Review Question

List the four orbital shapes.
The orbital shapes are: s, p, d, and f.

Summarize Aufbau’s rule for filling orbitals.
Electrons fill orbitals with the lowest energy level possible first.
**This week we will . . .**

- SC3 Students will use the modern atomic theory to explain the characteristics of atoms.
- b. Use the orbital configuration of neutral atoms to explain its effect on the atom’s chemical properties.
ELECTRON LOCATION:
ELECTRON ORBITALS
5.2
DESCRIBE SHAPE OF THE ELECTRON ORBITALS
**The electron orbitals**

- s orbitals are spherical
  - There is only one way to turn the s orbital along the xyz axis
  - s orbitals hold 2 electrons
The electron orbitals

- p orbitals are shaped like a set of dumbbells
  - There are three ways to turn the p orbitals along the xyz axis.
  - p orbitals hold a total of 6 electrons.
The electron orbitals

- Most of the d orbitals are shaped like a double dumbbell.
- One d orbital is shaped like a dumbbell with a ring around it.

- There are 5 ways to turn the d orbitals along the xyz orbitals.
- d orbitals can hold a total of **10 electrons**.
**THE ELECTRON ORBITALS**

- *f* orbitals have an intricate shape.
  - There are 7 ways to orient the *f* orbitals along the *xyz* axis.
  - *f* orbitals can hold a total of **14 electrons**.
HOW ARE THE ORBITALS FILLED?

Pauli
Aufbau
Hund
The system used to describe the best known location of electrons is called the electron configuration.

Elements have electron configurations that are unique to their kind. It is the arrangement of electrons in the atoms of an element that give that element its characteristics and properties.
RULES FOR DETERMINING AN ELECTRON CONFIGURATION

- **Aufbau principle** explains that electrons will occupy the lowest energy orbital available.
- **Pauli exclusion principle** shows that no two electrons can have the exact same location (as described by the four quantum numbers)
- **Hund’s rule** states that orbitals of equal energy are occupied by one electron before any orbital is occupied by a second electron. The Hund’s rule also states that when orbitals of equal energy are occupied by one electron, those electrons have the same spin.
**In Other Words . . .**

- **“Lazy”**
  - Electrons are located in the orbital with lowest energy level possible.

- **“Unique”**
  - No two electrons can share the same position and spin. Electrons that are on the same orbital have different spins, clockwise and counter clockwise.

- **“Share”**
  - When orbitals have the same energy level, each orbital gets one electron before any orbital gets two electrons.
Energy Levels

- The first energy level is closest to the nucleus, and the seventh energy level is furthest from the nucleus.

- There are a total of 7 energy levels.

- As the energy levels increase, there is overlap. This means that 4s sublevel is lower in energy than the 3d sublevel.
  (there are several other examples of this overlap)
Aufbau Filling order of atomic orbitals

1s
2s  2p
3s  3p  3d
4s  4p  4d  4f
5s  5p  5d  5f
6s  6p  6d  6f
7s  7p  7d  7f
HOW WAS INFORMATION ABOUT ELECTRON ORBITALS DISCOVERED?
Quatum science
GPB Video

- You will notice cloudlike shapes.
- Try to pick out the s, p, d, or f shapes.
1. Orbital notation:

\[
\begin{array}{c}
\uparrow \\
\downarrow \\
\end{array}
\]

N (7e\textsuperscript{-}): 

\[
\begin{array}{c}
\underbrace{\_\_\_}\quad \underbrace{\_\_\_}\quad \underbrace{\_\_\_} \\
2p & 2p & 2p
\end{array}
\]

1s

\[
\begin{array}{c}
\underbrace{\_\_\_} \\
2s
\end{array}
\]

\[
\begin{array}{c}
\_\_\_ \\
2s
\end{array}
\]
6 ELECTRONS

\[ \begin{align*}
1s \\
2s & \quad 2p \\
3s & \quad 3p & \quad 3d \\
4s & \quad 4p & \quad 4d & \quad 4f \\
5s & \quad 5p & \quad 5d & \quad 5f \\
6s & \quad 6p & \quad 6d & \quad 6f \\
7s & \quad 7p & \quad 7d & \quad 7f
\end{align*} \]
11 ELECTRONS

