Chemistry 30: Molar Heat of Neutralization Lab

Name _____ Partner _____ Score ____ / 12

Problem: What will be the effect on the molar heat of neutralization of a base, if it is neutralized by different acids?

Assumptions: In this lab, the volume of dilute acid and dilute base will be treated as if it is the water of a calorimeter. For calculation purposes, treat the specific heat capacity of the dilute acid and / or the dilute base as 4.19 $\frac{kJ}{kg°C}$

Prelab: a) Write the neutralization reactions for $NaOH_{(aq)}$ with each of the following acids. ($H_2SO_{4(aq)}$, $HNO_{3(aq)}$, and $HCl_{(aq)}$) (1 mark)

b) Make an observation table for the data that will need to be recorded for this lab. (3 marks)

Materials:

1.0 $\frac{mol}{L}$ $NaOH_{(aq)}$

1.0 $\frac{mol}{L}$ $H_2SO_{4(aq)}$, $HNO_{3(aq)}$, and $HCl_{(aq)}$

Styrofoam cups

Thermometers

Graduated cylinders

Procedure:

1. Use 10.0 mL of 1.0 $\frac{mol}{L}$ $NaOH_{(aq)}$. Measure and record the initial temperature of this basic solution.
2. Choose an acid to completely neutralize the base sample from step 1. Be sure to look at the balanced reactions in the prelab and calculate the volume of the 1.0 $\frac{mol}{L}$ acid that will be needed. Record the volume of the acid used and the initial temperature of the acid.
3. Pour the acid into the base and stir. Measure and record the <u>highest</u> temperature that results from this reaction.
4. Repeat the steps (1. ➜ 3.) <u>twice</u> for each acid.
5. Caution: Be sure to use the same thermometer for all the measurements. Also be sure to wipe it clean before moving it from one solution to the next.
6. At the end of each trial, the mixture can be flushed down the sink drain.

Analysis:

1. Use your observations to calculate the molar heat of neutralization of $NaOH_{(aq)}$ with each acid. (6 marks)

Conclusion : (2 marks)