1. What measurements are indicated by the arrows?

\[
\begin{array}{cccc}
0 \text{ cm} & & & 10 \\
\uparrow & \uparrow & \uparrow & \uparrow \\
a & b & c & d \\
a) \ 0.2 \quad b) \ 1.8 cm \quad c) \ 3.4 cm \quad d) \ 9.5 cm
\end{array}
\]

2. How many significant digits do each of the measurements have?

a) \_ \_ \_ \_ \_ b) \_ \_ \_ \_ \_ c) \_ \_ \_ \_ \_ d) \_ \_ \_ \_ \_

3. Definitions:
accuracy – how close a measurement is to an actual value
precision – how close a measurement is to a series of measurements

4. Data:

<table>
<thead>
<tr>
<th>Length of metal block</th>
<th>3.57 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width of metal block</td>
<td>2.83 cm</td>
</tr>
<tr>
<td>Height of metal block</td>
<td>1.75 cm</td>
</tr>
<tr>
<td>Mass of metal block</td>
<td>139.00 g</td>
</tr>
</tbody>
</table>

L \times w \times H = 3.57 \times 2.83 \times 1.75 = 17.7 \text{ cm}^3

D = \frac{m}{V} = \frac{139.00 \text{ g}}{17.7 \text{ cm}^3} = 7.85 \text{ g/cm}^3 = \text{iron}

Fill in this chart:

<table>
<thead>
<tr>
<th>atom</th>
<th>mass</th>
<th># p+</th>
<th># n°</th>
<th># e-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na</td>
<td>23</td>
<td>11</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Cu</td>
<td>63</td>
<td>29</td>
<td>34</td>
<td>29</td>
</tr>
<tr>
<td>Mg</td>
<td>24</td>
<td>12</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Br</td>
<td>80</td>
<td>35</td>
<td>45</td>
<td>35</td>
</tr>
<tr>
<td>F</td>
<td>19</td>
<td>9</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Mg²⁺</td>
<td>24</td>
<td>1</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td>Cl⁻</td>
<td>35</td>
<td>17</td>
<td>18</td>
<td>18</td>
</tr>
</tbody>
</table>

Fill in the orbital diagram for As (#33)

\[
\begin{array}{c}
\text{4p} \quad 1 \quad 1 \quad 1 \quad 3d \\
\text{3p} \quad 2 \quad 2 \quad 2 \quad 2 \\
\text{1s} \quad 2 \\
\text{2s} \quad 2 \\
\text{3s} \quad 2 \\
\text{3p} \quad 6 \\
\text{4s} \quad 2 \\
\text{3d} \quad 10 \\
\text{4p} \quad 3
\end{array}
\]

Finish the electron configuration for this atom:

1s² 2s² 2p⁶ 3s² 3p⁶ 4s² 3d¹⁰ 4p³

How many electrons valence electrons in this atom? \_ \_ \_ \_ \_ \_ \_ \_ \_
Check the category that corresponds to the description.

<table>
<thead>
<tr>
<th>PROPERTY</th>
<th>CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food browning in oven</td>
<td>✓</td>
</tr>
<tr>
<td>Decomposing leaves</td>
<td>✓</td>
</tr>
<tr>
<td>Sugar dissolving in water</td>
<td>✓</td>
</tr>
<tr>
<td>Ice melts at 0 °C</td>
<td>✓</td>
</tr>
<tr>
<td>High melting &amp; boiling point</td>
<td>✓</td>
</tr>
<tr>
<td>Iron rusts in air &amp; water</td>
<td>✓</td>
</tr>
<tr>
<td>Grinding metal to dust</td>
<td>✓</td>
</tr>
</tbody>
</table>

---

1. Fill in the orbital diagram for the element, Zn, and write the electron configuration of Zn and Zn^{2+} in the short form.

\[
\text{Zn} \quad [\text{Ar}] \quad 4s^2 \quad 3d^{10} \\
\text{Zn}^{2+} \quad [\text{Ar}] \quad 4s^2 \quad 3d^8
\]