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

Na

\[
\begin{array}{c}
\uparrow \\downarrow \\
1s \\
\hline
\uparrow \downarrow \uparrow \downarrow
\\
2s \\
\hline
\uparrow \downarrow \uparrow \downarrow \uparrow \downarrow
\\
2p \\
\hline
3s
\end{array}
\]
Zinc

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

30

\[ \begin{array}{c}
\uparrow \downarrow \\
\frac{1}{1s}
\end{array} \quad \begin{array}{c}
\uparrow \downarrow \\
\frac{2}{2s}
\end{array} \quad \begin{array}{c}
\uparrow \downarrow \uparrow \downarrow \uparrow \downarrow \\
\frac{2p}{2p 2p 2p}
\end{array} \]

\[ \begin{array}{c}
\uparrow \downarrow \\
\frac{3}{3s}
\end{array} \quad \begin{array}{c}
\uparrow \downarrow \\
\frac{3p}{3p 3p 3p}
\end{array} \quad \begin{array}{c}
\uparrow \downarrow \uparrow \downarrow \uparrow \downarrow \\
\frac{4}{4s}
\end{array} \]

\[ \begin{array}{c}
\uparrow \downarrow \\
\frac{3d}{3d}
\end{array} \quad \begin{array}{c}
\uparrow \downarrow \\
\frac{3d}{3d 3d 3d}
\end{array} \quad \begin{array}{c}
\uparrow \downarrow \\
\frac{3d}{3d}
\end{array} \]
**GROUP WORK**

- Divide your paper into 4 sections.
- Draw the orbital notation for each element given to your group.
- When you have successfully completed your group set, evaluate your answers.
- Make any necessary revisions to your orbital notations.
- Complete the individual/partner practice set.
List the four orbital shapes.

The orbital shapes are: s, p, d, and f.

Summarize Aufbau’s rule for filling orbitals.

Electrons are lazy. They fill the lowest energy level orbitals first.
Agenda:
- Complete Orbital Notation Group Practice
  - Electron Configuration Group Practice
  - Electron Configuration Independent Practice

- Take a few minutes to review your notes about electrons.

In a orbital diagram, what do the arrows represent?

The arrows are used to represent electrons.

Summarize Pauli’s rule for filling orbitals.
Representing Electron Location

2. Electron Configuration:

1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) 3p\(^6\) 4s\(^2\) 3d\(^6\)
6 ELECTRONS

\[ 1s^2 2s^2 2p^2 \]
11 ELECTRONS

Na

\[ 1s^2 2s^2 2p^6 3s^1 \]
**IRON Fe**

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

S-2
P-6
Cl-10
F-14
IODINE I

\[ 53e^- \]

\[ 1s^2 \, 2s^2 \, 2p^6 \, 3s^2 \, 3p^6 \, 4s^2 \, 3d^{10} \, 4p^6 \, 5s^2 \, 4d^{10} \, 5p^5 \]
GROUP WORK

- Divide your paper into 4 sections.
- Draw the electron configuration for each element given to your group.
- When you have successfully completed your group set, evaluate your answers.
- Make any necessary revisions to your orbital notations.
- Complete the individual/partner practice set.
In a orbital diagram, what do the arrows represent?

The arrows are used to represent electrons.

Summarize Pauli’s rule for filling orbitals.

Electrons are Unique. No two electrons can share the same position and spin.
REVIEW

Agenda:
- Noble Gas Configuration

In an orbital notation, why are the p orbitals written 3 times?

P orbitals have 3 different rotations along the x, y, and z axes.

Summarize Hund’s rule for filling orbitals.
TOMORROW’S QUIZ

Use your notes to review

- Photoelectric Effect
- Atomic Theory Scientists
- Quantum Numbers
- Orbitals
- Orbital Filling Rules
- Orbital Notation
- Electron Configuration
ELECTRON BASICS QUIZ REVIEW
The Photoelectric Effect

- Electrons absorb energy from electromagnetic radiation and move from the low energy ground state to the high energy excited state.

- “Excited” electrons move back to the ground state by releasing photons of light.
DALTON’S ATOM

Many years later, Dalton again proposed the idea of that all matter is made of indivisible and indestructible atoms.

Dalton’s model of the atom was one solid sphere.
THOMSON’S “PLUMB PUDDING”

Thomson tried to show how electrons were situated in the atom. He proposed in a model in which the atom was a positively charged ball with negatively charged electrons stuck onto the surface.

It was called the “plum pudding” model, since the electrons in the atom resembled the raisins in a plum pudding.
RUTHERFORD’S SPINNING ELECTRONS

Ernest Rutherford's experiments led him to describe the atom as having a relatively small but heavy nucleus with electrons in orbit around it.
He suggested that electrons could only have certain motions:

- The electrons travel in orbits at specific distances from the small nucleus. These distances were called energy levels.
SCHRODINGER

- Viewed electrons as continuous clouds and introduced "wave mechanics" as a mathematical model of the atom. Used quantum math to show the probability of an electron being in a given area, and he called those areas electron clouds.
**Principle Quantum Number**

- The principle quantum number \((n)\) indicates the **main energy level** occupied by the electron.

- \(n\) can only be a positive whole number 1-7.

- Small \(n\) values indicate close proximity to the nucleus. Large \(n\) values indicate that an electron is farther from the nucleus.
**Angular Momentum Quantum Number**

- The angular momentum quantum number \( \ell \) indicates the **shape of the orbital**.

- For a given energy level, the number of angular momentum values allowed is equal to \( n \).

- The angular values allowed are 0 through \( n-1 \).

- The angular momentum quantum number defines s, p, d, and f orbital shapes.
The magnetic quantum number (m) indicates the orientation of an orbital around the nucleus. It describes how the orbital lies on an axis x, y, z.

- s orbitals only have 1 orientation in space.
- p orbitals can have 3 orientations in space.
- d orbitals can have 5 orientations in space.
- f orbitals can have 7 orientations in space.
**Spin Quantum Number**

- The spin quantum number (s) indicates the direction of an electron’s spin.

- Electrons are thought of as having two spins. (clockwise & counter clockwise)

- There are only two possible values for the spin quantum number, +1/2 and -1/2.
Orbital Shape

- **s** -- sphere
  - (1 orientation; 2 electrons)

- **p** -- dumbbell (1 orientation; 2 electrons)
  - (3 orientations; 6 electrons)

- **d** -- double dumbbell
  - dumbbell & doughnut
  - (5 orientation; 10 electrons)

- **f** -- very complex shape
  - (7 orientation; 14 electrons)
RULES FOR DETERMINING AN ELECTRON CONFIGURATION

- **Aufbau principle** explains that electrons will occupy the lowest energy orbital available.

- **Pauli exclusion principle** shows that no two electrons can have the exact same location (as described by the four quantum numbers).

- **Hund’s rule** states that orbitals of equal energy are occupied by one electron before any orbital is occupied by a second electron. The Hund’s rule also states that when orbitals of equal energy are occupied by one electron, those electrons have the same spin.
IN OTHER WORDS . . .

- “Lazy”
  - Electrons are located in the orbital with lowest energy level possible.

- “Unique”
  - No two electrons can share the same position and spin. Electrons that are on the same orbital have different spins, clockwise and counter clockwise.

