FLINN SCIENTIFIC

Name_____

Chemical Formulas Worksheet

Data — Part A.

Table 1. Predictions

Name of predicted product	
Basis for prediction	
Predicted ratio of Iron(III) nitrate to sodium hydroxide	
Basis for prediction	

Table 2. Observations

Substance	Physical Properties
Iron(III) nitrate solution	
Sodium hydroxide solution	
New substance formed (solution)	
New substance formed (solid)	

Table 3. Iron(III) Nitrate and Sodium Hydroxide

Test Tube #	1	2	3	4	5	6	7
# drops 0.1 M $Fe(NO_3)_3$	4	8	11	16	22	24	28
# drops 0.1 M NaOH	28	24	22	16	11	8	4
Ratio of $Fe(NO_3)_3$ to NaOH							
Height of precipitate (mm)							

Data — Part B.

Table 4. Predictions

Name of predicted product	
Basis for prediction	
Predicted ratio of copper(II) chloride to sodium phosphate	
Basis for prediction	

Table 5. Observations

Substance	Physical Properties
Copper(II) chloride solution	
Sodium phosphate solution	
New substance formed (solution)	
New substance formed (solid)	

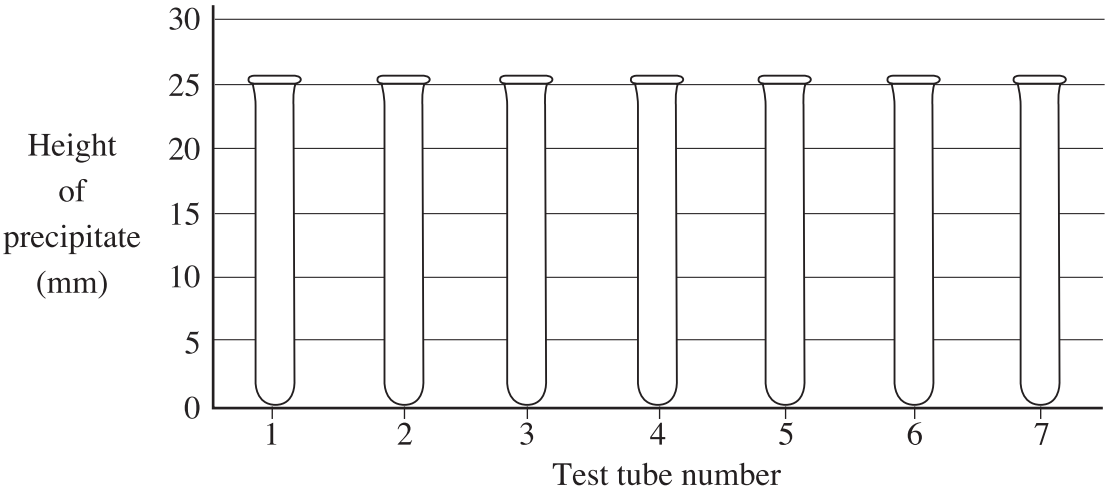
Table 6. Copper(II) Chloride and Sodium Phosphate

Test Tube #	1	2	3	4	5	6	7
# drops 0.1 M $CuCl_2$	3	6	12	15	18	24	27
# drops 0.1 M $Na_3PO_4 \cdot 12H_2O$	27	24	18	15	12	6	3
Ratio of $CuCl_2$ to $Na_3PO_4 \cdot 12H_2O$							
Height of precipitate (mm)							

Post-Lab Questions

Part A. Iron(III) Nitrate and Sodium Hydroxide

1. Using your results from Table 3, construct a bar graph using the test tube graph provided. To do this, plot the height of the precipitate (in mm) versus the test tube number by shading in the tubes to the appropriate level. Above each tube, label the ratio of the two reactants using the whole-number ratios that you determined in Table 3.



Iron(III) Nitrate and Sodium Hydroxide Graph

2. Write the name of the solid that formed in the tubes when you mixed Iron(III) nitrate and sodium hydroxide.

3. Look at your experimental results.

   a. Which test tube had the greatest amount of precipitate? Test Tube # _____

   b. Was your prediction correct about which tube would have the most precipitate? _____

   c. What is the ratio of the Iron(III) nitrate to sodium hydroxide in the tube with the greatest amount of precipitate? Ratio of $Fe(NO_3)_3$:NaOH = _____

4. Write the formula (using the ratio from #3) for the precipitate, based on your experimental results.

5. *a.* Which reagent is in excess in test tube #1? _____

   b. Which reagent is the limiting reagent in test tube #1? (*Hint:* Which ran out first?) _____