2. When do atoms emit light?
- When they absorb energy and jump up to a higher energy level.
- When they drop down to a lower energy level.
- When they fall into the nucleus.
1. Color in the seven diatomic elements:


3. Label Metals and Non-metals; cross-hatch the semi-metals (metalloids).

4. Draw arrows to represent the trends for atomic radius and electronegativity.

5. Define electronegativity: the ability to attract electrons.

6. Compare atomic size: Compare the atomic sizes of O and F.
   \[ \text{O} \] is larger because it has \text{less} protons
   
   Compare the atomic sizes of O and S.
   \[ \text{S} \] is larger because it has \text{more} orbitals

---

**Fall Final Topic Review**

**Station 6**

**IONIC BONDING**

1. Determine the # of ions needed to make a neutral compound and then write the formula.

<table>
<thead>
<tr>
<th># Cations</th>
<th>Cation</th>
<th># Anions</th>
<th>Anion</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Na(^+)</td>
<td>1</td>
<td>PO(_4)(^{3-})</td>
<td>Na(_3)PO(_4)</td>
</tr>
<tr>
<td>1</td>
<td>Sn(^{4+})</td>
<td>4</td>
<td>Cl(^-)</td>
<td>SnCl(_4)</td>
</tr>
<tr>
<td>1</td>
<td>Al(^{3+})</td>
<td>3</td>
<td>OH(^-)</td>
<td>Al((OH)(_3)</td>
</tr>
<tr>
<td>2</td>
<td>NH(_4)^+</td>
<td>1</td>
<td>SO(_4)(^{2-})</td>
<td>(NH(_4)(_2)SO(_4)</td>
</tr>
</tbody>
</table>

2. Draw Lewis Structures for the following ionic compounds.

   \[
   \text{NaCl} \quad [\text{Na}^+: \boxed{\text{Cl}^-}]
   \]
   
   \[
   \text{MgO} \quad [\text{Mg}^{2+}: \boxed{\text{O}^{2-}}]
   \]
   
   \[
   \text{CaCl}_2 \quad [\text{Ca}^{2+}: \boxed{\text{Cl}^-} \quad \boxed{\text{Cl}^-}]
   \]
   
   \[
   \text{KBr} \quad [\text{K}^{+}: \boxed{\text{Br}^-}]
   \]

3. Name the neutral ionic compounds formed in table #1.
   
   Sodium phosphate
   Tin (IV) chloride
   Aluminum hydroxide
   Ammonium sulfate
## Properties of Compounds

### Metals (M) or Non-Metals (NM)
- **M**: Conduct electricity.
- **NM**: Dull in appearance
- **M**: Form positive ions
- **NM**: Found on the right side of the periodic table.
- **NM**: Have elements in all three states.
- **M**: Hard.

### Ionic (I), Covalent (C), or Metallic (M) bonds
- **C**: Electrons shared between atoms.
- **M**: Delocalized electrons.
- **I**: Have positive ions and negative ions.
- **H**: Transferred electrons.
- **C**: Found in molecules.
- **M**: Found in alloys.
- **I**: Found in crystal lattice.

### Metallic Solids (MS), Molecular Solids (MOL), or Ionic Solids (IS)
- **IS**: High melting & boiling points.
- **IS**: Have many textures.
- **IS**: Conduct electricity in water.
- **IS, MOL**: Do not conduct electricity.
- **IS**: Brittle.

### Insulators, Mostly solids, Malleable and ductile
- **NM**: Insulators.
- **M**: Mostly solids.
- **M**: Malleable and ductile.
- **NM**: Found on left side of the periodic table.
- **NM**: Generally low melting & boiling points.
- **NM**: Have elements in all three states.