- “Share”
  - When orbitals have the same energy level, each orbital gets one electron before any orbital gets two electrons.
3. Noble Gas Configuration:

- Na: 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^1\) \text{ or } [\text{Ne}] 3s\(^1\)
- Mg: 1s\(^2\) 2s\(^2\) 2p\(^6\) 3s\(^2\) \text{ or } [\text{Ne}] 3s\(^2\)
6 ELECTRONS

\[ [\text{He}] 2s^2 2p^2 \]
11 ELECTRONS

Na

\[\text{[Ne]}\ 3s^1\]
Iron (Fe)

$^{26}\text{Fe}^-$

\[ [\text{Ar}] 4s^2 3d^6 \]
Iodine I

$53e^-$

$\left[\text{Kr}\right]5s^2\,4d^{10}\,5p^5$
In an orbital notation, why are the p orbitals written 3 times?

P orbitals have 3 different rotations along the x y and z axes.

Summarize Hund’s rule for filling orbitals.

Electrons Share. When filling similar orbitals, distribute one electron to each before giving a second electron.
In an electron configuration, what do the “exponents” represent?

The superscript numbers are not exponents. They represent the number of electrons in each orbital.

Describe the difference between Bohr’s model of the atom and the Orbital model.
Essential Question

- Only Hydrogen atoms.
- Fixed Pathways
- It was 1-D
- Both use protons & electrons
- Both revolve around nucleus of the atoms
- Schrodinger's Model
- Wave mechanics & Quantum
- Electron cloud
- Sp orf orbitals
Essential Question

- Electrons on rings
  - Photoelectric Effect

- Bohr’s Model
  - Shows Electrons, Neutrons, Protons

- Orbital Model
  - Shows Electrons only
  - $\frac{4}{4} \frac{1}{1} \frac{1}{5} \frac{1}{2}$

- Describe Electron Location
  - Use Energy Levels
  - Fill low E levels first
Electron Basics Quiz
Representing Electron Location

4. Electron Dot Diagram
   - Shows only the last energy level of the atom’s electron configuration
   - Each electron is represented as one dot
   - Imagine a box around your element symbol. A pair of dots can be placed on each side around the element’s symbol. There cannot be more than 8 dots in total.
6 ELECTRONS

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

\[ 1s^2 2s^2 2p^2 \]
11 ELECTRONS

\[\overset{1s}{1s} \quad \overset{2s}{2s} \quad \overset{2p}{2p} \quad \overset{3s}{3s} \quad \overset{3p}{3p} \quad \overset{3d}{3d} \quad \overset{4s}{4s} \quad \overset{4p}{4p} \quad \overset{4d}{4d} \quad \overset{4f}{4f} \quad \overset{5s}{5s} \quad \overset{5p}{5p} \quad \overset{5d}{5d} \quad \overset{5f}{5f} \quad \overset{6s}{6s} \quad \overset{6p}{6p} \quad \overset{6d}{6d} \quad \overset{6f}{6f} \quad \overset{7s}{7s} \quad \overset{7p}{7p} \quad \overset{7d}{7d} \quad \overset{7f}{7f}\]

\text{Na .}
IRON Fe

\[ 1s^2 \ldots 3p^6 4s^2 3d^1 \]

\[ \cdot Fe \cdot \]
Iodine I

\[ 1s^2 \ldots 5s^2 \ \underline{4d^{10}} \ \underline{5p^5} \]
In an electron configuration, what do the “exponents” represent?

The superscript numbers are not exponents. They represent the number of electrons in each orbital.

Describe the difference between Bohr’s model of the atom and the Orbital model.
Where are noble gases located on the periodic table?

Noble gases are located on the far right in group 18.

Which noble gas should you select when making a noble gas configuration for a given element?
ACROSTIC “PROTON”

- P
- R
- O
- T
- O
- N
CREATE AN ACROSTIC FOR “ELECTRON”

E
L
E
C
T
R
O
N
You will need a periodic table to complete today’s work.

Where are noble gases located on the periodic table?
Noble gases are located on the far right in group 18.

Which noble gas should you select when making a noble gas configuration for a given element?
Select the noble gas that is closest without going over in number of electrons to the given element.
Describe the process for creating a noble gas configuration.

