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**POST-LAB REPORT #8**

**Empirical Formula and Stoichiometry**

**I. Calculations:**

* Moles of zinc metal reacted = **0.00236 mol**

mass of zinc (before reaction) = **0.654 g**

mass of zinc (after reaction) = **0.500 g**

mass of zinc reacted = mass of zinc (before reaction) – mass of zinc (after reaction)

= 0.654 g – 0.500 g = **0.154 g**

moles of zinc metal reacted = = = **0.00236 mol**

* Moles of copper metal formed and isolated = **0.00562 mol**

mass beaker = **106.415 g**

mass Cu + beaker after 1st heating = **106.697 g**

mass Cu + beaker after 2nd heating = **106.688 g**

mass change = mass Cu + beaker after 1st heating – mass Cu + beaker after 2nd heating

= 106.697 g – 106.688 g = **0.009** < 0.05 **stop heating**

mass of Cu in beaker = mass Cu + beaker after 2nd heating – mass beaker = 106.688 g – 106.415 g = **0.273 g**

mass of vacuum filter paper = **0.173 g**

mass of Cu + filter paper = **0.257 g**

mass of Cu isolated = mass of Cu + filter paper – mass of vacuum filter paper = 0.257 g – 0.173 g = **0.084 g**

total mass of Cu = mass of Cu in beaker + mass of Cu isolated = 0.273 g + 0.084 g = **0.357 g**

moles of copper metal formed and isolated = = = **0.00562 mol**

* Moles of silver chloride formed and isolated = **0.008108 mol**

mass beaker = **103.620 g**

mass AgCl + beaker after 1st heating = **104.820 g**

mass AgCl + beaker after 2nd heating = **104.771 g**

mass change = mass AgCl + beaker after 1st heating – mass AgCl + beaker after 2nd heating

= 104.820 g – 104.771 g = **0.049** < 0.05 **stop heating**

mass of AgCl in beaker = mass AgCl + beaker after 2nd heating – mass beaker

= 104.771 g – 103.620 g = **1.151 g**

mass of vacuum filter paper = **0.167 g**

mass of AgCl + filter paper = **0.178 g**

mass of AgCl isolated = mass of AgCl + filter paper – mass of vacuum filter = 0.178 g – 0.167 g = **0.011 g**

total mass of AgCl = mass of AgCl in beaker + mass of AgCl isolated = 1.151 g + 0.011 g = **1.162 g**

moles of silver chloride formed and isolated = = = **0.008108 mol**

* Moles of chloride ions in the above = **0.008108 mol**

1:1 ratio moles of AgCl = moles of chloride ions = **0.008108 mol**

* Mole ratio of chloride to copper = **3 : 2**

mole ratio of chloride to copper = moles of chloride ions : moles of copper metal

= 0.008108 : 0.00562

= 1.443175 : 1

= **3 : 2 ratio**

* Mole ratio of chloride to zinc = **7 : 2**

mole ratio of chloride to zinc = moles of chloride ions : moles of zinc metal

= 0.008108 : 0.00236

= 3.43559 : 1

= **7 : 2 ratio**

* Mole ratio of zinc to copper = **1 : 2**

mole ratio of zinc to copper = moles of zinc metal : moles of copper metal

= 0.00236 : 0.00562

= 1 : 2.38136

= **1 : 2 ratio**

**II. Additional questions:**

*1. What are your experimentally-determined formulas for (i) copper chloride, and (ii) zinc chloride?*

Mole ratio of chloride to copper is **3 : 2** (i) Copper chloride:

Mole ratio of chloride to zinc is **7 : 2** (ii) Zinc chloride:

*2. What is the expected formula for (i) copper chloride, and (ii) zinc chloride?*

(i) Copper chloride: (ii) Zinc chloride:

*3. Write the balanced equation for the reaction you carried out, including phases. Use the expected formulas.*

*4. From the initial masses of zinc and copper(II) chloride dihydrate (think carefully about that formula), which is the limiting reactant? (Circle it in the line above.) Show how you reached that conclusion.*

mass copper(II) chloride dihydrate = mass of = **0.862 g**

0.862 g x x = **0.00506 g**

0.654 g Zn x x = **0.0100 g Cu**

Since 0.00506 g Cu < 0.0100 g Cu, the **limiting reactant is**  (which is entirely consumed in the reaction with a ratio 1 : 2 of zinc to copper).

*5. Determine the theoretical yield of copper. How does that compare to the actual amount of copper collected? What was your percent yield of copper?*

mass copper(II) chloride dihydrate = mass of = **0.862 g**

Theoretical yield of Cu in grams = mass of x x x

= 0.862 g x = **0.321 g Cu**

Actual yield of Cu in grams = mass of Cu = **0.357 g Cu**

The actual yield of Cu is higher than the theoretical yield of Cu with the difference of 0.036 g

Percent yield of Cu = x 100% = x 100% = **111%**

*6. List the two most likely sources of error in this experiment. Which would lead to an erroneously high mass? Which to an erroneously low mass?*

The two sources of error in this experiment are:

- The temperature of the heat is below the threshold (120 - 130C) then there may still be water present in the end product, which would cause an erroneously high mass because the mass would be the product + water.

- The duration to scrap the zinc bar is not long enough. This could lead to a lower mass if not scrapped for long enough, which is approximately 25 minutes according to the manual but most-likely is not exact.

*7. You washed solid samples with DI-water several times during the experiment. What is the purpose of these washing steps?*

The sample is washed with DI-water several times to separate any impurities from the product to get a lower chance of error.