Honors  **Summative Activity: Unit 1: Stoichiometry, Gases**

**Heat of Formation of Magnesium Oxide (30 points)**

**Purpose:**

1. Determine the heat of formation for MgO experimentally
2. Determine the % yield for H2 production

**Safety:**

1. Use caution handling HCl acid. Avoid contact with skin and do not inhale. Notify teacher of any contact.

2. Relieve the pressure slowly by gently removing the stopper. Hold stopper securely

**Procedure:**

1. Measure out 100.0 mL of 3.0 M HCl in a graduated cylinder.

 Assume that its density and specific heat are essentially equivalent to that of water.

 Pour the acid into a 125 ml flask with gas pressure sensor and thermometer

2. Mass approximaterly 0.1 g of cleaned magnesium to the nearest 0.001 g.

3. Add the magnesium to the acid and immediately seal the flask. Hold stopper securely onto flask

4. Swirl the flask to stir the mixture constantly, and record the highest temperature reached and the highest pressure.

5. Make duplicate determinations until you obtain a set of results for ΔH that differs by no more than 3%.

Record the average of these two values.

7. Determine the volume of the gas in the flask by filling the entire flask with water and then transferring

that amount to a graduated cylinder. Calculate the volume of the gas by subtracting the volume of the solution

6. Measure out 100.0 mL of 3.0 M HCl in a graduated cylinder.

 Assume that its density and specific heat are essentially equivalent to that of water.

 Pour the acid into a styrofoam cup. calorimter

7. Mass approximately 0.2 g of MgO instead of Mg. Record the temperature of the hydrochloric acid, then add the MgO. Be sure that all the MgO goes directly into the HCl. Do not allow it to “cake” on the bottom.

8. Stir the mixture constantly, and record the highest temperature reached.

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##  DATA TABLE A: THE REACTION OF Mg AND HCl (3 points)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Trial # | **1** | **2** | **3** | **ave** |
| Mass of Mg |  |  |  |  |
| Mass of HCl |  |  |  |  |
| Moles of Mg |  |  |  |  |
| **Ti** |  |  |  |  |
| **Tf** |  |  |  |  |
| **ΔT** |  |  |  |  |
| Heat released |  |  |  |  |
| **ΔHrxn/mole Mg** |  |  |  |  |
| **Pressure kPa initial** |  |  |  |  |
| **Pressure kPa final** |  |  |  |  |
| **Δ Pressure KPa** |  |  |  |  |
| **Volume of entire flask**  |  |  |  |  |
| **Volume of HCl** |  |  |  |  |
| **Volume of gas in flask** |  |  |  |  |
| **Moles of gas (PV=nRT)** |  |  |  |  |

1. Balanced Chemical Equation(1 point)

2. Calculations for 1 trial for ΔH/mole( 3 points)

3. Calculate the theoretical moles of H2 produces from the amount of Mg reacted.(2 points)

4. Calculate the actual moles of H2 from the P, T, V data.(3 points)

5. Calculate the percent yield for H2 produced( 2 points). :

 **DATA TABLE B: THE REACTION OF MgO and HCl( 2 points)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Trial #** | **1** | **2** | **3** | **ave** |
| **Mass of MgO**  |  |  |  |  |
| **Mass of Solution** |  |  |  |  |
| **Moles of MgO** |  |  |  |  |
| **Ti** |  |  |  |  |
| **Tf** |  |  |  |  |
| **ΔT** |  |  |  |  |
| **Heat released** |  |  |  |  |
| **ΔHrxn/mole MgO** |  |  |  |  |

6. Balanced Chemical Equation( 1 points):

7. Calculations for 1 trial for ΔH/mole(3 points)

Application of Hess’ s law:

1. Using the thermochemical equations for the reactions that you have performed, and the ΔHfo for H2O(l) form your textbook, apply Hess’s Law to obtain a thermochemical equation for the following equation (show work) 4 points:

Mg(s) + 0.5 O2(g) → MgO(s)

1. Determine the percent error between your value for the heat of formation of magnesium oxide and the published value from your text book. ( 2points)

**Error Analysis:**

 Be very specific and don’t not use human errors but experimental errors.Use complete sentences))

1. Error For heat of formation of Mg and HCl (2 points)

2. Error for the moles of H2 gas produced (2 points)