Introduction:

Introduction: The objective of this experiment is to utilize the techniques of weighing and titrating to determine the total amount of MgSO4 present in an unknown sample. Standardized EDTA will be used to titrate the unknown solution. This type of reaction is a complexation reaction, which usually involves Lewis acids and bases. EDTA in complexation reactions serves as a chelating ligand. The base, EDTA, will bind to the metal ions, which serve as the Lewis acid, thus playing a role as a ligand. The indicators used in EDTA titrations are metal ion indicators. Metal ion indicators work by the presence of absence of metal ions. Just like EDTA, the metal ion indicators will bind with metals. When the titrations begin, Mg2+ will be formed in a complex with the indicator. Once EDTA is added, it binds to the free Mg2+ ions, and then it reacts with the Mg2+ ions that are already bound to the indicator. When the EDTA is added, the solution will turn red. Once the solution turns from red to blue, that is the end point of the titration. The color change marks when the indicator is not bonded to the metal ion. The indicator used is “ Eriochrom Black T". If the proper techniques of weighing and titrating are employed in this experiment, the percentage of MgSO4 present in the unknown sample for each trial should be similar and precise. Experimental: The concentration of the standardized EDTA solution was obtained from the TA. A clean and dry weighing bottle was used to obtain the unknown. After obtaining the unknown, it was placed in a desiccator until titrating began. A 250 mL beaker was used to obtain the EDTA solution. A buret was acquired and rinsed with deionized water. After rinsing with deionized water, the buret was then rinsed with 5-10 mL of the standardized EDTA solution. The standardized EDTA solution was then used to fill the buret. 0. 14 to 0. 16 g of the unknown sample was weighed out by using the weigh-by-difference

technique and placed in a 250 mL Erlenmeyer flask. 30 mL of deionoized water was added to the flask to dissolve the unknown. Once the unknown was dissolved, 5 mL of pH 10 buffer solution and 2-3 drops of “ Eriochrom black T" indicator were added to the flask, as well. Titrations were performed with the EDTA solution until a purple or blue color appeared. This was repeated two more times. Results: Variables The independent variable was the amount of unknown that was measured out. The percentage of the MgSO4 in the sample was dependent on the amount of unknown that was measured out. The MgSO4 percentage was the dependent variable. The molecular weight of MgSO4 was the control. Qualitative When the unknown (Number 50) was dissolved with deionized water, the solution was colorless. Once the buffer solution and the Eriochrom black T indicator was added to the solution, the color changed into a dark red. When titrating with the standardized solution of EDTA, the solution turned from dark red to blue. Qualitative Unknown # 50 Concentration of the Standardized EDTA solution: 0. 04 M Trial 1 Trial 2 Trial 3 Mass of the unknown sample 0. 1534 g 0. 1615 g 0. 1566 g Volume of EDTA (Initial buret reading) 0 mL 8. 30 mL 16. 40 mL Volume of EDTA (Final buret reading) 7. 50 mL 16. 10 mL 23. 90 mL Volume of EDTA used 7. 50 mL 7. 80 mL 7. 50 mL # of moles, EDTA used 0. 0003 0. 000312 0. 0003 # of moles, MgSO4 in the Erlenmeyer flask 0. 0003 0. 000312 0. 0003 Mass of MgSO4 in the Erlenmeyer flask 0. 0361 g 0. 0375 g 0. 0361 g % MgSO4 in the unknown sample 23. 54% 23. 25% 23. 06% Average % MgSO4 in Unknown and STD: 23. 28% ± 0. 2411 Example Calculations Average % MgSO4 in the unknown sample = (23. 54 + 23. 25 + 23. 06)/3 = 23. 28% Standard Deviation = âˆš (23. 54 — 23. 28)2 + (23. 25 — 23. 28)2 + (23. 06 — 23. 28)2 /3-1 = 0. 2411 # of moles of EDTA/MgSO4

= 0. 0075 L x 0. 04 M = 0. 0003 mol Mass of MgSO4 = 0. 0003 mol x 120. 37 g/mol = 0. 0361 g % MgSO4 in the unknown sample = (0. 0361 g/0. 1534 g) x 100% = 23. 54% Discussion: The results were obtained by first measuring out three samples of Unknown 50. This was down by taring a sheet of weighing paper and measuring out 0. 14 to 0. 16 g of unknown. The masses of unknown for the three trials were 0. 1534 g, 0. 1615 g, and 0. 1566 g. The volume of EDTA used was obtained by subtracting the final buret reading from the initial reading. For example, in the second trial, the final buret reading was 16. 10 mL and the initial was 8. 30 mL. By subtracting the two, the difference was 7. 80 mL, which was the total volume of EDTA used. To obtain the number of moles of EDTA, the total volume of EDTA was first converted into Liters from milliliters and multiplied by the concentration of the standardized EDTA solution. The concentration of EDTA was 0. 04 M. For instance, for trial 2, the total volume of EDTA in Liters was 0. 0078 L. Once it was multiplied by the concentration of EDTA, 0. 04 M, the product was the number of moles of EDTA, 0. 000312 moles. The stoichiometry between EDTA and MgSO4 is a 1 to 1 ratio, thus the number of moles of EDTA is the same for the number of moles for MgSO4. To determine the mass of MgSO4, the moles of MgSO4 was multiplied by the molecular weight of MgSO4, which is 120. 37 g/mol, to convert from moles into grams. For trial 2, after multiplying 0. 000312 moles by the molecular weight of MgSO4, the product was 0. 0375 g of MgSO4. To calculate the percentage of MgSO4 in the unknown sample, the mass of MgSO4 was divided by the mass of the unknown sample that was measured out at the beginning of the experiment and then multiplied by 100. For trial 2, 0. 0375 g was divided by 0. 1615 g and the quotient was multiplied by 100. The percentage calculated for trial 2

was 23. 25%. The standard deviation and average percentage for MgSO4 was then calculated. The standard deviation was 0. 2411 and the average was 23. 28%. Conclusion: The purpose of this experiment was to use standardized EDTA solution to titrate a solution that contained an unknown sample to determine to amount of MgSO4 present. Upon completion of the titrations, the percentages of MgSO4 for each trial should be similar to each other. Based on the data, the percentages obtained for the three trials were 23. 54%, 23. 25%, and 23. 06%. The percentages were all precise to each other, thus the hypothesis was accepted. The standard deviation was 0. 2411. The percentages for trials 2 and 3 fall within the standard deviation. The percentage for trial 1, 23. 54%, is 0. 02 higher than the standard deviation range. Recommendations for further experimentation based on the data would be to use another primary standard to titrate. Another recommendation would be to use another unknown that contained a different metal ion instead of Mg2+. One more recommendation would be to use another indicator solution. By performing another experiment with these recommendations, one could compare both experiments to note the similarities and differences from the data.