

Partner's Name: \_\_\_\_\_

Section: \_\_\_\_\_

Date: \_\_\_\_\_

## ENTHALPIES OF REACTION

### POST-LAB QUESTIONS

1. What is the largest source of error in the experiment?
2. The heat of solution with calcium chloride is endothermic. What will happen to the temperature of the container/flask when calcium chloride is added to water in the container/flask? What is the sign of the enthalpy?
3. The heat of solution with copper (II) sulfate is exothermic. What will happen to the temperature of the container/flask when copper (II) sulfate is added to water in the container/flask? What is the sign of the enthalpy?

4. In Fall 2011, General Chemistry I students found that the average molar heat of neutralization from hydrochloric acid and sodium hydroxide was  $-70.9 \text{ kJ/mol}$ . The accepted value for this reaction is  $-57.3 \text{ kJ/mol}$ . Determine the percent error in the students' values.

5. The molar heat of neutralization from hydrochloric acid and sodium hydroxide is  $-57.3 \text{ kJ/mol}$ . Use this accepted value to predict the heat evolved during the neutralization of 655 mL of 1.00 M hydrochloric acid by 1.00 M sodium hydroxide.

6. A 12.99 g sample of copper that is at  $7.9^\circ\text{C}$  is added to 1.00 g of hot water initially at  $93.2^\circ\text{C}$ .

- From the first law of thermodynamics, what is the equation relating the sum of the heats of the two components?
- Algebraically substitute in symbols for the specific heat capacities for the copper and water ( $C_s, C_u$  and  $C_s, H_2O$ ), the symbols for masses ( $m_{Cu}$  and  $m_{H_2O}$ ), and the symbols for the temperature change ( $T_f, T_i, Cu$ , and  $T_{i, H_2O}$ ).
- Solve the algebraic problem in (b) for  $T_f$ , the final temperature of water.
- Substitute in the values to determine the final temperature of the metal in water.  
*Hint: it's the same for both water and copper.*

7. A 4.82 g sample of iron is heated to 84.3 °C. A 1.25 g sample of gold is heated to 95.1 °C. Both of these metals are added to 9.47 g of cold water that is initially at 14.5 °C.

- From the first law of thermodynamics, what is the equation relating the sum of the heats of the two components?
- Algebraically substitute in the specific heat capacities for the metals and water, the masses of the samples, and the temperature change. (See problem 7.)
- Solve the algebraic problem in (b) for  $T_p$ , the final temperature of water.
- Determine the final temperature of the metals in water. *Hint: it's the same for all three components.*

8. If the temperature of a sample of water requires 3.2 kJ of heat to raise the temperature from 26.1°C to 35.2°C, how much water was in the sample?

9. If a 85.0°C iron rod that weighs 1.20 kg was placed in 15.2 L of water at 20.0°C, what is the temperature of the mixture? (specific heat of iron = 0.450 J/gK and density of water at 20.0°C = 0.998234 g/mL)