Show your work for complete (and partial) credit. Report your answers to the correct number of significant figures, and use units where appropriate. All chemical equations should balance; indicate phases.

1. Please give an example of:
   a) an element.  
   b) a compound.

2. What category of matter can be decomposed into simpler substances by a chemical process but cannot be separated into simpler components by a physical process?

3. How is a theory different from a hypothesis? List two ways in which theories generally differ from hypothesis.


5. Convert $6.33 \times 10^8 \mu g$ to kg.

6. Toluene has a density of $0.866 g/cm^3$. What is the volume of 35.0 g of toluene?

7. Which of the following are expressed to a precision of 0.1 mg? Check all that apply; ignore SF.
   ___.001 g  ____0.0001 g  ____0.01 g  ____10^{-4} g  ____10 \mu g  ____10^2 \mu g

8. If carpet costs $8.50 per square foot, how many square meters could you buy for $550? (2.54 cm = in, 12 in = ft)
9. If the temperature goes up by 1K, it goes up by less than 1°C /1°C /more than 1°C (choose one) and less than 1°F /1°F /more than 1°F (choose one).

10. Fill in the 3 empty boxes in the following table.

<table>
<thead>
<tr>
<th>Isotope symbol</th>
<th># protons</th>
<th># neutrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{15}$N</td>
<td>8</td>
<td>9</td>
</tr>
</tbody>
</table>

11. Calculate the atomic weight of boron from the following data:

<table>
<thead>
<tr>
<th>Isotope</th>
<th>Isotope mass</th>
<th>Fractional abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^{10}$B</td>
<td>10.013amu</td>
<td>0.1978</td>
</tr>
<tr>
<td>$^{11}$B</td>
<td>11.009amu</td>
<td>0.8022</td>
</tr>
</tbody>
</table>

12. Most of an atom’s mass in is the _____________, which contains ____________ and ____________. Most of an atom’s volume is the region occupied by ____________.

13. Show that the law of multiple proportions applies to the following information concerning two compounds composed entirely of sulfur and oxygen. Show the calculation of the small whole numbers.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Mass of compound</th>
<th>Mass of sulfur</th>
<th>Mass of oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2.00g</td>
<td>1.00g</td>
<td>1.00g</td>
</tr>
<tr>
<td>B</td>
<td>1.50g</td>
<td>.600g</td>
<td>.900g</td>
</tr>
</tbody>
</table>

14. On the periodic table, the vertical columns are called ____________ and the horizontal rows are called ____________.

15. What is the formula of the compound that forms between:
   a) Mg$^{2+}$ ions and S$^{-2}$ ions?   b) aluminum ions and oxide ions?
16. What are the names of the following compounds?
   K₂O  CuS

17. What are the names of the following compounds?
   N₂O₅  NH₄F

18. What are the formulas for the following compounds?
   sodium sulfide  calcium nitrate

19. What are the formulas for the following compounds?
   iron(III)hydroxide  lithium carbonate

20. The formula for sodium oxalate is Na₂C₂O₄. What is the formula for calcium oxalate?

5 points extra credit: Answer only one of the following two questions.
   a) If you know the empirical formula for a compound but the homework wants you to deduce the molecular formula, what information will they give you?

   b) What do you learn from a mass spectrum?