Select the noble gas that is closest to your element without going over and put it in brackets. Add any additional orbitals necessary to complete the configuration for your element.

How do you determine the number of dots to use in a dot diagram?
REPRESENTING ELECTRON LOCATION-QUIZ

1. Orbital Notation
2. Electron Configuration
3. Noble Gas Configuration
4. Dot Diagram
Describe the process for creating a noble gas configuration.

Select the noble gas that is closest to your element without going over and put it in brackets. Add any additional orbitals necessary to complete the configuration for your element.

How do you determine the number of dots to use in a dot diagram?

Count the number of electrons in the highest energy level-valence electrons.
How is an ion created?

Negative ions are created when electrons are gained. Positive ions are created when electrons are lost.

What arrangement of electrons demonstrates stability?

Full s and p orbitals in the outer energy level - $s^2p^6$
IONS

- Cations - Positive ions have lost electrons
- Anions - Negative ions have gained electrons

Why do neutral elements become ions?
- Full octet (s and p orbitals)
- Behave like a noble gas
Stability:

- atoms are most stable when they have full s and full p orbitals in their highest energy levels
- 8 valence electrons
- He is stable with just 2 valence electrons. Why?
| **Part A:** Write the electron configuration for each atom and its ion. |
|------------------|------------------|
| **O**    | **O²⁺**   |
| **B**    | **B⁺**    |
| **K⁺**   | **K²⁺**   |
| **Sr⁻**  | **Sr²⁻**  |
| **Fe²⁺** | **Fe³⁺**  |

**BR:** Complete the configurations highlighted in green.
<table>
<thead>
<tr>
<th>Atom</th>
<th>Electron Configuration</th>
<th>Stable?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Se</td>
<td>$3^+ 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^4$</td>
<td>No</td>
</tr>
<tr>
<td>Ar</td>
<td>$18 1s^2 2s^2 2p^6 3s^2 3p^6$</td>
<td>Yes</td>
</tr>
<tr>
<td>Be$^{2+}$</td>
<td>$2 1s^2$</td>
<td>Yes</td>
</tr>
<tr>
<td>Ge$^{2+}$</td>
<td>$30 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$</td>
<td>No</td>
</tr>
<tr>
<td>Ne</td>
<td>$10 1s^2 2s^2 2p^6$</td>
<td>Yes</td>
</tr>
<tr>
<td>Co</td>
<td>$27 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10}$</td>
<td>No</td>
</tr>
<tr>
<td>Al$^{3+}$</td>
<td>$13 1s^2 2s^2 2p^6$</td>
<td>Yes</td>
</tr>
<tr>
<td>Al$^{3-}$</td>
<td>$13 1s^2 2s^2 2p^6 3s^2 3p^6$</td>
<td>No</td>
</tr>
<tr>
<td>P</td>
<td>$15 1s^2 2s^2 2p^6 3s^2 3p^3$</td>
<td>No</td>
</tr>
<tr>
<td>Kr</td>
<td>$37 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$</td>
<td>No</td>
</tr>
</tbody>
</table>

BR: Please check your work from yesterday.
<table>
<thead>
<tr>
<th>Atom/Ion</th>
<th>Electron Configuration</th>
<th>Stable?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Se</td>
<td>4p⁴</td>
<td>No</td>
</tr>
<tr>
<td>Ar</td>
<td>3p⁶</td>
<td>Yes</td>
</tr>
<tr>
<td>Be²⁺</td>
<td>1s²</td>
<td>Yes</td>
</tr>
<tr>
<td>Ge²⁺</td>
<td>1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰</td>
<td>No</td>
</tr>
<tr>
<td>Ne</td>
<td>2p⁶</td>
<td>Yes</td>
</tr>
<tr>
<td>Co</td>
<td>4s² 3d⁷</td>
<td>No</td>
</tr>
<tr>
<td>Al³⁺</td>
<td>2p⁶</td>
<td>Yes</td>
</tr>
<tr>
<td>Al³⁻</td>
<td>3p⁴</td>
<td>No</td>
</tr>
<tr>
<td>P</td>
<td>3p³</td>
<td>No</td>
</tr>
<tr>
<td>Kr⁻</td>
<td>5s¹</td>
<td>No</td>
</tr>
</tbody>
</table>
IONS: PREDICT THE CHARGES OF THE FOLLOWING ELEMENTS BASED ON THEIR ELECTRON CONFIGURATIONS THEN WRITE THE NEW CONFIGURATION

