

Stoichiometry Lab Final – this is not a proper title, so change it to be more descriptive

****All parts of the lab must be included in this lab report (except HYPOTHESIS)****

Abstract

Background

- Discuss titrations (how do they work?)
- Describe where chemists in industry use titrations in real life
- What type of chemistry is based on titrations, and detail at least 3 jobs that have to deal with this branch of chemistry (and how they are related)
- Discuss the difference between a strong acid and weak acid
- Discuss buffering capacity and how it applies to titrations. (you may want to use a diagram of a flask for this section and explain it)

Purpose

1. To demonstrate proper techniques to create a solution from a solid substance
2. To demonstrate proper titration techniques in order to determine the concentration of an unknown HCl solution (in order to quantify the solution)
3. To determine the molar mass of an antacid tablet using the quantified acid solution

Variables

Controlled (minimum 5)

Manipulated (minimum 2)

Responding (minimum 4)

Materials

Part I

- Scale
- Stir Rod
- Scoopula
- Beaker
- Funnel
- Volumetric Flask
- Lid
- Wash bottle
- Solid NaOH (mass = ???)
- Water

Part II

- Pipette
- Bulb
- Burette
- Funnel
- Beakers (3)
- Erlenmeyer Flasks (3)
- Unknown Concentration HCl
- Previously created NaOH Solution
- Bromothymol blue
- Wash bottle

Part III

- Pipette
- Bulb
- Burette
- Funnel
- Beakers (3)
- Erlenmeyer Flasks (3)
- Unknown Concentration HCl (Molarity = ???)
- Methyl Orange
- Wash bottle

Procedure

Part I – Creating a 0.10M NaOH Solution

- Using your knowledge of how to create a solution, create 100mL of a 0.1M NaOH solution from solid.

Part II – Quantifying an Unknown HCl Solution

- Perform a titration to determine the concentration of 10.0mL of HCl using your previously created 0.1M NaOH solution using Bromothymol blue as the indicator

Part III – Determining the Molar Mass of Solid Antacid (Rolaids / Tums)

- Perform a titration to determine the molar mass of 1 antacid tablet dissolved in ~25.0mL of water using your HCl solution (from part II) and methyl orange as an indicator
- Remember to measure the mass of your crushed antacid tablet prior to titrating!
 - Helpful Hint: Use between 0.1-0.2g of solid in each trial and keep your masses the same for easier calculations

Diagram

Create a diagram for part II and III (separate). Make sure to include all amounts and labels, as well as appropriate titles.

Data

Remember to include titles for all data tables in the lab.

Part II

Table 1:

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Volume of HCl Pipetted					
Concentration of NaOH used					
Initial Volume of NaOH					
Final Volume of NaOH					
Change in Volume of NaOH					
Color at Endpoint					

Average change in volume of NaOH =

Part III

Table 2:

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Mass of Antacid Tablet used					
Volume of Water used to Dissolve Tab					
Concentration of HCl used					
Initial Volume of HCl					
Final Volume of HCl					
Change in Volume of HCl					
Color at Endpoint					

Average change in volume of HCl =

Calculations

Part I

Show calculations to determine the mass of NaOH(s) required to create 100mL of a 0.1M NaOH solution.

Part II

Determine the chemical reaction between HCl and NaOH. List your givens and unknowns below the reaction

Determine the concentration of HCl using your titration results.

Using this concentration, determine the pH of your HCl solution.

Part III

Determine the chemical reaction between HCl and the antacid (assuming the chemical reagent in the tablet is CaCO_3). List your givens and unknowns below the reaction.

Determine the molar mass of your antacid tablet using your titration results

Analysis of Results

For part II, create a titration curve (graph) of the titration of a strong acid (HCl) with a strong base (NaOH) and discuss the graph (explain your graph completely). Ensure your axis are labeled appropriately and titles are included.

For part II, create a titration curve (graph) of the titration of a weak base (CaCO_3) with strong acid (HCl) and discuss the graph (explain your graph completely) Ensure your axis are labeled appropriately and titles are included.

Compare your two graphical results.

- Discuss the differences between the 2 graphs
- Discuss why the buffering area is larger for the weak base/strong acid titration than the strong acid/strong base.

Conclusion

Create a proper conclusion for this lab, discussing your molarity of HCl and molar mass of antacid tablet.

Extension

Discuss why the neutralization of HCl is an important process (biological link). Include relevant chemical reactions and discuss possible alternatives to acid reflux in your extension.

Error Analysis

Molarity of HCl = 0.145M HCl

Molar mass of Antacid = 100.0869g/mol

Determine your percentage error for Part II and Part III based on the given values (above)

Completely discuss 3 different errors. Explain the effect of the errors on the results of the lab and research a scientific fix or change to eliminate the error in the lab.

Sources

Minimum 5 sources – make sure they are in MLA format and are present in the work as well!

