C1151 Data Sheet Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Calorimetry v1.22 Date of Exp. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Lab Section \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| **Procedure 1 Det. of Calorimeter Constant** | **Trial 1** | **Trial 2** |
|  |  |  |
| **Masscalorimeter (empty)** |  |  |
| **Masscalorimeter (+H2O)** |  |  |
|  |  |  |
| **H2O** |  |  |
|  |  |  |
| **Mass** |  |  |
| **Ti** |  |  |
| **Tf** |  |  |
| **ΔT** |  |  |
| **c** | 4.184 J/goC | 4.184 J/goC |
| **q** |  |  |
|  |  |  |
| **Cu** |  |  |
|  |  |  |
| **Mass** |  |  |
| **Ti** |  |  |
| **Tf** |  |  |
| **ΔT** |  |  |
| **c** | 0.385 J/goC | 0.385 J/goC |
| **q** |  |  |
|  |  |  |
| **Calorimeter** |  |  |
|  |  |  |
| **q** |  |  |
| **ΔT** |  |  |
| **C** |  |  |
|  |  |  |
| **Caverage  *Excess Sig. Figs.*** |  | |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| **Procedure 2 Determination of an unkknown metal’s specific heat** | **Trial 1** | **Trial 2** |
|  |  |  |
| **Masscalorimeter (empty)** |  |  |
| **Masscalorimeter (+H2O)** |  |  |
|  |  |  |
| **H2O** |  |  |
|  |  |  |
| **Mass** |  |  |
| **Ti** |  |  |
| **Tf** |  |  |
| **ΔT** |  |  |
| **c** | 4.184 J/goC | 4.184 J/goC |
| **q** |  |  |
|  |  |  |
| **Calorimeter** |  |  |
| **ΔT** |  |  |
| **C** |  |  |
| **q** |  |  |
|  |  |  |
|  |  |  |
| **Mystery Metal** |  |  |
|  |  |  |
| **Mass** |  |  |
| **Ti** |  |  |
| **Tf** |  |  |
| **ΔT** |  |  |
| **q** |  |  |
| **c** |  |  |
| **caverage** |  | |

|  |  |  |
| --- | --- | --- |
| **Procedure 3 Determination of ΔHrxn** | **Trial 1** | **Trial 2** |
|  |  |  |
| **Masscalorimeter (empty)** |  |  |
| **Masscalorimeter**  **(+ combined solutions)** |  |  |
|  |  |  |
| **Solutioncombined** |  |  |
|  |  |  |
| **Masscombined solutions** |  |  |
| **Ti** |  |  |
| **Tf** |  |  |
| **ΔT** |  |  |
| **c** | 4.184 J/goC | 4.184 J/goC |
| **q** |  |  |
|  |  |  |
| **Calorimeter** |  |  |
| **ΔT** |  |  |
| **C** |  |  |
| **q** |  |  |
|  |  |  |
| **Reaction** |  |  |
|  |  |  |
| **qtotal** |  |  |
|  |  |  |
|  |  |  |
| **HCl: Concentration** |  |  |
| **HCl: Volume** |  |  |
| **HCl: Moles** |  |  |
|  |  |  |
| **ΔHreaction (kJ/mole)** |  |  |
|  |  |  |
| **NaOH: Concentration** |  |  |
| **NaOH: Volume** |  |  |
| **NaOH: Moles** |  |  |
|  |  |  |
| **ΔHreaction (kJ/mole)** |  |  |
|  |  |  |

**Procedure 1 SHOW ALL WORK AND REPORT RESULTS IN TABLES ABOVE**

**Calculate for each trial:**

* **calorimeter H2O mass**
* **H2O ΔT**
* **H2O total heat q = m c ΔT**
* **Cu ΔT**
* **Cu total heat q = m c ΔT**
* **calorimeter q: - qCu = qH2O + qcalorimeter**
* **calorimeter constant: C = qcalorimeter/ ΔT**
* **average calorimeter constant**

**Procedure 2 SHOW ALL WORK AND REPORT RESULTS IN TABLES ABOVE**

**Calculate for each trial:**

* **calorimeter H2O mass**
* **H2O ΔT**
* **H2O total heat q = m c ΔT**
* **calorimeter: q (use average calorimeter constant)**
* **Metal: - qmetal = qH2O + qcalorimeter**
* Table

  Description automatically generated**Metal: Specific heat**
* **Identity of metal: Use your average specific heat value  
   to identify your mystery metal (Circle)**

**Procedure 3 SHOW ALL WORK AND REPORT RESULTS IN TABLES ABOVE**

**Calculate for each trial:**

* **calorimeter TOTAL combined solution mass**
* **Solution ΔT**
* **Solution total heat q = m c ΔT (use water’s specific heat)**
* **calorimeter: q (use average calorimeter constant)**
* **Reaction: - qreaction = qsolution + qcalorimeter**
* **Reaction: moles of HCl**
* **Reaction: ΔHreaction = qreaction/molHCl**
* **Reaction: moles of NaOH**
* **Reaction: ΔHreaction = qreaction/molNaOH**

**Problem:** 55.0 mL of 1.0 M HCl is mixed with 67.0 mL of 1.25 M NaOH.

The initial temperatures of the two solutions is 22.8oC  
  
Use your value of ΔHrxn to determine the final temperature of the combined solutions.

**Step 1:** Determine the moles of HCl and NaOH present and *clearly* identify the *limiting* reactant.

**Step 2:** Use the limiting reactant and your ΔHrxn value to determine the heat released by the reaction.

**Step 3:** Use the heat you determined in Step 2 to calculate the temperature change using   
 the equation: - **qrxn = msolution × Csolution × ΔT**  **+** **Ccal × ΔT.**

*Assume the solution has the same density and specific heat as pure water.*

**Step 4:** Assuming the initial temperature of the two solutions is 22.8 oC, determine the   
 final temperature of the total solution.