

THERMOCHEMISTRY

Date: _____

Name: _____

Partner: _____

OBJECTIVE: To determine the enthalpies of reaction for three chemical reactions and to use the data to verify Hess' Law of Enthalpy Summation.

PROCEDURE: As in the Chem 1105 lab manual, pp. _____.

OBSERVATIONS:

DATA:

Part 1: The enthalpy of solution of solid sodium hydroxide.

	Run 1	Run 2
Mass of NaOH and boat		
Mass of boat		
Mass of NaOH		
Volume of water		
Mass of water (density = 1.00 g/mL)		
Total mass of solution		
Initial temperature of water (T ₁)		
Final temperature of water (T ₂)		
ΔT		

Part 2: The enthalpy of neutralization of solid sodium hydroxide.

	Run 1	Run 2
Mass of NaOH and boat		
Mass of boat		
Mass of NaOH		
Volume of HCl and water		
Mass of HCl and water (density = 1.00 g/mL)		
Total mass of solution		
Initial temperature of solution (T1)		
Final temperature of solution (T2)		
ΔT		

Part 3: The enthalpy of neutralization of aqueous sodium hydroxide.

	Run 1	Run 2
Volume of HCl solution		
Volume of NaOH solution		
Total volume of solution		
Total mass of solution		
Initial temperature of NaOH solution		
Initial temperature of HCl solution		
Average temperature of two solutions (T1)		
Final temperature of solution (T2)		
ΔT		

CALCULATIONS:

1. The heat of solution or enthalpy change (ΔH) of solid NaOH for each run:

	Run 1	Run 2
Temperature change (ΔT)		
Heat change, q		
Moles of solid NaOH, mol		
Enthalpy Change (ΔH_1)		
Average(ΔH_1) J/mol		
Average(ΔH_1) KJ/mol		

2. The heat of neutralization (ΔH) of aqueous HCl and solid NaOH.

	Run 1	Run 2
Temperature change (ΔT)		
Heat change, q		
Moles of solid NaOH, mol		
Moles of aqueous HCl, mol		
Rewrite the Moles of the limiting reagent		
Enthalpy Change (ΔH_2)		
Average(ΔH_2) J/mol		
Average(ΔH_1) KJ/mol		

3. The heat of neutralization (ΔH) of aqueous HCl and aqueous NaOH.

	Run 1	Run 2
Temperature change (ΔT)		
Heat change, (q)		
Moles of aqueous NaOH, <i>mol</i>		
Moles of aqueous HCl, <i>mol</i>		
Rewrite the Moles of the limiting reagent		
Enthalpy Change (ΔH_3)		
Average(ΔH_3) J/mol		
Average(ΔH_1) KJ/mol		

RESULTS:

SUMMARY TABLE

Reaction	ΔT ($^{\circ}\text{C}$)	q (Joules)	# of moles	ΔH (kJ/mol)	Av. ΔH (kJ/mol)
1. (a)					$\Delta H_1 =$
1. (b)					
2. (a)					$\Delta H_2 =$
2. (b)					
3. (a)					$\Delta H_3 =$
3. (b)					

CONCLUSION:

Write down three reactions with their ΔH 's. Then, show that one of the three reactions performed is the algebraic sum of the other two. Show that this summation is confirmed by the summation of the ΔH values that you have determined. **To what extent has Hess' Law been verified by your results, show by calculating percent deviation.**

QUESTIONS:

1. What percentage error is there between the experimental specific heat of value, $3.89 \text{ J/g } ^\circ\text{C}$ of 1.00 M NaCl solution, and an expected value of $4.18 \text{ J/g } ^\circ\text{C}$?

2. Are the reactions performed in this lab, exothermic or endothermic? Please explain your answer.