11C – HESS'S LAW

Analysis

Table 1: Change in temperature

Empty calorimeter mass, Trial 1 = _____ g Empty calorimeter mass, Trial 2 = _____ g

Full calorimeter mass, Trial 1 = _____ g Full calorimeter mass, Trial 2 = _____ g

Trial #	Mass of the HCl solution (g)	Mass of Mg reactant (g)	Initial temperature (°C)	Final temperature (°C)	Change in temperature (°C)	Total mass inside cup (g)
1 (Mg)						
2(MgO)						

1. Calculate the change in temperature for each trial and enter your answers in Table 1.

2. Add the mass of HCl solution to the reactant mass to calculate the total mass inside the cup for each trial and enter your answers in Table 1.

3. Determine the moles of magnesium and magnesium oxide for your two trials; show your work below and record your answers in Table 2.

4. Calculate the amount of heat that each solution absorbed. Heat, in Joules, can be calculated with the following equation:

$$Q = m \times 4.18\ J/g{\cdot}°C \times \Delta T$$

The mass for the calculation is the total mass of the cup system. Since the solution is mostly water, you can assume that the specific heat capacity is 4.18 J/ g·°C. Show your calculations below and record the results in Table 2.

5. The heat of the reaction is the same heat value, but opposite sign, as the heat absorbed by the solution equals heat released during the reaction. (Remember the law of conservation of energy!) Calculate the heat of reaction for each trial and convert the units to kJ. Show your work below and record these values in Table 2.

6. Heats of reaction are expressed on a per mol basis. Determine the ΔH_{rxn} in kJ/mol by dividing heat of reaction by the moles of limiting reactant. The limiting reactant was the reactant containing magnesium. Show your work below and record your answers in Table 2.

Table 2: Heats of reactions

Trial #	Moles of magnesium reactant (mol)	Heat of solution (J)	Heat of reaction (kJ)	ΔH_{rxn} (kJ/mol)
1 (Mg)				
2 (MgO)				

7. Write the balanced thermochemical equations for the two reactions in this lab. Balance the equations and write the ΔH_{rxn} next to the reaction.

8. The standard heat of formation of liquid water can be written as:

   $H_2(g) + ½\ O_2(g) \rightarrow H_2O(l)$; $\Delta H_{rxn} = -285.8$ kJ/mol

   Combine this equation and the equations from the previous step to get an equation for the formation of MgO(s). Include the ΔH_{rxn} for each equation.

   Desired equation: $Mg(s) + ½\ O_2(g) \rightarrow MgO(s)$; ΔH_{rxn} =

Questions

1. Describe what you learned about calorimetry reactions in this investigation.

2. In your opinion, what is the largest source of error?

3. How do your heats of reaction for Trials 1 and 2 compare to those of other groups? Explain.

4. What was the least precise measurement you made when collecting your data? Explain.

5. Why do we need to calculate ΔH_{rxn} per mole of solid (Mg or MgO)? Explain.