

## "Making a Salt" Laboratory Activity

(W. Lee, GHCHS 2002~ Rev. 2004-5 J. Baumwirt)

In a standard acid/base reaction the products are always the same. In this activity you will be doing two tasks:

- 1) Drop Calibration: calibrating a dropper to determine the number of drops per milliliter for use in this activity. This can easily be accomplished two ways: by volumetric or gravimetric determination. See instructor for directions.
- 2) Reacting an acid with a base on a glass slide and then heating the mixture on a hot plate to drive off all excess water to reveal a solid product.

**Objective:** 1) To determine that a salt is the product of an acid-base neutralization reaction. 2) To determine the color changes of red litmus, blue litmus, phenolphthalein, and bromthymol blue in the presence of an acid and in the presence of a base. 3) To learn how to solve a limiting reactant, solution stoichiometry problem.

**Materials:** spotting plate, glass microscope slide, analytical balance, 1.0 M HCl solution, 1.0 M NaOH solution, red litmus, blue litmus, phenolphthalein, and bromthymol blue.

**Method:** Place 5 to 10 drops of 1.0 M HCl into two spotting plate depressions and 5 to 10 drops of 1.0 M NaOH into two different spotting plate depressions. Answer the questions below. What color change occurs when

- 1) a drop of phenolphthalein is added to a base? \_\_\_\_\_
- 2) a drop of bromthymol blue is added to an acid? \_\_\_\_\_
- 3) red litmus paper is soaked in a base? \_\_\_\_\_
- 4) blue litmus paper is soaked in an acid? \_\_\_\_\_

Weigh a clean and dry microscope slide on an analytical balance. Mix 2 drops of 1.0 M HCl with 1 drop of 1.0 M NaOH on the microscope slide. Use a clean straw to mix. **Be very sure to mix well.** Test the mixture with blue litmus. **If the blue litmus does not change to red (pink) do not proceed! Check with your instructor before continuing.** Record the mass of the slide to the nearest 0.0001 g. Carefully and slowly heat the slide over a Bunsen burner so as to evaporate the water and drive off the excess hydrogen chloride gas. Hold the slide with your fingers so that you will not get it too hot. After the slide has cooled to room temperature, weigh it and record the mass to the nearest 0.0001 g. (*Optional*) Taste the residue on the microscope slide. What does it taste like? \_\_\_\_\_ What mass of NaCl was formed on the slide? \_\_\_\_\_ g There are approximately 20 drops in one mL. You added 1 drop of 1.0 M NaOH to 2 drops of 1.0 M HCl. Check the equation in question 5. on the Prelab Question sheet. Which reactant is in excess? \_\_\_\_\_ Which reactant is the limiting reactant? \_\_\_\_\_ Approximately what mass of NaCl should have been produced? \_\_\_\_\_ g

### Making a Salt – PRELAB QUESTIONS

1. Acid + Base  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_ <sup>1</sup>
2. What is the name given to the kind of reaction indicated in question #1? \_\_\_\_\_ <sup>2</sup>
3. Sodium hydroxide (NaOH) is a **solid**. Sodium hydroxide solutions are made by dissolving **solid** sodium hydroxide pellets in water. Hydrogen chloride is a **gas**. Hydrochloric acid solutions are made by dissolving HCl **gas** in water. Both sodium hydroxide and hydrochloric acid are very toxic materials and should not be ingested. If you placed a drop of NaOH solution on a microscope slide and then evaporated the liquid to dryness what do you think would be left on the slide? \_\_\_\_\_ <sup>3</sup>
4. If you placed a drop of HCl acid solution on a microscope slide and then evaporated the liquid to dryness what do you think would be left on the slide? \_\_\_\_\_ <sup>4</sup> Explain your answer: \_\_\_\_\_
5. \_\_\_\_\_ HCl + \_\_\_\_\_ NaOH  $\longrightarrow$  \_\_\_\_\_ + \_\_\_\_\_ <sup>5</sup>
6. You will be making a salt by mixing a 1.0 M solution of sodium hydroxide with a 1.0 M solution of hydrochloric acid. You will then evaporate the liquid and taste the salt left on the slide. What would be the problem with using one drop of 1.0 M NaOH mixed with one drop of 1.0 M HCl? \_\_\_\_\_ <sup>6</sup>
7. If you wanted to make **absolutely** sure that only sodium chloride (no toxic substance) was left after evaporating the water from a mixture of 1.0 M HCl and 1.0 M NaOH what would you do? \_\_\_\_\_ <sup>7</sup>
8. Explain why the method you describe in step 7 would work: \_\_\_\_\_

**Prelab Question Hints and Resources:**

- 1 Acid + Base  $\longrightarrow$  see text page 131 in Brown and Lemay
- 2 see text page 612
- 3 solid sodium hydroxide (it would look like a frost on the slide)
- 4 nothing, but you must explain why, if you cannot explain then try re-reading the second and third sentences of question 3.
- 5 HCl + NaOH  $\longrightarrow$  see text page 131 in Brown and Lemay
- 6 Are drops always the same volume? If the drops were different volumes would the neutralization be complete. If the drop of 1.0 M NaOH solution was the larger than the drop of 1.0 M HCl solution what toxic material would contaminate the salt formed on the slide after drying. If the drop of 1.0 M HCl solution was the larger than the drop of 1.0 M NaOH solution what toxic material, if any, would contaminate the salt formed on the slide after drying (be careful in answering this question, you might want to first look at your answer to question 4).
- 7 add **two** drops of the 1.0 M HCl solution to one drop of 1.0 M NaOH solution, then test with litmus to make sure solution is acidic before drying.

Name: _____		Per#: _____		Date: _____	
<i>Drops Calibration Rubric</i>	Points possible	Student Assessment	Points Earned		
Data Table	1				
Minimum 3 Trials	0.5				
Find the Average	0.5				
Procedure	1				
Describe the Method Used	1				
a) Gravimetric					
Describe the Method Used	1				
a) Volumetric					
<b>TOTAL</b>	<b>5</b>				

Name: _____		Per#: _____		Date: _____	
<i>MAKING A SALT LAB</i>	Points Possible	Student Assessment	Points Earned		
Equipment List	0.5				
Labeled Diagram of Set up	0.5				
Procedure ( <i>in Sentence Form</i> )	0.5				
Discussion (2-3 paragraphs)	1				
Data Table	0.5				
Calculation (Sample)	0.5				
Conclusion	0.5				
Lab Questions	1				
<b>TOTAL</b>	<b>5</b>				

**MAKING A SALT LAB – COMPLETE THIS ON SEPARATE PAPER ~ 5 POINT LAB**

**Procedure:** Write a short procedure for what you did (*in sentence form*).

**Diagram:** Draw and label a simple diagram of the set up and equipment you used.

**Equipment List:** Make a complete list of all equipment utilized in this lab.

**Discussion:** Describe your *findings* and *observations* in sentence form. *Include a discussion of the reactants, their preparation as discussed in class, which reagent is the limiting reactant, which is the reagent in excess, and why this was intentionally controlled in this experiment.*

**Data Table:** Make a Data Table that shows **all** data gathered in all trials completed.

**Calculations:** Show complete calculations (or one complete sample calculation) boxing the answer(s).

**Conclusion:** Make a direct statement of what you found. (*ex: I experimentally determined the concentration of... to be ..., etc.*)

**Lab Questions:** Answer all lab questions (you may simply affix your answered question sheet in your comp book)