Name: ______________________

Chemical Analysis of Martian Rocks

Background
Reverse Percent Composition is a method used in spectral analysis of stars and meteors. This method can also be used to analyze rocks. Using data collected from spectrographs, the percentage of each element present in a sample is determined. By knowing the gram formula mass of each element (from a periodic table), the empirical formula of a specimen may be determined.

Example
A rock sample is determined to contain 58.8% Barium, 13.74% Sulfur, and 27.45% Oxygen by mass. What is the empirical formula of the compound?

**Step 1:** Assume there is a 100g sample:

*Our 100g sample would contain 58.8g of Barium, 13.74g of Sulfur, and 27.45g of Oxygen.*

**Step 2:** Using the gram formula mass of each element, calculate the number of moles of each element in the sample

- **Barium:** 58.8 grams x (1mol/137.3 grams) = 0.43 mole Barium
- **Sulfur:** 13.74 grams x (1mol/32.1 grams) = 0.43 mole Sulfur
- **Oxygen:** 27.45 grams x (1mol/16.0 grams) = 1.72 mole Oxygen

**Step 3:** Empirical formulas contain whole numbers as subscripts. Find the common denominator between the molar quantities to arrive at subscripts for the empirical formula for the compound.

- **Ba** (0.43/0.43)  **S** (0.43/0.43)  **O** (1.72/0.43)

**Empirical Formula:** **BaSO₄**

Practice Question
A compound has 14.6% Carbon and 85.4% Chlorine by mass. What is the empirical formula for the compound?

Objective
Analyze the spectral graph to determine the empirical formula for the Martian Rock (asteroid) discovered by Curiosity Rover. Be prepared to defend your answer to your classmates.
Procedure
1. Use the graph provided to determine what elements are in your sample:
   a. Locate the Emission Energies that exhibit peaks.
   b. By comparison to the Chart of Emission Energies, determine the element that most likely caused that peak.
   c. Record the element names in the data table provided.
2. Use the graph provided to determine the percentage of each element that is present in your sample.
   a. Record the Percent Composition for each element that an obvious peaks occur in the data table.
   b. Read the graphs to the nearest TENTHS.
3. Use the percent composition of each element to complete calculations and determine the empirical formula for your sample.
4. Once you have the empirical formula, you can find molecular formulas that naturally exist on earth. Use your research materials (textbook, Google, etc.) to find the name of your compound and locate, if possible, where a similar sample could be found on earth.
5. As a group, prepare a brief presentation of your findings on your whiteboard. Include your estimated percent compositions (from the graph), all calculations, and any difficulties you had arriving at results.

Data (you may not need all of the rows)

<table>
<thead>
<tr>
<th>Asteroid #:</th>
<th>Elements Present (by comparison to Chart of Emissions)</th>
<th>Percent Composition (determine from graph)</th>
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Calculations
Record all necessary calculation used to determine empirical formula below:

Conclusion
Is this compound unique to Mars or can it be found on Earth? Explain.