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Data and Calculations

Mass of clean, dry calorimeter: _______________ g

Mass of calorimeter with solution after conclusion of reaction: _______________ g

Final mass of reaction solution: _______________ g

Initial temperature of H_2SO_4 solution: _______________ °C

Initial temperature of NaOH solution: _______________ °C

Average initial temperature of starting solutions: _______________ °C

Final temperature of mixture: _______________ °C

Change in temperature of solution (ΔT): _______________ °C

1. Write the balanced chemical equation for your acid/base neutralization reaction.

2. Determine the theoretical yield of water (in grams) of the reaction that you carried out.

3. What is the limiting reactant of your reaction?

4. Calculate the mass of each reactant that is theoretically left over at the end of your reaction.

_______________ g of NaOH left over _______________ g of H_2SO_4 left over

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5. Assuming that the specific heat capacity of the solution that you used is equal to 3.70 J / g °C, calculate the heat ($q_{solution}$) in kJ that was absorbed by the contents of the coffee cup during the reaction.

6. Calculate ΔH of your reaction using the units specified:

_________________ kJ / g H_2O formed _________________ kJ / mol H_2O formed

7. Rewrite your balanced chemical equation and include the value of ΔH beside it:

________________________ → ________________________ ΔH = _________ kJ

8. Use the $\Delta H_f°$ values given to calculate the theoretical value of ΔH for your reaction.

Substance	**$\Delta H_f°$ (kJ / mol)**
H_2SO_4 *(aq)*	–909.3
NaOH *(aq)*	–470.1
H_2O *(l)*	–285.8
Na_2SO_4 *(aq)*	–1387.1

9. Using your results from questions 7 & 8, calculate the percent error in your determination of ΔH.

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Pre-lab Assignment

A student carries out the following reaction in lab by mixing 50.0 mL of a 1.00 M solution of hydrochloric acid with 50.0 mL of a 1.00 M solution of potassium hydroxide:

$$HCl\ (aq) + KOH\ (aq) \rightarrow KCl\ (aq) + H_2O\ (l)$$

The average initial temperature of the two solutions was 25.00 °C. After mixing, the final temperature of the solution was 31.43 °C. The mass of the resulting solution was 100.2 g.

1. Determine the theoretical yield of KCl (in moles) of the student's reaction.

2. Assuming that the specific heat capacity of the solutions that the student used are equal to the specific heat capacity of pure water, calculate the heat ($q_{solution}$) in kJ that was absorbed by the contents of the coffee cup from the reaction.

3. Calculate the value of ΔH_{rxn} in the units kJ / mol KCl.

4. For this reaction, the theoretical value of ΔH_{rxn} is –55.8 kJ / mol KCl. What was the student's percent error when determining ΔH_{rxn}?