Oxygen

Magnesium

Chlorine

Potassium
IONS: PREDICT THE CHARGES OF THE FOLLOWING ELEMENTS BASED ON THEIR ELECTRON CONFIGURATIONS THEN WRITE THE NEW CONFIGURATION

Neon

Iron

Nitrogen
Agenda:
- Five Square Review
- Ion Configuration & Stability

How is an ion created?
Negative ions are created when electrons are gained. Positive ions are created when electrons are lost.

What arrangement of electrons demonstrates stability?
Full s and p orbitals in the outer energy level - $s^2\ p^6$
In terms of orbitals, what does it mean to have a “full octet”?
In the highest energy level $s^2 \, p^6$.

List four different ways to represent electron location.
Five Square Review

Noble Gas Configuration

Number of Protons, Neutrons, electrons

Dot Diagram

Element

Electron Configuration

Orbital Notation
REPRESENTING ELECTRON LOCATION QUIZ

1. Orbital Notation
2. Electron Configuration
3. Noble Gas Configuration
4. Dot Diagram

Good Luck!

After the quiz, begin outlines for your Electron Unit Activities.
In terms of orbitals, what does it mean to have a “full octet”? 

In the highest energy level $s^2 p^6$.

List four different ways to represent electron location.

1. Orbital notation
2. Electron configuration
3. Noble gas configuration
4. Dot diagram

Agenda:
- Four Square Review
- Ion Configuration & Stability
Which two projects did you select as review activities?

Element double bubble – Atomic Theory double bubble
Orbital tree map – Orbital Filling Rules tree map
Electron Unit taboo – Electron Unit acrostic

List two new things you learned about electrons during the electron unit lessons.
## Complete Electron Review Projects

**Electron Configuration Unit Activities**

Directions: Select 2 of the following project options to complete. The minimum requirements for each activity are listed in the table. These should serve as a foundation for your creations, but you should not limit yourself to doing only what is listed in the table. For maximum credit, be creative and add your own ideas to enhance each activity. Each project should be completed in a manner that is accurate, thorough, well thought out, and visually attractive.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Create a double bubble map for two elements within the same group in periods 2-7 of the periodic table.</td>
<td><strong>2.</strong> Create a tree map of the orbitals described in the electron cloud atomic theory.</td>
<td><strong>3.</strong> Create a taboo game with terms relevant to the topics we discussed in the electron unit.</td>
</tr>
<tr>
<td><strong>Minimum requirements include:</strong></td>
<td><strong>Minimum requirements include:</strong></td>
<td><strong>Minimum requirements include:</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>📚 Orbital notation</td>
<td>📚 Shape</td>
<td>📚 5 main taboo terms</td>
</tr>
<tr>
<td>📚 Electron configuration</td>
<td>📚 Orientations in space</td>
<td>📚 3 “off limits” terms/phares for each taboo term</td>
</tr>
<tr>
<td>📚 Dot diagram</td>
<td>📚 Total number of electrons</td>
<td>📚 Written example of a good clue for the taboo term/phrase</td>
</tr>
<tr>
<td>📚 Group on periodic table</td>
<td>📚 Energy levels where this orbital is present</td>
<td>📚 4 details per category</td>
</tr>
<tr>
<td>📚 Number of valence electrons</td>
<td>📚 8 content bubbles</td>
<td>📚 4 details per category</td>
</tr>
<tr>
<td>📚 8 content bubbles</td>
<td>📚 4 details per category</td>
<td>📚 4 details per category</td>
</tr>
</tbody>
</table>

