Lab - Percent Composition

Part 1: Percent of Copper in a Penny
Purpose: To determine the percent of copper and percent of zinc in a penny.

Introduction
Pennies produced before 1982 were made of pure copper. With the rise in the price of copper, the metal value of a penny was more than their face value as a coin. The US Mint began making pennies from a zinc wafer with a thin outer coating of copper. In this lab, you will determine the percent composition of copper in a penny minted after 1982. The penny will be cut in half and reacted with hydrochloric acid (HCl). The HCl will react with the zinc, but not the copper, leaving the copper behind after the reaction

Procedure:
DAY 1
1) Read the entire procedure and construct a suitable data table for the experiment. Construct a data table to hold your data.
2) Obtain a penny dated after 1982. Using the tin-snips, cut 3 evenly spaced notches on the edge of the penny exposing the zinc wafer inside.
3) Find the mass of the penny to the nearest 0.01 g.
4) Place the penny in a clean 100 mL beaker. If more than one person is doing the lab, be sure to mark your beaker so it won't be confused with another person's beaker.
5) Carefully add 20 mL of 6M HCl to the beaker without splashing. Place your beaker in a fume hood or a well-ventilated area for 24 hours.

DAY 2
5) Carefully remove the penny from the acid with the forceps and rinse thoroughly with distilled water from your rinse bottle. Remember, you had excess acid, so the beaker still contains acid. Dispose of the acid in the wast container in the fume hood. All that is left of the penny is the copper coating.
6) Holding the penny with forceps, gently heat the copper over the bunsen burner to remove any excess water or hydrochloric acid. Be careful not to heat the copper to strongly. If you see a green flame you are burning copper away. Place the copper on the watch glass to cool.
7) When cool, find the mass of the copper to the nearest 0.01 g.

Data Table/List:

Calculations and Questions:
1) Write a balanced reaction for the reaction of zinc with hydrochloric acid.
2) Explain why the zinc reacted with the hydrochloric acid but the copper did not.
3) Calculate the percent composition of copper in the penny.
4) Calculate the percent composition of zinc in the penny.
5) Do the values for questions 3 & 4 add up to 100%? Should they add to 100%? Explain
6) Given the accepted value for the percent of copper, calculate a percent error for your lab.
7) The US Mint has been discussing the idea of discontinuing the minting of pennies for the past few years. What arguments do you believe have been placed on both sides of the issue that have made the discussion go on for years?

Conclusion:

Part 2: Percent water in a hydrate

Purpose: To determine the percent of water in a hydrated compound.

Background

Hydrates are ionic compounds (salts) that have a definite amount of water as part of their structure. When the hydrate is heated, the water is released as water vapor, and the remaining solid is known as the anhydrous salt. In this experiment, a hydrate of iron (II) sulfate will be studied ($FeSO_4 \cdot xH_2O$). The change from iron sulfate hydrate to anhydrous salt is accompanied by a change in color.

$$FeSO_4 \cdot xH_2O\ (s) \rightarrow FeSO_4\ (s) + x\ H_2O\ (g)$$

light green gray/brown

Procedure:

1) Set–up an evaporating dish on a ring stand set over a burner just high enough that the inside blue cone of a flame is just below the dish. Clean the dish and rinse with distilled water.
2) Heat the crucible with the hottest part of the flame.
3) Using crucible tongs, remove the evaporating dish from the apparatus. Place in on the countertop and allow it to cool for several minutes.
4) While cooling, measure out approximately 2.00 g of iron sulfate hydrate.
5) Find the mass of the evaporating dish to ± 0.01 g. Record the mass in the data table.
6) With the evaporating dish on the balance, measure into it exactly 2.00 g of iron sulfate hydrate. Record the data.
7) Place the evaporating dish and hydrate back on the wire gauze, GENTLY heat the dish by moving the burner back and forth around the base. Increase the heat gradually. Avoid any popping or spattering.
8) Heat strongly for 5 minutes, or until the green color has disappeared. During heating, a microspatula may be used to spread the solid and break up any caked portions of the hydrate. Be careful not to pick up any of the solid on the microspatula. If the edges of the solid appear to be turning black, remove the heat momentarily and resume heating at a gentler rate.
9) Allow the evaporating dish to cool. When the evaporating dish is cool to the touch, find the mass of the dish and anhydrous salt and record.

Data Table:

Mass of evaporating dish	
Mass of evaporating dish and hydrate	
Mass of evaporating dish and anhydrous salt	

Calculations:

1) Find the mass of water in the compound.
2) What is the percent of water in the hydrate?
3) Given the true value for the percent of water in this hydrate, what is your percent error?

Questions:

1) Why must the evaporating dish be allowed to cool before measuring the mass?
2) Why must the mass of the anhydrous salt be measured immediately upon cooling?
3) Why does this experiment not violate the Law of Conservation of Mass?

Conclusion: