02 Synthesis and Analysis of a Copper Compound (1805866)

Question | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |

Description
Submit your answers after each part. This lab will count as two daily grades.

Instructions
Part I: Synthesis (each individual should synthesize crystals)

1. Obtain a 50 mL graduated cylinder.

2. Measure about 25 mL of 0.70 M copper(II) sulfate pentahydrate into a clean150 mL beaker.

3. In the fume hood, (while wearing goggles) add concentrated (14.8M) ammonia (NH_4OH) a few mL at a time while stirring to the beaker. The color should change from pale blue to intense dark blue. A light blue precipitate of $Cu(OH)_2$ may form initially. Continue adding ammonia until add this precipitate dissolves with no trace of cloudiness.

4. Add about 50 mL of ethanol (a.k.a. ethyl alcohol) (Caution: Very flammable!) to a 400 mL beaker. Place the entire 150 mL beaker containing the intense blue solution into the larger 400 mL beaker so that it is sitting in the pool of ethanol.

5. Cover the 400 mL beaker with aluminum foil, label the beaker with a sharpie pen, and place it in a secure and still place for at least five days. (during this time the alcohol vapor will diffuse into the aqueous solution causing the precipitation of the complex copper salt)

Part II. Purification of crystals

1. Decant most of the liquid into the sink, retaining the dark blue crystals in the beaker. Using forceps or a spatula, remove the dark blue crystals and place them into a clean empty 50 mL beaker. Add about 10 mL of ammonia/ethanol solution to the beaker. Swirl to mix

2. Using forceps or a spatula, remove the dark blue crystals and place them into a clean test tube and stopper it to preserve them for analysis.

III. Gravimetric Analysis for Sulfate Ion. (two trials)

1. Precisely weigh out close to 0.5 g of your crystals and place them in a 50 mL beaker.

2. Dissolve this mass in about 6 mL 6M nitric acid(while wearing goggles).

3. Add 1.0 M Lead(II) nitrate dropwise until precipitation is complete (about 10 mL).

4. Precisely weigh a piece of quantitative filter paper. (be sure to use quantitative-- it will filter much slower than qualitative)

5. Filter the solution, retaining the precipitate in the filter paper. Wash out the beaker

with distilled water into the filter several times. Police the beaker and rinse the rubber policeman with distilled water into the filter.

6. Allow the liquid to drain from the paper and then carefully unfold the filter paper, place it on a paper towel in a secure place to dry.

7. After a couple of days of drying, place the filter paper in a warm oven to dry completely for about 30 minutes.

8. Find the mass of the filter and precipitate and determine the mass of the precipitate after heating in the oven to constant mass.

IV. Volumetric Analysis for Ammonia.

1. Weigh out about 0.25 gram (precisely) of your salt crystals.

2. Dissolve this sample in about 25 mL of distilled water in a 250 mL erlenmeyer flask.

3. Add about 10 drops of Methyl Orange* indicator and titrate with standard HCl.

*Methyl Orange may undergo several color changes: blue-green-yellow-orange-red. The end point is a change from yellow-orange to red-orange. The end point can also be detected by the disappearance of a precipitate which forms during the titration.

4. Repeat steps 1-3 above and check your precision by dividing the volume of acid used by the sample mass. If the two runs do not agree within 2%, do another determination. (% Difference = Difference between the two numbers/average of the two numbers)

V. Spectrophotometric Analysis for Copper(II) ion

Test solution 1: distilled water.
Test solution 2: 0.100 M $Cu(NO_3)_2$
Test solution 3: 0.080 M $Cu(NO_3)_2$
Test solution 4: 0.060 M $Cu(NO_3)_2$
Test solution 5: 0.040 M $Cu(NO_3)_2$
Test solution 6: 0.020 M $Cu(NO_3)_2$

1. Prepare your unknowns as follows:
Test Solution 7: Measure an exact mass of your crystals close to 0.150 g in 10.0 mL of 1 M HNO_3 in a small test tube. Record the mass of the crystals used. Stopper the test tube and mix to dissolve.

Test solution 8: Measure an exact mass of your crystals close to 0.040 g in 10.0 mL of 1 M HNO_3 in a small test tube. Record the mass of the crystals used. Stopper the test tube and mix to dissolve. Record the mass of the crystals used.

2. Calibrate the Spec 20. at a wavelength of 645 nm. Test solution 1 is the blank.

3. Measure the absorbance of the test solutions 2 - 8 at a wavelength of 645 nm.

Results:

Determine the % of sulfate, ammonia, and copper from your data. For the copper you need to make a calibration curve and obtain the trend line equation using the Data

Analysis app. Use your trendline equation to determine the molarity of the unknowns.

