Lesson 8: Electron Configuration

If we are interested in showing the arrangement of electrons in an atom in their orbitals, we can do this with electron configuration and orbital diagrams.

**Electron configuration**

List each type of ____________ showing number of electrons as an ________________

\[ 3p^4 \]

**Orbital Diagrams**

______________ represent orbitals; __________________________ represent electrons

<table>
<thead>
<tr>
<th>Orbital Diagram</th>
<th>Electron Configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td>H 1s ↑</td>
<td>1s^1</td>
</tr>
<tr>
<td>He 1s ↑↓</td>
<td>1s^2</td>
</tr>
</tbody>
</table>

Hydrogen has 1 electron. It will be in the 1s orbital because it is the most favorable position (greatest attraction to nucleus).

Helium has 2 electrons.

Follow the periodic table left to right, top to bottom to see the order in which electrons fill orbitals.
Goals:

- Derive electron configurations (short- and long-hand) and draw electron box diagrams of neutral atoms 1-20 and their ions based on their position on periodic table.
- Identify the name, symbol, valence electrons of the element or ion based on the electron configuration or box diagram.
- Determine # of core and valence electrons.
- Determine # of paired and unpaired electrons.

PRACTICE: Given the following atoms/ions, use the periodic table to...

a) Draw box diagrams for each element
b) Write the longhand electron configuration for each
c) State how many total & unpaired electrons are present
d) Circle the valence electrons.

1. Li
   Total electrons: _________ Unpaired electrons: _________
   Longhand electron configuration: ________________________________

2. Be
   Total electrons: _________ Unpaired electrons: _________
   Longhand electron configuration: ________________________________
3. B
Total electrons: _______ Unpaired electrons: _______

Longhand electron configuration: ____________________________________________

4. C
Total electrons: _______ Unpaired electrons: _______

Longhand electron configuration: ____________________________________________

5. N
Total electrons: _______ Unpaired electrons: _______

Longhand electron configuration: ____________________________________________
6. O  
Total electrons: _______ Unpaired electrons: _______

Longhand electron configuration: ____________________________________

7. F  
Total electrons: _______ Unpaired electrons: _______

Longhand electron configuration: ____________________________________

8. Ne  
Total electrons: _______ Unpaired electrons: _______

Longhand electron configuration: ____________________________________
9. K  
Total electrons: _________  Unpaired electrons: _________

Longhand electron configuration: ____________________________________________

10. Ca  
Total electrons: _________  Unpaired electrons: _________

Longhand electron configuration: ____________________________________________

Rules and Principles for Electron Configuration:

Aufbau Principle: __________________________________________________________

__________________________________________________________
Pauli Exclusion Principle: ____________________________________________________________________________________________

Hund’s Rule: ________________________________________________________________________________________________

IONS: Predict ion formed by Group A element by ___________________________.

Group B elements are the _____________________________.

1. Al^{3+} Total electrons: _______ Unpaired electrons: _______

Longhand electron configuration: ______________________________________________________________________________
2. $S^{2-}$
   Total electrons: _________ Unpaired electrons: _______

Longhand electron configuration: ________________________________________

3. $Cl^-$
   Total electrons: _________ Unpaired electrons: _______

Longhand electron configuration: ________________________________________

4. $Ca^{2+}$
   Total electrons: _________ Unpaired electrons: _______

Longhand electron configuration: ________________________________________
**Shorthand Electron Configuration:**

- Saves you time in writing electron configurations for heavier elements.
- Makes use of the fact that Noble gases have ________________________________
  (short hand is also known as “Noble gas notation”)
- **Steps:** Write the chemical symbol for the noble gas in front of the configuration in square brackets. Write the configuration for any additional electrons in the standard format.

**Calcium:** \([\text{Ar}] \ 4s^2\)

*Calcium has “the configuration of Argon plus 2 4s electrons”*

Write the shorthand electron configuration for these neutral atoms. Then, write the number of total electrons.

1. Li ________________________________  Total e's : ______
2. O ________________________________  Total e's : ______
3. K ________________________________  Total e's : ______

Write the shorthand electron configuration for the ions of these elements. Then, write the number of total electrons.

1. Be \(\rightarrow \) ______  ________________________________  Total e's : ______
2. F \(\rightarrow \) ______  ________________________________  Total e's : ______
3. Al \(\rightarrow \) ______  ________________________________  Total e's : ______
4. Cl \(\rightarrow \) ______  ________________________________  Total e's : ______