Introduction to Natural Science 2006/07

Winter 2007 Quarter

Chemistry Lab I: “Acid-Base Chemistry”

Prepared by: Dr. Dharshi Bopegedera

Do not tape or staple this lab to your lab notebook. We will be starting a new procedure of record keeping in the labs and I will discuss this in lab. Print out the lab and bring to class on Friday.

Do your pre-lab on a separate sheet (as you did in the fall quarter) and bring to class. It will be collected at the start of lab.

Some background information on acid-base chemistry

A titration is commonly used to determine the strength of an acid or a base in solution. The "unknown" acid/base is titrated against a base/acid of a known concentration. The acid is usually placed in a titration flask (Erlenmeyer flask) and the base in a buret. The solution in the buret is called the **titrant.** The titrant is delivered from the buret to the titration flask until the solution in the flask is neutralized.

The point of neutralization (also called the **stoichiometric point,** the **end point** or **equivalence point**) is often signified by a color change of an indicator that is added to the titration flask at the beginning of the titration.

Part I: Strong Acid – Strong Base Titration Using an Indicator

Pre-Lab:

1. Write a balanced equation for the reaction between hydrochloric acid and sodium hydroxide, both in aqueous solution. Write the complete ionic and net ionic equations. What is the driving force for this reaction to occur?

2. What color would you get when you add a few drops of phenolphthalein indicator to an acid? What color would you get when you add a few drops of phenolphthalein indicator to a base? What source did you find this information from? Cite your reference correctly.

Lab work: (work on your own)

1. Transfer 25.00 mL of hydrochloric acid into an Erlenmeyer flask. The exact concentration of the HCl solution will be given to you in lab. Clean and set up the buret as shown in class and fill it with sodium hydroxide solution. Add 2-3 drops of phenolphthalein indicator to the Erlenmeyer flask. Titrate the acid with the base as directed in class. The base from the buret will gradually neutralize the acid in the Erlenmeyer flask. When all the acid is neutralized, and one more drop of the base is added (which is called the **end point** of the titration), the contents in the Erlenmeyer flask will change color. Record the volume of NaOH added at the end point. **Placing a clean white paper underneath the titration flask will enable you to see the end point more clearly.**

2. Repeat the above experiment one more time so you have two data points total. Use the average of your two burette readings for post lab calculations.

3. Draw a block diagram of the titration setup.

Post Lab Calculations:

Take the average of the two burette readings. This is the average volume of sodium hydroxide needed to neutralize 25.00 ml of the hydrochloric acid. Determine the concentration of the NaOH solution from the above data.

In your conclusion explain why is it important to take more than one data point in this experiment? Is this true in general in the lab? Explain.

Part II: testing the strength of various antacid tablets using acid – base titrations

Pre-Lab:

1. Most antacid tablets tend to contain calcium carbonate as the active ingredient, although other carbonates and hydroxides are also available in some antacid formulas. Stomach acid is hydrochloric acid. Assuming that antacid is 100% calcium carbonate, write a balanced chemical reaction for the reaction between antacid and stomach acid. Write the complete and net ionic equations for this reaction.

2. What is the driving force for this reaction to occur?

3. What is the difference between regular strength Tums (a popular antacid) and extra strength Tums? Justify your answer.

Lab work: (work in pairs)

1. There will be three different types of antacid tablets available in the lab. You will be assigned one of these tablets (type A, B, or C). Once you complete your work, obtain data from other groups that used tablets different from yours. When you do the post lab work, you need to compare your data with those of others using different antacids.

2. Place an antacid tablet in a sealed zip lock bag and place the bag between folded napkins. Hammer on the napkins with a pestle to crush the tablet. Weigh **accurately** between 1-2 grams of the antacid tablet and carefully transfer it into an Erlenmeyer flask.

3. Add 50.00 mL of the hydrochloric acid to the Erlenmeyer flask containing the antacid. Record the strength of the acid.

4. Set up a hot plate in the hood and place the Erlenmeyer flask on the hot plate. Heat gently and bring to a gentle boil. Remove from heat, cover with a watch glass and allow to cool to room temperature.

5. Once cooled, use a small stream of DI water to wash the bottom of the watch glass into the Erlenmeyer flask. Add 3-4 drops of phenolphthalein indicator to the flask. Titrate with the sodium hydroxide solution to a colorful endpoint.

6. Write down the volume of sodium hydroxide required for this titration.

7. Write down the mass of antacid tablets and the volumes of sodium hydroxide for the other two types of antacid tablets used by fellow students.

Post Lab Calculations:

Determine the moles of calcium carbonate present in tablets A, B, and C.
Determine the grams of calcium carbonate per gram of antacid for tablets A, B, and C. Show all work.
In your conclusion, comment on the effectiveness of the three types of antacid tablets tested in the lab and justify your answer.