Acid-base titration

Science

Introduction

Acid and bases are two important classes of compounds that react to form a salt and water. When mixing acids and bases a precise amount of the base must be added in order to reach the equivalence point. At this point, one reactant has been exactly consumed by the addition of the other reactant. When performing chemical reactions chemists use a process called titration to determine the equivalence point of the reaction.

Once the equivalence point is known then the chemist can correctly determine the amount the concentration of the acid and the base. In this experiment acid-base titration will be used to determine the concentration of HCl at equilibrium when it reacts with the NaOH H+ (aq)+ Cl- (aq) + Na+ (aq) + OH- > H2O(l) + Na+ (aq)+ Cl- (aq)

Procedure

When performing this experiment one must first obtain and wear goggles. Next, add 40mL of distilled water to a 100mL beaker, then add 5. 00mL of HCl to the beaker. Then obtain 40mL of 0. 1M NaOH.

Place the NaOH in a 60mL reagent reservoir and drain a small amount into a 250mL beaker to fill the tip. Connect the Ph sensor to the LabQuest and set up the drop counter. Then calibrate the titrant by adjusting the reservoir tip to and letting the NaOH slowly drain into a graduated cylinder until 9 or 1o ml has been recorded. After the LabQuest has been calibrated discard the solution. The assemble the titration apparatus as shown in the picture below. Place the HCl solution onto the magnetic stirrer and slowly titrate the NaOH into the solution.

Start the data collection to calculate the volume of NaOH is added when the solution reaches its equivalence point. Then write down the calculations and disassemble the apparatus.

Discussion

My lab group and I completed this experiment by doing two trials. We found that both trials were concluded with similar results. In trial 1 we found that the volume of NaOH added to the solution was 4. 01ml before the largest pH increase, and 4. 05mL after. We calculated the volume at the equivalence point to be 4. 03mL. We found there were 4. 3x10-4 moles of NaOH and 4. 03x10-4 moles of HCl. Then we calculated the concentration of the HCl to be 0. 08 moles per liter. In trial 2 we found 4. 951mL of NaOH has added before the increase and 4. 992mL after. The volume at the equivalence point was 4. 971mL. There were 4. 971x10-4 moles of HCl and 4. 971x10-4 moles of NaOH. The concentration of HCl was found to be 0. 094 moles per liter. We found the average concentration to be 0. 08971M. Although the results of both trials in the experiment were similar the results were not exactly the same.

The mistake may have come from an error in measuring the HCl and distilled water. More HCl may have been added because we did not have an accurate pipet bulb. We used a graduated cylinder to add the HCl and may have had a more or less HCl than what was needed in the experiment.

Conclusion

The results of this experiment show that titration is an effective way to find the concentration of reactants in an acid-base reaction. Using the titration helped my group accurately calculate the volume of NaOH that was added to

the solution, and helped us to correctly determine the correct concentrations.