Heat of Neutralization
Lab Report

LibreTexts page: 5: Calorimetry
(https://chem.libretexts.org/link?214682)

Please don’t edit, rearrange or delete anything that is already in this document. Just add your answers.
You can use shortcuts for superscripts and subscripts when needed:

\( X^\circ \) Superscript Ctrl+.
\( X_0 \) Subscript Ctrl+.

You can obtain the data from this Google sheet → [Insert the link]

Part I: The reaction

1. Write the balanced equation.

2. You mixed 30ml 2M NaOH with 30ml 2M HCl. Are these in stoichiometric proportions or is there a limiting reagent?

3. Predict the moles of NaCl
Part II: Obtaining the ΔT from the graph

1. Obtain $T_H$ by using the Google sheet to extend a linear trendline of your data to the time of mixing and consider that point to be your highest temperature point.

2. Take a snapshot of your graph and replace the picture below with it.

![Placeholder](image)

Part III: The heat of reaction

1. What is the total mass of the solution after mixing.

2. Using the temperature change obtained in part II calculate the heat absorbed by the solutions. Consider these solutions to have the specific heat capacity as pure water.

3. Calculate the heat absorbed by the calorimeter using the calorimeter constant of 24.6 J/C (that was calculated before class).
4. Using the first law show how the heat released by the reaction in part I was the heat absorbed by the solution and the calorimeter constant.

Part IV: Molar heat of reaction
1. Using the equation in Part I, calculate the number of moles responsible for the heat released in Part III.

2. Calculate the numerical value of the molar heat of reaction in units of kJ/mol

Part V: Theoretical molar heat of reaction
1. Using the following enthalpies of formation calculate the theoretical molar enthalpy of neutralization for the reaction of the HCl and NaOH

<table>
<thead>
<tr>
<th>Substance</th>
<th>kJ/mol</th>
</tr>
</thead>
<tbody>
<tr>
<td>NaCl(aq)</td>
<td>-407.3</td>
</tr>
<tr>
<td>H₂O(l)</td>
<td>-285.8</td>
</tr>
<tr>
<td>HCl(aq)</td>
<td>-167.2</td>
</tr>
<tr>
<td>NaOH(aq)</td>
<td>-470.1</td>
</tr>
</tbody>
</table>
Part VI: Percent error

1. Using the equation below, calculate percent error.

\[
\% \text{ Error} = \left( \frac{|\text{experimental value} - \text{accepted value}|}{\text{accepted value}} \right) \times 100\%
\]