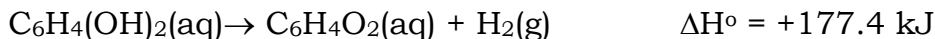


CHEM-1105**THERMOCHEMISTRY**

1. A 46.2 g sample of copper is heated to 95.4°C and then placed in a calorimeter containing 75.0 g water at 19.6°C. The final temperature of the metal and water is 21.8°C. Calculate the specific heat of copper, assuming that all the heat lost by the copper is gained by water.
(0.203J/g °C)
2. In a coffee-cup calorimeter, 100.0 mL of 1.0 M NaOH and 100.0 mL of 1.0 M HCl are mixed. Both solutions were originally at 24.6°C. After the reaction, the final temperature is 31.3°C. Assuming that all the solutions have a density of 1.0g/mL and a specific heat of 4.184 J/g°C, calculate the enthalpy change for the neutralization of HCl by NaOH.
(-56.1kJ/mol)
3. Consider the reaction
$$2 \text{HCl(aq)} + \text{Ba(OH)}_2\text{(aq)} \rightarrow \text{BaCl}_2\text{(aq)} + 2\text{H}_2\text{O(l)} \quad \Delta H = -118\text{kJ}$$
Calculate the heat when 100.0 mL of 0.500 M HCl is mixed with 300.0 mL of 0.500 M Ba(OH)₂. Calculate the final temperature of the mixture assuming that the initial temperature was 25.0°C. **(26.76°C)**

4. The bombardier beetle uses an explosive discharge as a defensive measure. The chemical reaction involved is the oxidation of hydroquinone by hydrogen peroxide to produce quinone and water.
$$\text{C}_6\text{H}_4(\text{OH})_2\text{(aq)} + \text{H}_2\text{O}_2\text{(aq)} \rightarrow \text{C}_6\text{H}_4\text{O}_2\text{(aq)} + 2 \text{H}_2\text{O(l)}$$

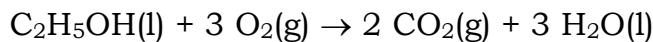
Calculate ΔH° for the reaction from the following data: **(-203 kJ)**



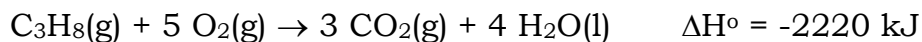
5. A 0.1964 g sample of quinone, C₆H₄O₂, is burned in a bomb calorimeter that has a heat capacity of 1.56 kJ/°C. The temperature of the calorimeter increases by 3.2°C. Calculate the energy of combustion of quinone per mole. **(-2745kJ/mol)**

6. Use ΔH°_f data to

a) calculate the enthalpy change for the reaction: **(-1367kJ)**



b) calculate ΔH°_f of $\text{C}_3\text{H}_8(\text{g})$ and the following information: **(104kJ)**



7. Write a balanced thermochemical equation depicting the formation of the following substances.

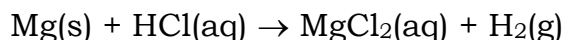
a) $\text{CH}_3\text{OH}(\text{l})$ b) $\text{NH}_4\text{NO}_3(\text{s})$

For the following problems assume that specific heat and density of the solution is same as that for water.

8. When a 4.25 g $\text{NH}_4\text{NO}_3(\text{s})$ dissolves in 60.0 mL of water in a coffee-cup calorimeter, the temperature drops from 22.0°C to 16.9°C. Calculate ΔH for **(+25.8kJ/mol)**



9. Suppose you place 0.500 g of Mg in a coffee-cup calorimeter and then add 100.0 mL of 1.00 M HCl. That reaction occurs



Calculate ΔH if the temperature of the solution changes from 22.2°C to 44.8°C. **(-462kJ/mol)**

10. 50.0 mL of 1.00 M HCl is mixed with 50.0 mL of 1.00 M NaOH. The temperature of the solution changes from 21.0°C to 27.5°C. Calculate ΔH . **(-54.4 kJ/mol)**

