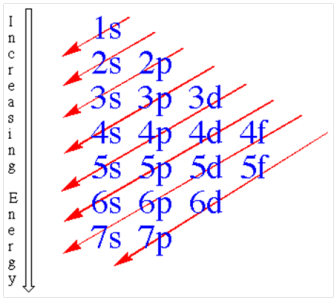
4.3 – Electron Configuration



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Quick Review

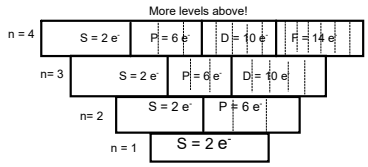
The system for housing electrons in an atom (so they're not all willy-nilly) is like a weird, seven floor apartment building; each floor has a certain number of apartments, those apartments have a certain number of rooms, and each room holds two electrons.

Energy Levels:
1 - 7

4 differently shaped sub-levels:
S, P, D, F

Orbitals:
S = 1, P = 3, D = 5, F = 7

Electrons:
2/orbital



Electron Apartment Complex

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Electron Configuration

Electron ordering system governed by 3 principles:
- Aufbau
- Pauli Exclusion
- Hund's Rule

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1 - Aufbau Principle

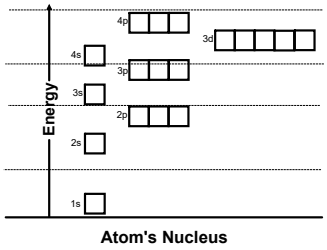
Means "arrange" in German. (German Language Demo).

Barbara Aufbau Chris Aufbau Heike Aufbau

Electrons occupy the lowest energy orbitals available.

Aufbau diagrams show relative energy of electrons.

Aufbau Diagram



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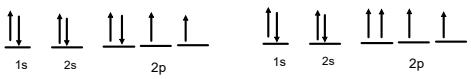
2 - Pauli Exclusion Principle

Electrons have a quantum "spin": up ↑ or down ↓.
Arrows represent electrons, and they share an orbital if they are opposite.

Example: Oxygen has 8 electrons:
(This is an Orbital Diagram)



Right Wrong

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3 - Hund's Rule

Known as "The Bus Rule".

Electrons share orbitals if no unoccupied orbitals remain.

			1s	2s	2p
Boron,	B	5 Electrons	↑↓	↑↓	↑
Carbon,	C	6 Electrons	↑↓	↑↓	↑ ↑
Nitrogen,	N	7 Electrons	↑↓	↑↓	↑ ↑ ↑
Oxygen,	O	8 Electrons	↑↓	↑↓	↑↓ ↑ ↑

Orbital Diagrams

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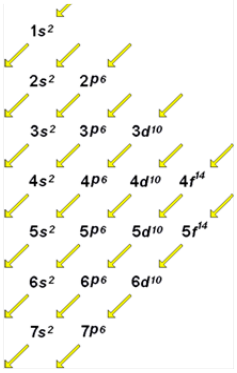
The Order: Resource Page 2

Procedure:
1. Determine element's electrons.
2. Use the order to assign electrons until you run out.

$3p^6$

Energy Level
Sublevel
Maximum Electrons in Sublevel



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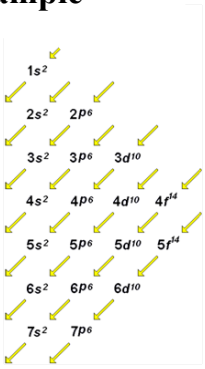
1. Sodium Example

Electrons? = 11
First two go in 1s,
second two: 2s,
next six: 2p,
last one goes in 3s.

Answer: $1s^2 2s^2 2p^6 3s^1$



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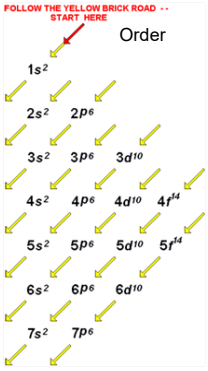
2. Zinc Example: YOU DO!

