Experiment 7 – Empirical Formulas

Pre-Lab Hints

1. The mass difference is due to oxygen loss only. Divide Hg and O masses by their atomic weights to get moles of Hg and O atoms (*not* molecules), then divide Hg moles by O moles. The empirical formula uses the lowest integer ratio of the two elements in its formula.
2. The mass of Cl is equal to the increase in sample mass (final mass minus initial mass). Divide the masses of Ti and Cl by their atomic weights to get moles of each element. Examples 3.10 and 3.11 (chapter 3 notes) show you how to determine an empirical formula. Divide Ti and Cl masses each by total sample mass to obtain their mass percentages.
3. Refer to Technique 15B (page 33) and Step A1 of Experiment 5.
4. Refer to Technique 12 (page 29) and Step D2 of the procedure.
5. Refer to Technique 13C (page 31).
6. Line 3 Iron mass is difference between first two measurements (Lines 2 and 1).
   Line 7 Total mass of compound is the difference between final mass and crucible mass (Lines 6 and 1).
   Line 8 Leave blank.
   Line 8a Sulfur mass is difference between compound mass and iron mass (Lines 7 and 3).
   Line 8b Mass ratio is iron mass divided by sulfur mass (Lines 3 and 8a).
   Lines 8c/d Divide the masses (Lines 3 and 8a) by their atomic weights to get the moles.
   Line 8e Divide the Fe moles by the S moles to get the ratio (Lines 8c and 8d).
   Line 8f Divide sulfur and iron masses (Lines 3 and 8a) by the total mass (Line 7).

Safety Precaution

Wear goggles for entire duration of experiment!
Intensely hot, burning metal can spatter in your eyes!

Procedure Notes

Part A: Do not handle fired crucible with your hands at any time, use tongs only.
You can burn yourself *and* contaminate the crucible at the same time.
Use a pair of tongs for the crucible, and a pair of forceps for the lid.
Review techniques 15B and 15C (pp 27-8).
Note figures T.15c and T.15e on page 29 for firing and for heating sample.
Cool crucible only in dessicator provided. See figure T.15b on page 28.

Part B: It is crucial to polish Mg strip until it is completely shiny.
Otherwise, surface oxidation will prevent combustion.
It is also crucial to coil or bend the strip so that it rests completely on the bottom of the crucible, so that it will be closest to the heat source.
Vent lid when reaction nears completion to ensure complete combustion, but be ready to replace lid quickly if sample flares up.
Perform two trials simultaneously to save time.

Part C: Skip entirely.

Part D: Skip entirely.

Report Sheet Information

Show all calculations for empirical formula and mass percentages on a separate page.
Calculate percentages both from the atomic weights and from your experimental data.
Compare the results.

Post-Lab Questions

1. Suppose you do not fire the crucible. The empty crucible mass will contain impurities, but suppose these impurities are vaporized and lost when you heat your sample. The mass of your product is the final mass minus the crucible mass. Explain how your final product mass and your oxygen mass are affected by the impurities burning off during the experiment.

2. Suppose you do not polish your magnesium strip. That leaves an oxide layer on the surface that prevents the reaction from reaching completion. Explain how your final product mass and your oxygen mass are affected.

3. Suppose the flame is too intense and it causes your sample to spatter during the experiment. Explain how your final product mass and your oxygen mass are affected.

4. Suppose you measure your final product mass, and you calculate the results before you discard your sample. Suppose your calculations show that not enough oxygen has been added. Describe what you would do with your sample to complete the experiment.

5. Write the balanced reaction for this experiment.
   Include the phase subscripts and the stoichiometric coefficients.
   Use your data to determine the moles of product that you created.