| **4.** Create a double bubble thinking map to compare two main theories in the atomic theory timeline (Dalton, Thompson, Rutherford, Bohr, or Schrödinger). A “Bohr vs Schrödinger” map is off limits. | **5.** Create a tree map of the orbital filling rules. | **6.** Select a term relevant to the topics we discussed in the electron unit. Create two completely different acrostics for the term you selected. The terms “proton” and “electron” are off limits. |
| **Minimum requirements include:** | **Minimum requirements include:** | **Minimum requirements include:** |
|   |   |   |
| 📚 Detailed explanation of key points in each theory | 📚 Description/Definition of the law | 📚 Topic word relevant to the electron unit |
| 📚 Illustration of the atom proposed in each theory | 📚 Summary of the law in your own words | 📚 Appropriate words or phrases beginning with each letter of the topic word |
| 📚 8 content bubbles | 📚 Illustration of incorrect example | 📚 Words or concepts are not repeated between the two acrostics |
Which two projects did you select as review activities?

Element double bubble – Atomic Theory double bubble
Orbital tree map – Orbital Filling Rules tree map
Electron Unit taboo – Electron Unit acrostic

List two new things you learned about electrons during the electron unit lessons.
REVIEW

Agenda:
- Electron Unit Projects
- Electron Unit Study Guide

Br: Which two projects did you select as review activities?
Element double bubble – Atomic Theory double bubble
Orbital tree map – Orbital Filling Rules tree map
Electron Unit taboo – Electron Unit acrostic

EQ: Name this element $1s^2\ 2s^2\ 2p^5$
Fluorine
COMPLETE ELECTRON REVIEW PROJECTS

Electron Configuration Unit Activities

Directions: Select 2 of the following project options to complete. The minimum requirements for each activity are listed in the table. These should serve as a foundation for your creations, but you should not limit yourself to doing only what is listed in the table. For maximum credit, be creative and add your own ideas to enhance each activity. Each project should be completed in a manner that is accurate, thorough, well thought out, and visually attractive.

1. Create a double bubble map for two elements within the same group in periods 2-7 of the periodic table.
   Minimum requirements include:
   - Orbital notation
   - Electron configuration
   - Dot diagram
   - Group on periodic table
   - Number of valence electrons
   - 8 content bubbles

2. Create a tree map of the orbitals described in the electron cloud atomic theory.
   Minimum requirements include:
   - Shape
   - Orientations in space
   - Total number of electrons
   - Energy levels where this orbital is present
   - 4 details per category

3. Create a taboo game with terms relevant to the topics we discussed in the electron unit.
   Minimum requirements include:
   - 5 main taboo terms
   - 3 “off limits” terms/phrases for each taboo term
   - Written example of a good clue for the taboo term/phrase

4. Create a double bubble thinking map to compare two main theories in the atomic theory timeline (Dalton, Thompson, Rutherford, Bohr, or Schrödinger). A “Bohr vs Schrödinger” map is off limits.
   Minimum requirements include:
   - Detailed explanation of key points in each theory
   - Illustration of the atom proposed in each theory
   - 8 content bubbles

5. Create a tree map of the orbital filling rules.
   Minimum requirements include:
   - Description/Definition of the law
   - Summary of the law in your own words
   - Illustration of incorrect example
   - Illustration of correct example
   - 4 details per category

6. Select a term relevant to the topics we discussed in the electron unit. Create two completely different acrostics for the term you selected. The terms “proton” and “electron” are off limits.
   Minimum requirements include:
   - Topic word relevant to the electron unit
   - Appropriate words or phrases beginning with each letter of the topic word
   - Words or concepts are not repeated between the two acrostics
Electron Unit Study Guides

Electrons in Atoms Study Guide: Chapter 5

- Define the following terms in your own words:
  - Atomic Emission Spectrum
  - Wave length
  - Quantum
  - Atomic orbital
  - Excited state
  - Frequency
  - Photon
  - Electron
  - Ground State

- Describe the purpose of an emission spectrum and how it is created.

