

## Calorimetry and Molar Enthalpy

1. 9.0 grams of charcoal (C) were completely consumed in a bomb calorimeter. If we assume that the 2.0 L of water in the calorimeter absorbed all of the heat released by the charcoal, and if the temperature of the water increased from 20.25 to 56.04°C, what is the **molar enthalpy** of carbon?
2. CS<sub>2</sub>, a very flammable liquid, has a molar enthalpy of -1028 kJ/mole. What do you expect aluminum's final temperature to be if 1.0 kg of Al is initially at 20.0 C, and it absorbs all the heat from the following sample of CS<sub>2</sub>:  
mass of CS<sub>2</sub> before burning: 22.6 g  
mass of CS<sub>2</sub> after burning: 11.6 g  
specific heat capacity of Al: 0.900 J/[g C]
3. 300 mL of 0.2 M aqueous KOH neutralizes 150 mL of aqueous 0.2 M H<sub>2</sub>SO<sub>4</sub>. We go from an average initial temperature of 22.3 °C to a maximum of 29.2 C. Calculate the molar heat(enthalpy) of neutralization of KOH.



4. Find the final temperature of the following mixture:

400. g of Cu initially at 99.0 °C  
25 L of water initially at 10.0 °C  
c for Cu = 0.39 J/[g C]

5. A student mixed 100.0 ml of 1.50 **mol/l** sulfuric acid with 200.0 ml of 1.50 mol/l sodium hydroxide. Both solutions were at 19.67 C initially and the highest temperature reached by the reaction mixture was 34.06 C. Calculate the molar enthalpy of sulfuric acid.

6. Calculate the molar enthalpy for the solidification of gallium metal (Ga) if 10.0 g of gallium causes 50 ml of water to change temperature from 24.0 to 27.8 C when it solidifies.
  
7. The molar enthalpy of methane ( $H_f = 803 \text{ KJ/mol}$ ). What is the minimum mass of methane that must be burned to warm 4.00 L of water from 22.4 to 87.6 C, assuming no heat losses? (Assume that 1L of water = 1Kg).
  
8. Find the temperature increase expected for 1.00 L of water when it absorbs all of the energy from the combustion of 1.00 g of acetylene,  $\text{C}_2\text{H}_2$  (g). The molar enthalpy of combustion for acetylene is 1,290 KJ/mol.
  
9. In a chemistry experiment 10 g of urea  $\text{NH}_2\text{COHN}_2$  is added to 150 ml of water in a simple coffee cup calorimeter. A temperature decrease of 3.7 C is noticed. Calculate the molar enthalpy of urea.
  
10. A laboratory technician initially adds 43.1 ml of concentrated 11.6 mol/l hydrochloric acid to water to form a 500 ml solution. The temperature of the solution rises 2.6 C. Calculate the molar enthalpy of solution of HCl.