Heat of Combustion: Magnesium

In this experiment, you will use this principle as you determine a heat of reaction that would be difficult to obtain by direct measurement—the heat of combustion of magnesium ribbon.

Heats of reaction for the involved reactions will be determined in this experiment. Your textbook will be used to find the heat of reaction of the third equation.

OBJECTIVES

In this experiment, you will

- Use prior knowledge about the additivity of reaction heats.
- Determine the heat of combustion of magnesium ribbon.

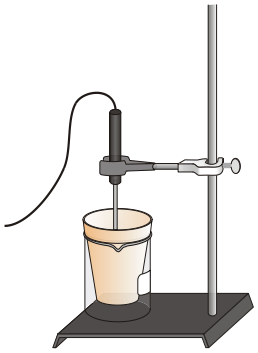

Figure 1

MATERIALS

LabQuest
LabQuest App
Temperature Probe
1.00 M HCl
magnesium oxide, MgO
magnesium ribbon, Mg
100 mL graduated cylinder
250 mL beaker
Styrofoam cup
ring stand
utility clamp
stirring rod
balance

The Data Collection and Processing (DCP) and Concluding and Evaluating (CE) portions of this lab will be assessed for your internal assessment mark.

PROCEDURE

1. Obtain and wear safety glasses and an apron.
2. Connect the Temperature Probe to LabQuest and choose New from the File menu. If you have an older sensor that does not auto-ID, manually set up the sensor.
3. On the Meter screen, tap Rate. Change the data-collection rate to 1 sample/second and the data-collection length to 480 seconds. Data collection will last 8 minutes. Select OK.
4. Use a utility clamp to suspend the Temperature Probe from a ring stand as shown in Figure 1.

Reaction 1

5. Place a Styrofoam cup into a 250 mL beaker as shown in Figure 1. Measure out 100.0 mL of 1.00 M HCl into the Styrofoam cup. Lower the Temperature Probe into the solution. **CAUTION:** *Handle the HCl solution with care. It can cause painful burns if it comes in contact with the skin.*
6. Weigh out about 1.00 g of magnesium oxide, MgO, on a piece of weighing paper. Record the exact mass used in your data table. **CAUTION:** *Avoid inhaling magnesium oxide dust.*
7. Start data collection. Monitor temperature (in °C) on the screen. It may take several seconds for the Temperature Probe to equilibrate at the temperature of the solution. After three or four readings at the same temperature have been obtained, add the white magnesium oxide powder to the solution. Use a stirring rod to stir the cup contents until a maximum temperature has been reached and the temperature starts to drop.
8. Data collection will stop after 8 minutes (or stop *before* 8 minutes have elapsed).
9. Examine the data points along the curve on the displayed graph. As you tap each data point, the temperature and time values are displayed to the right of the graph.
10. Discard the solution as directed by your teacher.

Reaction 2

11. Repeat Steps 5–10 using about 0.50 g (37cm) of magnesium ribbon rather than magnesium oxide powder. **CAUTION:** *Do not breathe the vapors produced in the reaction!*

CONSTANTS

1. The following assumptions will be made as you calculate:

a. The density of the HCl solution is really close to the density of water, thus, the density of the solution will be assumed to be 1.00g/mL

b. The reactions will take presumably take place at constant pressure and, thus, $q=\Delta H$.

c. Look up the heat of formation of water from your textbook and use this in your calculation.