6. *a.* Which reagent is in excess in test tube #7? _____

   b. Which reagent is the limiting reagent in test tube #7? (*Hint:* Which ran out first?) _____

7. Write the formulas for both the Iron(III) ion and the nitrate ion. (*Hint:* Refer to the Ion Formula chart.)

8. Write the formulas for both the sodium ion and the hydroxide ion. (*Hint:* Refer to the Ion Formula chart.)

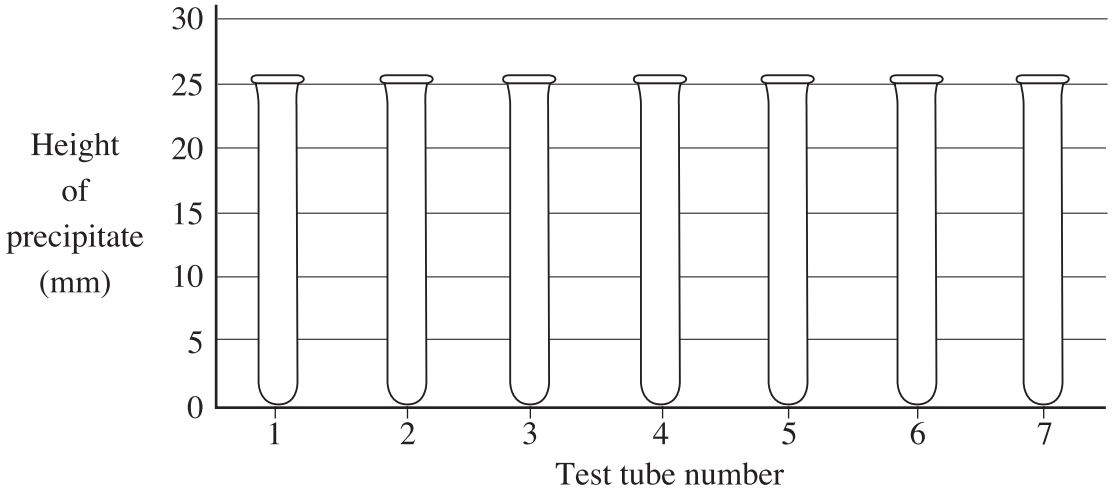
9. Based on the formulas and charges for the four ions listed in questions #7 and #8, what would you predict is the correct chemical formula for the precipitate?

10. Do your experimental results for the formula of this precipitate (from question #4) agree with your predicted chemical formula in question #9? Explain

11. Write the complete balanced equation for the reaction between Iron(III) nitrate and sodium hydroxide. Include physical states, using (aq) for aqueous, (s) for solid, (l) for liquid, and (g) for gas. Include the names of the two products.

Part B. Copper(II) Chloride and Sodium Phosphate

12. Using your results from Table 6, construct a bar graph using the test tube graph provided. To do this, plot the height of the precipitate (in mm) versus the test tube number by shading in the tubes to the appropriate level. Above each tube, label the ratio of the two reactants using the whole-number ratios that you determined in Table 6.



Copper(II) Chloride and Sodium Phosphate Graph

13. Write the name of the solid that formed in the tubes in part B when you mixed copper(II) chloride and sodium phosphate.

14. Look at your experimental results.

    a. Which test tube had the greatest amount of precipitate? Test Tube # _____

    b. Was your prediction correct about which tube would have the most precipitate? _____

    c. What is the ratio of the copper(II) chloride to sodium phosphate in the tube with the greatest amount of precipitate? Ratio of $CuCl_2$:Na_3PO_4 = _____

15. Write the formula (using the ratio from #14) for the precipitate, based on your experimental results.

16. Write the formulas for both the copper(II) ion and the chloride ion. (*Hint:* Refer to the Ion Formula chart.)

17. Write the formulas for both the sodium ion and the phosphate ion. (*Hint:* Refer to the Ion Formula chart.)

18. Based on the formulas and charges for the four ions and charges listed in Questions #16 and #17, what would you predict is the correct chemical formula for the precipitate?

19. Do your experimental results for the formula of this precipitate (from Question #15) agree with your predicted chemical formula in question #18? Explain.

20. Write the complete balanced equation for the reaction between copper(II) chloride and sodium phosphate. Include physical states, using (aq) for aqueous, (s) for solid, (l) for liquid, and (g) for gas. Include the names of the two products.

Post-Lab Questions

21. What do you think determines how much precipitate will be made in each tube?

22. What if you had not tried combining the correct ratio of reactants?

23. Discuss any possible sources of error which may have occurred in this experiment. Discuss ways in which the experiment may be modified or improved.