# Enthalpy of Formation Using Hess’s Law

Student Name

Date

## Data

### Activity 1

Data Table 1: The Heat Capacity of the Calorimeter

| **Time (min)** | **Trial 1**  **Temp. °C** | **Trial 2**  **Temp. °C** | **Trial 3**  **Temp. °C** |
| --- | --- | --- | --- |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |

|  | **Trial 1** | **Trial 2** | **Trial 3** |
| --- | --- | --- | --- |
| Initial temperature of cold water, Tc |  |  |  |
| Initial temperature of warm water, Th |  |  |  |
| Average temperature, Ta  (Th + Tc)/2 |  |  |  |
| Temperature of time 0 from graph, T0 |  |  |  |
| Heat lost by hot water |  |  |  |
| Heat gained by cold water |  |  |  |
| Heat lost by water to the calorimeter in J |  |  |  |
| Temperature change of the calorimeter |  |  |  |
| Heat capacity (C) of the calorimeter in J/°C |  |  |  |

Average heat capacity (C) of calorimeter in J/°C =

### Activity 2

Data Table 2: Determination of **ΔHrxn Mg and HCl**

|  | **Trial 1** | **Trial 2** | **Trial 3** |
| --- | --- | --- | --- |
| Mass of magnesium (g) |  |  |  |
| Moles of magnesium |  |  |  |
| Initial temperature (°C) |  |  |  |
| T at 1 minute (°C) |  |  |  |
| T at 2 minutes (°C) |  |  |  |
| T at 3 minutes (°C) |  |  |  |
| T at 4 minutes (°C) |  |  |  |
| T at 5 minutes (°C) |  |  |  |
| T at 6 minutes (°C) |  |  |  |
| T at 7 minutes (°C) |  |  |  |
| T at 8 minutes (°C) |  |  |  |
| T at 9 minutes (°C) |  |  |  |
| T at 10 minutes (°C) |  |  |  |
| Equation of line |  |  |  |
| Final temperature (°C) |  |  |  |
| ΔT (°C) |  |  |  |
| Δqsoln (J) |  |  |  |
| Δqc (J) |  |  |  |
| ΔH1 (kJ/mol) |  |  |  |

Average ΔH1 (kJ/mol) =

### Activity 3

Data Table 3: Determination of **ΔHrxn MgO and HCl**

|  | **Trial 1** | **Trial 2** | **Trial 3** |
| --- | --- | --- | --- |
| Mass of magnesium oxide (g) |  |  |  |
| Moles of magnesium oxide |  |  |  |
| Initial temperature (°C) |  |  |  |
| T at 1 minute (°C) |  |  |  |
| T at 2 minutes (°C) |  |  |  |
| T at 3 minutes (°C) |  |  |  |
| T at 4 minutes (°C) |  |  |  |
| T at 5 minutes (°C) |  |  |  |
| T at 6 minutes (°C) |  |  |  |
| T at 7 minutes (°C) |  |  |  |
| T at 8 minutes (°C) |  |  |  |
| T at 9 minutes (°C) |  |  |  |
| T at 10 minutes (°C) |  |  |  |
| Equation of line |  |  |  |
| Final temperature (°C) |  |  |  |
| ΔT (°C) |  |  |  |
| Δqsoln (J) |  |  |  |
| Δqc (J) |  |  |  |
| ΔH2 (kJ/mol) |  |  |  |

Average ΔH2 (kJ/mol) =

Average ΔH1 (kJ/mol) =

ΔH3 (kJ/mol) = -286

ΔHf of magnesium oxide (kJ/mol) =

1. Why is a linear regression taken on the temperature data only as the temperature begins to decrease?
2. Why is it important to know the heat absorbed by the calorimeter?
3. Were the reactions in Activities 2 and 3 endothermic or exothermic? Would ΔH1 and ΔH2 have the same sign (positive or negative)? Why or why not?
4. The known standard enthalpy of formation for magnesium oxide is −601.24 KJ/mol. Describe potential sources of error that would cause the experimental value to deviate from the known value.
5. A student wishes to conduct this investigation more quickly and decides to perform the activities using three calorimeters. What portion of the investigation would need to be modified to account for three separate calorimeters being used?