---

## Lewis Structures and VSEPR

### Draw Lewis Structures and predict shape

<table>
<thead>
<tr>
<th>CS₂</th>
<th>O₃</th>
<th>N₂</th>
<th>Br₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>S=C=S</td>
<td>O=O</td>
<td>N≡N</td>
<td>Br–Br</td>
</tr>
<tr>
<td>Linear</td>
<td>bent</td>
<td>Linear</td>
<td>Linear</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PF₃</th>
<th>BF₃</th>
<th>CCl₄</th>
<th>SiF₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>F–P–F</td>
<td>F–B–F</td>
<td>Cl–C–Cl</td>
<td>F–Si–F</td>
</tr>
<tr>
<td>trigonal</td>
<td>trigonal</td>
<td>tetrahedral</td>
<td>tetrahedral</td>
</tr>
<tr>
<td>pyramidal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NO₃⁻</th>
<th>SeO₃</th>
<th>H₂S</th>
<th>CH₃O</th>
</tr>
</thead>
<tbody>
<tr>
<td>trigonal planar</td>
<td></td>
<td>bent</td>
<td></td>
</tr>
</tbody>
</table>
## Fill in this chart:

<table>
<thead>
<tr>
<th>Compound</th>
<th>Lewis Structure</th>
<th>Name of Shape</th>
<th>Polar (P) or Nonpolar (NP)</th>
<th>Soluble in water? (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NH₃</td>
<td>( H \cdot N \cdot H )</td>
<td>trigonal pyramidal</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>CO₂</td>
<td>( O = C = O )</td>
<td>Linear</td>
<td>NP</td>
<td>N</td>
</tr>
<tr>
<td>HCN</td>
<td>( H \cdot C \equiv N \cdot )</td>
<td>Linear</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>CH₄</td>
<td>( H \cdot C \cdot C \cdot H )</td>
<td>tetrahedral</td>
<td>NP</td>
<td>N</td>
</tr>
<tr>
<td>H₂O</td>
<td>( H \cdot \overset{\ddot{}}{O} \cdot H )</td>
<td>bent</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td>Cl₂</td>
<td>( \cdot Cl \cdot Cl \cdot )</td>
<td>linear</td>
<td>NP</td>
<td>N</td>
</tr>
<tr>
<td>HCl</td>
<td>( H \cdot Cl \cdot )</td>
<td>linear</td>
<td>P</td>
<td>Y</td>
</tr>
</tbody>
</table>

## TERMS:

1. Atomic number
2. Isotope
3. Mass number
4. Nucleus
5. Compound
6. Substance
7. Precision, Accuracy
8. Significant figures
9. Conservation of Mass
10. Density
11. Metric Conversions
12. Conversion factors
13. Kelvin, Celsius (convert between these)
14. Atoms, ions, cations, anions, polyatomic ions
15. Group (family), period
16. Electron Configuration
17. Noble Gas configuration
18. Ionization energy, Electronegativity, Atomic Radius
19. Lewis Structure
20. VSEPR (shape minimizes electron pairs repelling each other)
21. Polar covalent, nonpolar covalent
Fill in this chart:

Directions: Identify the following as alpha, beta, gamma, or neutron.

1. $\frac{1}{0}n$ neutron
2. $\frac{0}{-1}e$ beta
3. $\frac{4}{2}He$ alpha
4. $\frac{0}{0}\gamma$ gamma

5. Nuclear decay with no mass and no charge
   - gamma
   - beta

6. An electron
   - alpha

7. Least penetrating nuclear decay
   - alpha

8. Most damaging nuclear decay to the human body
   - gamma

9. Nuclear decay that can be stopped by skin or paper.
   - alpha

10. Nuclear decay that can be stopped by aluminum.
    - beta

Complete the following nuclear equations.

11. $^{42}_{19}K \rightarrow ^0_{-1}e + ^{42}_{20}Ca$

12. $^{239}_{94}Pu \rightarrow ^4_2He + ^{235}_{92}U$

13. $^{9}_{4}Be \rightarrow ^9_{4}Be + ^8\gamma$

14. $^{235}_{92}U \rightarrow ^2_4He + ^{231}_{90}Th$

15. What is the difference between nuclear fusion and fission? Which gives off more energy?
   - fusion brings two atoms together to form a new element.
   - fission is dividing an atom into 2 or more elements.
   - fusion gives off more energy.