Write the full configuration for:

Zinc

Zinc = 30 Electrons

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$



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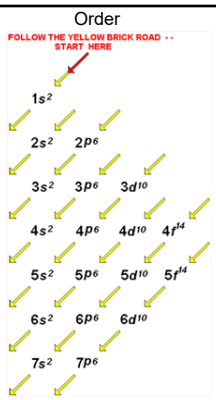
3. Boron Example

Write the full configuration for:

Boron

5 electrons

$1s^2 2s^2 2p^1$



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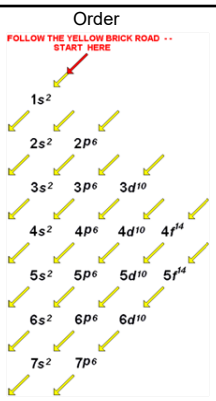
4. Boron Example

Write the full configuration for:

Chlorine

17 electrons

$1s^2 2s^2 2p^6 3s^2 3p^5$



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5. Tin Example

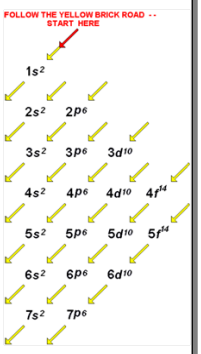
Write the complete electron configuration for:

Tin (Sn)

Electrons = 50

$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^2$

This is tedious business!



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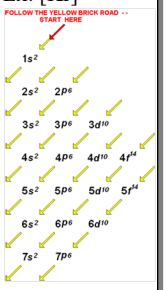
Method 2: Noble Gas Notation

1. Determine electrons. Ex: Tin = 50 e⁻.
2. Put previous noble gas (count backwards) symbol in brackets; subtract its electrons from your element's. Ex: [Kr]
3. **Resume counting froms sublevel of your element's row. Ex: 5s**

Tin becomes: [Kr] $5s^2 4d^{10} 5p^2$



6. Platinum Example (Pt = 78 e⁻)
Previous noble gas = Xe; = 54e⁻.
Resume at 6s with remaining 24 e⁻:
Pt = [Xe] $6s^2 4f^{14} 5d^8$

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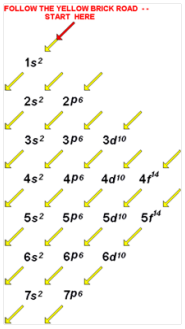
7. Polonium Example

Write the noble gas electron configuration for Polonium (Po)

[Xe] $6s^2 4f^{14} 5d^{10} 6p^4$



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Exceptions

Aufbau works up to Vanadium; but half- or totally-filled d-sublevels are more stable electrons move from s sublevels.

Cr, Mo, W; and Cu, Ag, Au are exceptions:

Cr = [Ar]$4s^1 3d^5$ NOT: [Ar]$4s^2 3d^4$

Cu = [Ar]$4s^1 3d^{10}$ NOT: [Ar]$4s^2 3d^9$

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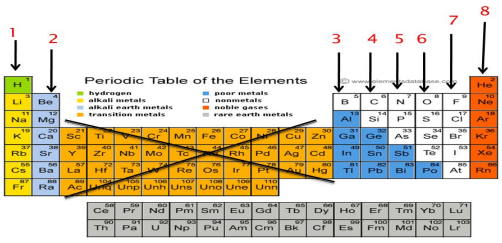
Valence Electrons

Def: Electrons in outermost energy level which determine chemical properties.

Ex: Sulfur = [Ne]$3s^2 3p^4$ = 6 valence electrons

Shortcut: look at which column the element is in:



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8. How many valence electrons do the following elements have?

S 6

B 3

Ca 2

Sb 5

Sn 4

N 5

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Homework

Preview 4.4

4.3 Problems in your Booklet
Due: Next Class

Configuration Essential Skills: P. 60

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Attachments

Barbara Aufbau.MOV

Chris Aufbau.MOV

Heike Aufbau.MOV