1. (10 points) Sulfur is a (metal) (nonmetal) (metalloid) ___________ with a symbol of ___________ and an atomic number of ___________. It is in Group ___________ and in period ___________ of the periodic table. The element has ___________ protons in the nucleus. A sulfide ion has the formula ___________ and has ___________ electrons. The most abundant isotope of sulfur is $^{32}\text{S}$, an isotope with ___________ neutrons in the nucleus. A metal in the same period as sulfur would be ________________ (give its name or symbol).

2. (14 points) Complete the following table of names and formulas.

<table>
<thead>
<tr>
<th>Cation</th>
<th>Anion</th>
<th>Formula</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Al$^{3+}$</td>
<td></td>
<td>Al(OH)$_3$</td>
<td>copper(II) carbonate</td>
</tr>
<tr>
<td>Mg$^{2+}$</td>
<td>ClO$_4^-$</td>
<td>Fe$_3$O$_4$</td>
<td>iron(III) oxide</td>
</tr>
<tr>
<td>Ni$^{2+}$</td>
<td>CH$_3$CO$_2^-$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cu$^{2+}$</td>
<td></td>
<td>CuSO$_4$</td>
<td></td>
</tr>
</tbody>
</table>

3. (3 points) Give the name or formula of each of the following nonionic compounds.

<table>
<thead>
<tr>
<th>Name</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>nitrogen dioxide</td>
<td></td>
</tr>
<tr>
<td>ammonia</td>
<td></td>
</tr>
<tr>
<td>HBr</td>
<td></td>
</tr>
</tbody>
</table>

4. (4 points) In one of the boxes below sketch an atomic level view of solid iron. In the other box, sketch a molecular level view of nitrogen gas. Use a circle to represent an atom. Include at least 20 atoms of iron or of nitrogen in your drawing.

Iron metal

Nitrogen gas
5. (2 points) The density of iron is 7.874 g/cm$^3$. What volume of iron contains 0.10 mol of iron?

i) 0.013 cm$^3$
ii) 0.71 cm$^3$
iii) 1.4 cm$^3$
iv) 44 cm$^3$
v) none of the above

6. (3 points) Classify each of the following as a chemical or physical change:

(a) _____________ A cup of household bleach changes the color of your favorite T-shirt from purple to pink.

(b) _____________ The fuels in the space shuttle (hydrogen and oxygen) combine to give water and provide the energy to lift the shuttle into space.

(c) _____________ An ice cube in your glass of lemonade melts.

7. (2 points) Which of the following contains the largest number of atoms?

a) A piece of copper with a mass of 0.10 g.

b) A piece of platinum with a volume of 0.10 cm$^3$. (The density of platinum is 21.45 g/cm$^3$.)

c) 0.10 mL of liquid mercury. (Mercury has a density of 13.6 g/cm$^3$.)

8. (5 points) A cylindrical piece of sodium is 12.00 cm long and has a diameter of 4.5 cm. The density of sodium is 0.971 g/cm$^3$. How many atoms does the piece of sodium contain? [The volume of a cylinder is $V = \pi r^2 \times \text{length}$.]

You must show your work here! Pay attention to units!
8. (4 points) Fill in the blank or circle the correct answer.
   a) A flask has a volume of 800 mL. In liters, the volume is ____________ L
   b) A sample has a mass of 0.156 g. In milligrams, this mass is ____________ mg.
   c) What is the most correct answer for the following mathematical operation
      \[(0.012345) \times (5.3 \times 10^{-3}) = \_____________
      \]
      i) 6.5429 x 10^{-5}
      ii) 6.54 x 10^{-5}
      iii) 6.5 x 10^{-5}
      iv) 6.5 x 10^5
   d) Sodium metal melts at 371 K. On the Celsius scale, this temperature would be ______ °C

9. (3 points) Tylenol has the molecular structure illustrated here. Its formula is
   
   \[
   \text{C}____\text{H}____\text{N}____\text{O}____
   \]

   Models of tylenol (acetaminophen)