

Lab T8 - Hess's Law

Question:

What is the heat of reaction (ΔH) for the reaction: $\text{Mg(s)} + 1/2 \text{O}_2(\text{g}) \implies \text{MgO(s)}$?

Purpose:

To use Hess's Law and calorimetry measurements to determine the enthalpy change or heat of reaction for the reaction: $\text{Mg(s)} + 1/2 \text{O}_2(\text{g}) \implies \text{MgO(s)}$.

(Given: For the reaction $\text{H}_2(\text{g}) + 1/2 \text{O}_2(\text{g}) \implies \text{H}_2\text{O(l)}$ $\Delta H_3 = -285.8 \text{ kJ}$)

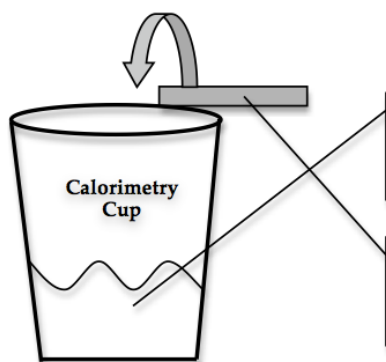
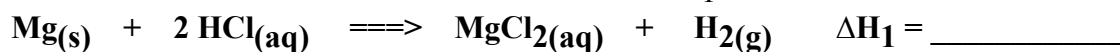
Safety:

Hydrochloric acid is toxic by ingestion and inhalation; it is corrosive to skin, eyes and clothing. Magnesium metal is extremely flammable; keep away from flames. Wear goggles at all times.

Disposal:

Unreacted solids (of which there should be none) should never be placed in the drain. All solutions can be poured down the drain and cups can be rinsed thoroughly.

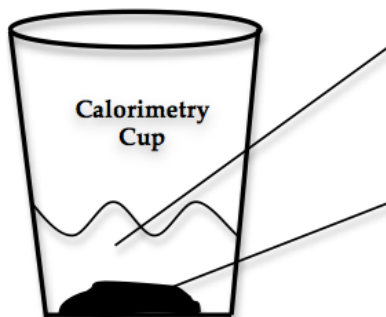
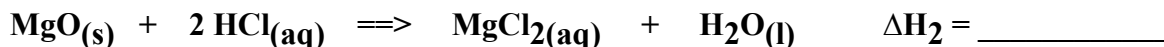
Procedure: Reaction 1: Use calorimetry to determine the ΔH_1 value for the following reaction:



1st: Mass empty cup. Record. Add 25.0 mL of 1.0 M HCl(aq) ; mass cup again. Record. Determine mass of HCl(aq) . Measure and record temperature.

2nd: Acquire a ~ 7 cm Mg strip; measure exact length. Record. Determine mass of Mg from its linear density (2.19 g/m). Fold in half. Add to solution; stir. Determine ΔT .

Reaction 2: Use calorimetry to determine the ΔH_2 value for the following reaction:



1st: Mass empty cup. Record. Add 25.0 mL of 1.0 M HCl(aq) ; mass cup again. Record. Determine mass of HCl(aq) . Measure and record temperature.

2nd: Acquire ~ 0.3 g MgO ; measure exact mass. Record. Add to solution; stir. Determine ΔT .

Assuming the specific heat of the aqueous solutions to be $4.184 \text{ J/g}^\circ\text{C}$, calculate the Q values and the ΔH values (kJ per mole of Mg and kJ per mole of MgO) for each reaction. Then use the results with Hess's Law to determine the ΔH for the reaction: $\text{Mg(s)} + 1/2 \text{O}_2(\text{g}) \implies \text{MgO(s)}$

Theoretical value: $\Delta H = -602 \text{ kJ}$