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 CHEM 1105 lab manual, pages _____.

Observations:

DATA:

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

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

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

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

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

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

CALCULATIONS:

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

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

2. The heat of neutralization ($\triangle H$) of aqueous HCl and solid NaOH.

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

3. The heat of neutralization ($\triangle H$) of aqueous HCl and aqueous NaOH.

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

RESULTS:

SUMMARY TABLE

Reaction	ΔT(°C)	*q* (Joules)	No. of moles	ΔH(kJ/mol)	Av. ΔH (kJ/mol)
1. (a)					ΔH_1 =
1. (b)					
2. (a)					ΔH_2 =
2. (b)					
3. (a)					ΔH_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 Δ*H* values that you have determined. **To what extent has Hess' Law been verified by your results, show by calculating percent deviation.**

QUESTIONS:

1) What is the percentage error between the actual specific heat, (3.89 J/g·°C), and our assumed specific heat (4.184 J/g·°C) of a 1.00 *M* NaCl solution?

2) Which of the reactions that you conducted today are exothermic and which are endothermic? How do you know?