Calorimetry Practice Worksheet

1) Compound A is burned in a bomb calorimeter that contains 2.50 liters of water. If the combustion of 0.175 moles of this compound causes the temperature of the water to rise 45.0^0 C, what is the molar heat of combustion of compound A? The heat capacity of water is 4.184 J / g^0C.

2) Compound B is burned in a bomb calorimeter that contains 1.50 liters of water. When I burned 50.0 grams of compound B in the calorimeter, the temperature rise of the water in the calorimeter was 35.0^0 C. If the heat of combustion of compound B is 2,150 kJ/mol, what is the molar mass of compound B?

3) The molar heat of combustion of compound C is 1,250 kJ/mol. If I were to burn 0.115 moles of this compound in a bomb calorimeter with a reservoir that holds 2.50 L of water, what would the expected temperature increase be?

Calorimetry Practice Worksheet

1) Compound A is burned in a bomb calorimeter that contains 2.50 liters of water. If the combustion of 0.175 moles of this compound causes the temperature of the water to rise 45.0^0 C, what is the molar heat of combustion of compound A?

$$\Delta H = mC_p\Delta T$$
$$\Delta H = (2.50 \times 10^3 \text{ g } H_2O)(4.184 \text{ J/g}^0\text{C})(45.0^0 \text{ C})$$
$$\Delta H = 471{,}000 \text{ J}$$

Because 471 kJ of energy are given of when 0.175 moles of compound A burn, we can divide 471 kJ/0.175 mol to find that the molar heat of combustion of compound A is 2.70 x 10^3 kJ/mol.

2) Compound B is burned in a bomb calorimeter that contains 1.50 liters of water. When I burned 50.0 grams of compound B in the calorimeter, the temperature rise of the water in the calorimeter was 35.0^0 C. If the heat of combustion of compound B is 2,150 kJ/mol, what is the molar mass of compound B?

$$\Delta H = mC_p\Delta T$$
$$\Delta H = (1.50 \times 10^3 \text{ g } H_2O)(4.184 \text{ J/g}^0\text{C})(35.0^0 \text{ C})$$
$$\Delta H = 2.20 \times 10^5 \text{ J}$$

Because the molar heat of combustion of this compound is 2,150,000 J, we can determine the number of moles of compound that were burned by dividing the amount of heat generated in the calorimeter by the molar heat of combustion. (2.20 x 10^5 J / 2.15 x 10^6 J/mol) = 0.102 mol.

If 0.102 mol of compound B weighs 55.0 grams, the molar mass of compound B is 55.0 grams/0.102 mol = 539 g/mol.

3) The molar heat of combustion of compound C is 1,250 kJ/mol. If I were to burn 0.115 moles of this compound in a bomb calorimeter with a reservoir that holds 2.50 L of water, what would the expected temperature increase be?

Because 0.115 moles of the compound are burned, we would expect the amount of heat given off to be equal to 0.115 mol x 1,250 kJ/mol = 144 kJ. Putting this into our equation:

$$\Delta H = mC_p\Delta T$$
$$144{,}000 \text{ J} = (2.50 \times 10^3 \text{ g } H_2O)(4.184 \text{ J/g}^0\text{C})(x)$$
$$x = 13.8^0 \text{ C}$$

