Determination of Heats of Reaction Laboratory Exercise

**Purpose:** To experimentally determine the amount of heat energy absorbed or released during a chemical reaction.

**Procedure:**

Measuring the heats of reaction of different chemical reactions.

1. You must perform each of the reactions listed below in your calorimeter

(coffee cup).

A. Zn + 2 HCl → ZnCl2 + H2

**Warning!!! This reaction should be performed inside the fume hood. Be careful, because 6 M HCl can burn your skin. Also, make sure to use the**

**6 M HCl instead of the 1 M HCl.**

(1.) Pour 50 mL of 6 M HCl into your calorimeter and record your initial

temperature. Density = 1.01 g/mL.

Initial temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Mass of HCl \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(2.) Measure out between 1.8-2.0 g of Zn metal

Mass of Zn \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(3.) Add the Zn metal to the 6 M HCl, allow the reaction to proceed, and

record the final temperature.

Final temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(4.) Total mass of reaction \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(5.) Change in temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(6.) Calculate the heat energy produced or absorbed by the reaction:

q = \_\_\_\_\_\_\_\_\_\_

B. CH4N2O (*s*) → CH4N2O (*aq*) (Dissolution of urea)

(1.) Pour 100 mL of DI H2O into your calorimeter and record your initial

temperature. Density = 1.00 g/mL.

Initial temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Mass of DI H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(2.) Measure out between 50-60 g of solid urea

Mass of urea \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(3.) Add the urea to the DI H2O, allow the reaction to proceed, and

record the final temperature.

Final temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(4.) Total mass of reaction \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(5.) Change in temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(6.) Calculate the heat energy produced or absorbed by the reaction:

q = \_\_\_\_\_\_\_\_\_\_

C. 2 Ca + 2 H2O → 2 Ca(OH)2 + H2

(1.) Pour 50 mL of H2O into your calorimeter and record your initial

temperature. Density = 1.00 g/mL.

Initial temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Mass of H2O solution \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(2.) Measure out between 0.6-0.8 g of Ca metal

Mass of Ca \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(3.) Add the Ca metal to the H2O, allow the reaction to proceed, and

record the final temperature.

Final temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(4.) Total mass of reaction \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(5.) Change in temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(6.) Calculate the heat energy produced or absorbed by the reaction:

q = \_\_\_\_\_\_\_\_\_\_

D. 2 HCl + Mg → MgCl2 + H2

**Make sure to use the 1 M HCl instead of the 6 M HCl!!!!**

(1.) Pour 50 mL of 1 M HCl into your calorimeter and record your initial

temperature. Density = 1.01 g/mL.

Initial temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Mass of HCl solution \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(2.) Measure out between 0.6-0.8 g of Mg metal

Mass of Mg \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(3.) Add the Mg metal to the 1 M HCl, allow the reaction to proceed, and

record the final temperature.

Final temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(4.) Total mass of reaction \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(5.) Change in temperature \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

(6.) Calculate the heat energy produced or absorbed by the reaction:

q = \_\_\_\_\_\_\_\_\_\_