singly fill 2 of the 3 orbitals. Fluorine has enough (5) to singly fill all 3, then pair up 2 of them, leaving 1 orbital still unpaired.

Reflection — sample answer

An element's block matches the type of subshell (s, p, d, or f) that receives its last electron in the filling order — that's literally how block is defined. Noble gas notation is preferred for heavier elements like Iodine because writing out all 53 electrons individually ($1s^2 2s^2 2p^6 \dots$) is long and error-prone; collapsing the first 36 electrons into [Kr] keeps the focus on the part of the configuration that actually determines the element's chemistry.

Teaching notes

- All elements used in this worksheet (O, Si, K, I, C, F) are representative elements with zero exceptions to Aufbau filling — intentional, per request, to keep the worksheet focused on the core skill before any exception cases.
- The app's Explore mode now covers all 118 elements including transition/inner-transition metals with documented exceptions (e.g. Cr, Cu) — worth a follow-up worksheet or class discussion once students are solid on representative elements.
- Iodine (Part B, problem 4) is a good stretch problem — it's the first one requiring students to skip past a completed d-subshell, and to recognize that d^{10} doesn't count toward valence electrons.