AP Chemistry Name_____
Preparation and Analysis of a Double Salt
Mr. McAfoos Period_____ Date _____

During the course of this lab you will have the opportunity to form and analyze an unusual inorganic ionic compound. As you know, most ionic compounds consist of a cation (positive ion) and an anion (negative ion) and sometimes waters of hydration.

A double salt, such as the one you will form is one that has two cations rather than one. Alum is one example of a double salt formed from potassium, aluminum and sulfate. The formula of this compound which was found after a great deal of investigative work is $KAl(SO_4)_2 \cdot 12H_2O$.

You will be forming a double salt during this lab that will be a combination of potassium ions, sulfate ions, waters of hydration and either copper II ions, cobalt II ions or nickel II ions. Having formed your double salt you will use suction filtration to separate it from solution, and then analyze it to determine the percentages of the various constituents using techniques you have already learned this year or during your first year chemistry course.

PROCEDURE:

Part 1. Formation of the Salt.

Obtain 0.05 moles of potassium sulfate in a clean 250 ml beaker. (Reagent bottles have GMMs printed on them). Dissolve the potassium sulfate in 50 ml of deionized water. Gravity filter the solution into a clean 250 ml beaker.

Obtain 0.05 moles of your metal II sulfate in a clean 150 ml beaker. Add 35 ml of deionized water and dissolve. You may need to heat this solution gently to fully dissolve the salt. Filter this solution into the SAME beaker.

Boil the solution to approximately ½ volume. If a solid appears during this step, filter the hot solution through a new piece of filter paper into a clean beaker. Cool the solution with intermittent stirring. DO NOT boil away more than half of the solution. Allow the solution to cool and crystallize at least overnight.

Suction filter the remaining crystals, and allow the crystals to dry overnight with the filter paper on a watch glass. Transfer the crystals to a small, clean, PRE-WEIGHED beaker and re-weigh. Seal the beaker and the dry crystals with parafilm.

Part 2. Hydrate Analysis.

Determine a simple procedure by which you can determine the percent of water in your compound. Your approach should probably be similar to that which you used in your first year course. (You probably analyzed copper sulfate, watching the blue crystals turn greenish-white). Use a small amount of the double salt and repeat the procedure at least once to assure consistent reliable data. When doing this procedure it is important to use LOW heat. Some of the compounds are not stable at high temperatures.

Part 3. Sulfate Analysis.

Determine the percent of sulfate in your compound. This procedure should mimic the sulfate analysis that you already have accomplished in class this year. You will be provided with saturated barium nitrate solution and anything else you require.

Many of the problems encountered in the previous sulfate analysis may have had to do with loss of sulfate due to incomplete precipitation or insufficient digestion. A longer digestion time may help reduce this error.

An additional factor that will help is to repeat this procedure several times. I suggest that you do this three times (side by side to save time) with three samples and three crucibles. Use approximately 0.5 g of the unknown double salt and about 50 mL of saturated barium nitrate each time.

From this data you should be able to calculate the percent of sulfate in your salt.

Part 4. Metal Ion Analysis.

You will use a CBL and colorimeter to analyze your metal ion content. To make an appropriate solution of the unknown, use 1.0 g of the unknown in 100 ml of solution. Since it is vital that you can later calculate this molarity exactly, I suggest that you use a volumetric flask to make this solution and all others. Be sure to use an appropriate color of light that will be absorbed by your solution.

From the data obtained you should be able to calculate (in order) the molarity of your solution, the number of moles of the metal in your solution, the number of grams of the metal in your sample, and the percent of your unknown that is the metal in question.

Part 5. Formula of the Double Salt.

From the data you have obtained you should be able to calculate:

- the percent of potassium in the salt
- the formula of your salt