

Exp. No. Lab 7	Experiment/Subject Moles and Empirical Formula	Date 2/23/23
Name Christopher Hunt	Lab Partner	Locker/ Desk No.
		Course & Section No.

Purpose:

Experimental: In this lab a copper chloride hydrate will be heated to remove the water. This will be massed before and after to determine the amount of water. The anhydrous copper chloride will be reacted to produce elemental copper. ~~Measuring this mass will then~~ From this the moles of copper and chlorine can be identified.

Mathematical: By identifying the mass of the compounds during various stages of chemical reactions it is possible to estimate the empirical formula for the compound.

Theoretical: This lab leverages the law of definite proportions and the law of multiple proportions to find the chemical formula for a compound containing copper, chlorine, and water.

Practice Problems:

1. When a solid sample is heated, the heat from the sample can cause air currents around the pan. This affects the air pressure around the sample leading to inaccurate readings.

2. Practice Problem Table 2. Results to identify iron fluoride hydrate

Item	Mass (g)	Moles
Iron Fluoride Hydrate	.91	
H ₂ O removed	.47	.026
Anhydrous iron Fluoride	.44	
iron	.228	.0041
Fluoride	.212	.011
Formula of the iron fluoride hydrate	$\text{FeF}_3 \cdot 7\text{H}_2\text{O}$	
Name of the iron fluoride hydrate	Iron (III) Fluoride Heptahydrate	

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Procedure:Part A:

1. Don a pair of gloves
2. Construct the experimental set up, use a metal crucible.
3. Heat empty crucible For ~3 minutes. Let Crucible cool, then measure and record mass of crucible
4. Obtain ~1 g of unknown Copper Chloride hydrate. Place it in crucible and break up the large pieces. Measure and record mass of crucible + sample.
5. Place crucible onto clay triangle and light the bunsen burner.
6. Observe the color change of the solid, ensure sample is being evenly heated
7. Turn off burner, cover crucible and allow to cool. After ~5 minutes remove cover. If there are any blue-green crystals, reheat until the crystals have turned brown
8. Allow the crucible to cool to the touch. Measure and record the mass of the crucible + sample
9. Use a spatula to transfer solids to a clean 50-ml beaker. Rinse crucible with DI water and add water to the beaker. Gently swirl the beaker until solids have completely dissolved. Note color of the solution.
10. Measure ~20 cm of aluminum wire, Make a loose coil by wrapping it around a pen and place it in the beaker of Copper solution so that it is completely immersed
11. Gas will be produced and solid copper will form on the surface of the wire.

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Procedure:

12. While waiting for the reaction to complete. Perform measurements for Part B
13. When the reaction is completed, the solution should be close to colorless with solid copper evident on the wire. Add a few drops of 6.0 M $\text{HCl}_{(aq)}$ to dissolve any Al salts in the mixture
14. Use the glass stir rod to knock off as much copper as possible from the wire.
15. Obtain a piece of filter paper, record its mass. Fold the filter paper twice and place it in a funnel over an Erlenmeyer flask
16. Pour the solution with the copper onto the filter paper
17. Wash the copper in the funnel again with a small amount of DI water
18. Wash the copper with a small amount of 95% ethanol.
19. Take out a watch glass, record its mass and transfer the filter paper with the copper to the watch glass. Dry the watch glass with the copper for at least 5 minutes
20. Pour the solution from the Erlenmeyer flask into the waste container
21. Remove watch glass from dry oven and let it cool. Measure and record the mass of the watch glass, filter paper, and copper
22. Repeat the drying and massing until the mass does not change within $\pm 0.03 \text{ g}$
23. Dispose of the copper solid and recovered wire in the solid waste container in the hood

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Procedure:Part B:

24. Measure the mass of a sample of each solid listed
 - microscope slide
 - aluminum can
 - piece of chalk
 - copper cube
25. Record the length (cm) of the copper cube
26. Tare a dry 50-mL beaker on the digital scale. Pour ~10mL of Epsom salt into the beaker. Record the mass
27. Remove Epsom salts, clean beaker
28. Tare a 10-mL graduated cylinder on the digital scale. Add DI Water to the 10-mL mark. Record the mass, discard the water

Safety and Waste Disposal:

Safety: Ethanol - Causes moderate skin irritation. Wash skin with water and soap

Waste Disposal: Reacted Cu can be placed in solid waste container. The filtrate has a waste container in the hood. Epsom salts can be returned to its container.

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Data:

Data Table 1.

Item	Mass (g)
Cooled Crucible	
Crucible + Hydrate before heating	
Crucible + anhydrous after heating	
Filter Paper	
Watch Glass	
Watch Glass, Filter paper, and dried copper (1 st)	
Watch Glass, Filter paper, and dried copper (2 nd)	
Watch Glass, Filter paper, and dried copper (3 rd)	

Data Table 2.

Item	Formula	Mass (g)	Length (cm)
Cube	Cu		
Aluminum Can	Al		
Glass Slide	SiO ₂		
Chalk	CaCO ₃		
Epsom Salt	MgSO ₄ · 7H ₂ O		
Water	H ₂ O		

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