1. Question Details % Sulfate in Copper Ammonia Sulfate Water Lab [1760446]

a. Enter the experimental mass(from the balance) of the unknown salt for trial 1: [ ] g

b. Enter the mass of the filter paper for trial 1: [ ] g

c. Enter the mass of the filter paper + lead(II) sulfate for trial 1: [ ] g

d. Enter the mass of the lead(II) sulfate for trial 1: [ ] g

e. Enter the mass of the sulfate for trial 1: [ ] g

f. Enter the experimental mass(from the balance) of the unknown salt for trial 2: [ ] g

g. Enter the mass of the filter paper for trial 2: [ ] g

h. Enter the mass of the filter paper + lead(II) sulfate for trial 2: [ ] g

i. Enter the mass of the lead(II) sulfate for trial 2: [ ] g

j. Enter the mass of the sulfate for trial 2: [ ] g

k. Calculate the average percent of sulfate in your sample: [ ] %

2. Question Details % Ammonia in Copper Ammonia Sulfate Water Lab [1760578]

a. Enter the concentration of the standard HCl solution: [ ] M

b. Enter the experimental mass(from the balance) of the unknown salt for trial 1: [ ] g

c. Enter the volume of the HCl solution for trial 1: [ ] mL

d. Enter the experimental mass(from the balance) of the unknown salt for trial 2: [ ] g

e. Enter the volume of the HCl solution for trial 2: [ ] mL

f. Calculate the average percent of ammonia in your sample: [ ] %

3. Question Details % Copper in Copper Ammonia Sulfate Water Lab [1760865]

Test Solution #	*Concentration* (M)	*Absorbance*
1		
2		
3		
4		
5		
6		

a. Enter the experimental mass(from the balance) of the unknown salt for test tube 7: g

b. Enter the absorbance for test solution 7:

c. Calculate the concentration of the solution for trial 1(Test solution 7) using the trendline equation: M

d. Enter the experimental mass(from the balance) of the unknown salt for test tube 8: g

e. Enter the absorbance for test solution 8:

f. Enter the concentration of the solution for trial 2(Test solution 8) using the trendline equation:: M

g. Calculate the average percent of copper in your sample: %

4. Question Details Upload Lab Graph [3414163]

Upload a photo of the graph you created in Data Analysis or Logger Lite. Choose File no file selected It must be less than 5MB in size.

5. Question Details % Error in Copper Ammonia Sulfate Water Lab [1760953]

Enter the % of sulfate from question # 1g above:
Calculate the % error using 39.1 as the accepted value:
Enter the % of ammonia from question # 2f above:
Calculate the % error using 27.7 as the accepted value:
Enter the % of copper from question # 3g above:
Calculate the % error using 25.9 as the accepted value:

6. Question Details Empirical formula of a Copper Compound [1760955]

The general formula for the compound is: $Cu_x(NH_3)_y(SO_4)_z \cdot aH_2O$

Using the accepted values in question 4, determine the integer values for x,y,z, and a.

x = ☐
y = ☐
z = ☐
a = ☐

7. Question Details Objective and procedure summary [3413760]

Restate the objective in your own words using complete sentences. Summarize the steps in your procedure. (Be sure and include any safety concerns).

8. Question Details Upload Calculations (Show Work) [3418656]

Upload a photo of your calculations, showing your work. Make sure your name and the date are written on the page. Title the image with a unique file name before you upload it.(Maybe use your initials and part of the lab title and the word Calcs)
Choose File no file selected

9. Question Details Upload Lab Photo [3413757]

Upload a photo of the lab apparatus with your face in the photo as you perform some part of the lab. Title the image with a unique file name before you upload it.(Maybe use your initials and part of the lab title) Choose File no file selected It must be less than 5 MB in size.

10. Question Details Observations, Skills utilized and learning [3413764]

What observations did you make during the lab? What chemistry concepts, laws, and/or skills were necessary to complete this lab? What did you learn or re-learn? Use complete sentences.

11. Question Details Error discussion [3413763]

What are some specific sources of error, and how do they influence the data? Which measurement was the least precise? Does the error make the final value obtained larger or smaller than it should be (give at least one example and trace the steps)? If your calculated percent errors are significant, you must propose valid explanations here.
Instrumental error and human error exist in all experiments, and should not be mentioned as a source of error unless they caused a significant fault. Significant digits and mistakes in calculations are NOT a valid source of error. In writing this section it is sometimes helpful to ask yourself what you would do differently if you were to repeat the experiment and wanted to obtain better precision and accuracy. Use complete sentences.

Assignment Details

Name (AID): **02 Synthesis and Analysis of a Copper Compound (1805866)**
Submissions Allowed: **5**
Category: **Homework**
Code:
Locked: **Yes**
Author: **Ryan, Matt (** mryan@allsaintsschool.org **)**
Last Saved: **Sep 18, 2017 09:24 PM CDT**
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