Worksheet 3 - Mass % and Empirical Formulas

1. You are given 100. g of each of the following compounds:
   a. Write their formulas and calculate their formula masses, in g/mol.

<table>
<thead>
<tr>
<th>Formula</th>
<th>Formula mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>aluminum oxide</td>
<td></td>
</tr>
<tr>
<td>iron (III) oxide:</td>
<td></td>
</tr>
<tr>
<td>iron (II) oxide:</td>
<td></td>
</tr>
<tr>
<td>potassium permanganate</td>
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</tbody>
</table>

   b. Rank your samples by the number of moles of compound present:
      most moles of compound fewest moles of compound

   c. Rank your samples by the number of moles of oxygen present:
      most moles of oxygen fewest moles of oxygen

   d. Rank your samples by the mass % oxygen present:
      highest mass % oxygen lowest mass % oxygen

   e. Rank your samples by the mass % of metal present:
      highest mass % metal lowest mass % metal
2. Analysis of a compound yields the following percent composition by weight: 65.05% Ag, 15.68% Cr and 19.29% O.

   a. How many moles of silver are present in 100. g of the unknown?
   
   b. How many moles of chromium are present in 100. g of the unknown?
   
   c. How many moles of oxygen are present in 100. g of the unknown.
   
   d. What is the empirical formula of the unknown?
   
   e. Name the unknown.

3. Butyric acid, the odor in rancid butter, contains only carbon, hydrogen and oxygen. When 3.907 g of butyric acid are burned, the products of the combustion are 3.196 g of water and 7.807 g of carbon dioxide.

   \[ _____ \text{C} \_ \text{H} \_ \text{O} \_ (l) + _____ \text{O}_2 (g) \rightarrow _____ \text{CO}_2 (g) + _____ \text{H}_2\text{O} (l) \]

   Determine the empirical formula for butyric acid.

   a. How many moles of CO2 are produced?

   How many moles of carbon were present in the butyric acid sample?

   b. How many moles of H2O are produced?

   How many moles of hydrogen were present in the butyric acid sample?

   c. How many moles of oxygen were present in the butyric acid sample?

   (Hint: total mass of butyric acid = mass C + mass H + mass O)
d. What is the empirical formula of butyric acid?

e. The molar mass of butyric acid is 88.10 g/mol. What is the formula for butyric acid?

f. Complete the formula of butyric acid, above, and balance the reaction.