Name: _____

Period: ____ Subject: _____

Date: _____

Lab: Formula for an Ionic Compound

Objectives:

- Determine the formula for an ionic compound experimentally
- Observe a chemical reaction in which two soluble compounds recombine to produce an insoluble product (a "precipitate")
- Practice using polyatomic ions in chemical formulas and equations

Materials:

Note: This is an incomplete list. Make sure you take note of all the equipment used in this lab in order to include a proper list in the "Materials" section for the writeup of this lab in your notebook.

- Copper(II) chloride solution (0.1 M)
- Sodium phosphate solution (0.1 M)
- mini test tubes

Methods:

1. Label seven small test tubes #1-7.
2. Fill a pipette with 0.1 M copper(II) chloride solution and record the color of the solution in data table.
3. Carefully add the appropriate number of drops (shown in the data table) of copper(II) chloride solution to each test tube (#1-7). *Note:* Exact volumes are very important in this lab – hold the pipette vertically to obtain uniform size drops.
4. Fill the second pipette with 0.1 M sodium phosphate solution. Record the color of the solution in the data table.
5. Carefully add the appropriate number of drops of sodium phosphate solution to each test tube (#1-7).
6. Use a *clean* stirring rod or wood splint to stir each reaction mixture in test tubes #1-7. Let the tubes sit undisturbed for 10-15 minutes to allow the precipitates to settle.
7. During this time, determine the volume ratio for the drops of $CuCl_2$ to Na_3PO_4 for each tube and record these values in the data table. *Example*: In test tube #1, 9 drops of $CuCl_2$ and 81 drops of Na_3PO_4 corresponds to a 1:9 ratio of $CuCl_2$:Na_3PO_4.
8. After the precipitates have settled, observe the appearance of the liquids and solids in each tube and record these observations in the data section.
9. Use a metric ruler to measure the height of the precipitate in millimeters in each test tube. Record these values in the data table. Construct a bar graph displaying the height (mm) of precipitate in each tube.
10. Dispose of all solutions (and precipitates) in a waste beaker at your station.

Data:

Test tube	1	2	3	4	5	6	7
$CuCl_2$, 0.1 M (drops)	9	18	36	45	54	72	81
Na_3PO_4, 0.1 M (drops)	81	72	54	45	36	18	9
Volume Ratio (drops $CuCl_2$:drops Na_3PO_4)							
Height of Precipitate (mm)							

Color of $CuCl_2$ solution: **Color of Na_3PO_4 solution:**

Notes on appearances of liquids or solids in test tubes after mixing:

Discussion:

1. a) Name the two possible products in the precipitation reaction of copper(II) chloride with sodium phosphate. Use the charges on the ions to predict the empirical formulas of the products.

b) Based on common knowledge, which product is likely to be insoluble in water and to precipitate from solution?

2. Which test tube had the greatest amount of precipitate? Does this result agree with the prdiction made in Question #1 concerning the empirical formula of the product?

3. Write a balanced chemical equation for the precipitation reaction of copper(II) chloride and sodium phosphate. Include abbreviations for the physical state of each reactant and product, using **(aq)** for aqueous solution, **(s)** for solid, **(l)** for liquid, and **(g)** for gas.

4. a) Which test tubes showed evidence of unreacted Cu^{2+} ions in the supernatant when the reaction was complete? Explain why unreacted Cu^{2+} ions were present in these tubes based on the volume ratio of solutions used.

b) How could you tell that all of the Cu^{2+} ions had reacted in a particular test tube? Which test tubes showed such evidence? Explain, based on the volume ratio of solutions used.

Conclusion:

Is it possible to determine the ionic formula for an ion experimentally as well as mathematically? Could this be used to help determine the charge of an ion whose charge isn't know before doing the experiment?