## **CHEMISTRY 101L DATA SUMMARY**

## **Conductometric Titration**

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## Results

During the start of the reaction, after around 4.00mL of Sulfuric Acid had been added, there was some very light white precipitation at the bottom of the beaker, which mainly surrounded the stir bar. After the reaction had progressed more, all of the liquid appeared more opaque, with a white hue. After turning off the stir bar, the precipitant settled on the bottom of the beaker, however the water was still a cloudy white.

Given that we had 10mL of barium hydroxide that was .005 M, and .004 M sulfuric acid, and we know that we expect a 1 to 1 correspondence of the two reactants (barium hydroxide and sulfuric acid), we can simply use the ratio of the molarities to determine the needed mL of sulfuric acid: 10\*(.005/.004) = 12.5 mL of sulfuric acid.

Table 1. Volumes and Concentrations of Barium Hydroxide and Sulfuric Acid used

Data Table 1	Volumes	Concentrations
Barium Hydroxide	10.0 mL	0.005 M
Sulfuric Acid	50.0 mL	0.004 M



Conductivity (microsiemens/cm) vs. Corrected Volume (mL)

Figure 1. Trial 1 - Conductivity in microsiemens/cm vs Corrected Volume (mL). The conductivity minimum of 23 microsiemens/cm occurred at an added volume of 10.50 mL of sulfuric acid. Calculating the titration volume of sulfuric acid, the intersection of the two trend lines, leads to 9.97mL, so that's .0000398 moles.



Figure 2. Trial 2 – Conductivity in microsiemens/cm vs Corrected Volume (mL). The conductivity minimum of 16 microsiemens/cm occurred at an added volume of 10.10 mL of sulfuric acid. Calculating the titration volume of sulfuric acid, the intersection of the two trend lines, leads to 10.01mL, so that's .00004 moles.



Figure 3. Trial 3 – Conductivity in microsiemens/cm vs Corrected Volume (mL). The conductivity minimum of 16 microsiemens/cm occurred at an added volume of 9.60 mL of sulfuric acid. Calculating the titration volume of sulfuric acid, the intersection of the two trend lines, leads to 9.40mL, so that's .000038 moles.

Table 2. Calculating the titration volume of sulfuric acid, the intersection of the two trend lines, leads to 9.40mL, so that's .000038 moles. The other values are listed in the caption for each of the figures. The moles of  $Ba(OH)_2$  in the 5mL sample used is 0.0642 moles. The ratio of the barium to hydroxide ions is 2:1.

$$Ba(OH)_2(aq) + H_2 SO_4(aq) \implies BaSO_4(s) + 2H_2O(l)$$

Conclusion:

Before the conductivity minimum, the reaction species that was most present was the base, Ba(OH)<sub>2</sub> because the conductivity had not been reduced by the interaction with the sulfuric acid, that is, the concentration of aqueous ions in the solution was still falling. At the minimum, there were equal amounts of barium hydroxide and sulfuric acid, and the concentration of Ba<sup>+2</sup> and OH<sup>-</sup> had hit a minimum. Finally, as more sulfuric acid was added, the concentration of ions climbed and so the conductivity increased again. At that point, the sulfuric acid was most abundant.

The shape of the conductivity plot would have been slightly less steep if we had added distilled water, because the ions would have been more spread out (diffused) in the water, and so the conductivity per centimeter would have been reduced.

Possible sources of error are not cleaning out the beaker fully, which could have resulted in an altered minimum across trials. This would likely be a random source of error. Moreover, if we did not clean the conductivity probe fully after each trial, there could have been some reactant still on the probe which would affect the readings of the future trials. This would be classified as a systemic source of error.