- Electron configuration:
  - Dot Diagram
  - Orbital Notation
  - Noble gas configuration

- What major contributions did the following make to our understanding of the atom?
  - Dalton
  - Rutherford
  - Bohr

- List the four quantum numbers and what each number describes.

- Describe the rule(s) being broken in this problem.

- List the four orbital shapes. Indicate their number of orbitals and total electrons.

- Give the orbital notation, electron configuration, noble gas configuration, and dot diagram for:
  - Copper
  - Silicon

- Determine the name of the element denoted by the given neutral electron configuration:

  - \(1s^22s^22p^63s^1\)
  - \(1s^22s^22p^63s^23p^2\)
  - \(1s^22s^22p^63s^23p^6\)
  - \(1s^22s^22p^63s^23p^2\)
  - \(1s^22s^22p^63s^23p^6\)
  - \(1s^22s^22p^63s^23p^2\)

- The following electron configurations are not valid. Explain and correct the error using the same number of electrons:

  - \(1s^22s^22p^63s^23p^64s^2\)
  - \(1s^22s^22p^63s^23p^64s^2\)
  - \(1s^22s^22p^63s^23p^64s^2\)
Agenda:
- Electron Unit Projects
- Electron Unit Study Guide

Which two projects did you select as review activities?

Element double bubble – Atomic Theory double bubble
Orbital tree map – Orbital Filling Rules tree map
Electron Unit taboo – Electron Unit acrostic

Name this element $1s^2 2s^2 2p^5$

Fluorine
REVIEW

Agenda:
- Electron Unit Scavenger Hunt Review
- Electron Unit Study Guide Questions

How is an emission spectrum created?
A photon of light is released from an energized electron as it moves from the excited state back to the ground state.

Name this element $1s^2 \ 2s^1$

Lithium
Electron Test Review

- Electron Facts Scavenger Hunt
  - Begin at any question #1-20
  - Write your answer the question in the appropriate space
  - Look around the room to find the paper that matches your answer
  - Read the next question
How is an emission spectrum created?

A photon of light is released from an energized electron as it moves from the excited state back to the ground state.

Name this element $1s^2\ 2s^1$ lithium
Review your notes and study guide until the test begins.

- Take your time.
- Check your work.
- Eliminate careless mistakes.
- Orbital Notation
  \[
  \begin{array}{c}
  \uparrow \downarrow \\
  |s \ 2s
  \end{array}
  \]

- Electron Configuration
  \[1s^2 2s^2\]

- Noble Gas Configuration
  \[\text{[He]} 2s^2\]

- Dot Diagram
  \[\text{Na}\cdot\]
EXCEPTIONS

- Chromium
- Copper
Double Bubble Map

Meets Minimum Requirements ~ 90%
- Visually Attractive
- Orbital notation
- Electron configuration
- Noble gas configuration
- Dot diagram
- Group on periodic table
- Number of valence e⁻

Exceeds Requirements ~ 100%
- All Minimum Requirements
- Visually Attractive
- Additional Information
After the Test . . .

**Orbital Tree Map**
- Shape
- Orientations in space
- Total number of electrons
- Energy levels

**Orbital Filling Rules Tree Map**
- Definition
- Summarize in your words
- Incorrect example
- Correct example

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Groups 1 and 2: write the dot diagram and the last orbital.
Groups 3-18: write the dot diagram and the last 2 orbitals.

**Predictions**

- Last orbital of:
  - Ra
  - Ag
  - Pt
  - Pb
  - I
  - Xe

- Where would the f block be located? Color and outline it in purple.

- Which elements will end in:
  - $5s^2\ 4d^2$
  - $6s^1$
  - $6s^2\ 6p^3$
  - $5f^3$

- How many electrons would be gained/lost from elements for Groups 1, 2, and 13-18?

- What charge would you expect for Groups 1, 2 and 13-18?