Calorimetry Worksheet

1) If I burn 0.315 moles of hexane (C_6H_{14}) in a bomb calorimeter containing 5.65 liters of water, what's the molar heat of combustion of hexane is the water temperature rises 55.4^0 C? The heat capacity of water is 4.184 J/g^0C.

2) If I burn 22.0 grams of propane (C_3H_8) in a bomb calorimeter containing 3.25 liters of water, what's the molar heat of combustion of propane if the water temperature rises 29.5^0 C?

3) As it turns out, the data from the two experiments described above would not give the correct molar heats of combustion for the compounds stated. Explain why this is, based on your knowledge of how bomb calorimetry works.

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$$\Delta H = mC_p\Delta T$$
$$\Delta H = (5{,}650 \text{ grams } H_2O)(4.184 \text{ J/g}^0\text{C})(55.4^0 \text{ C})$$
$$\Delta H = 1310 \text{ kJ}$$

Now, remember, this is the amount of energy generated when 0.315 moles of hexane is burned. To find the molar heat of combustion, we need to multiply this by (1 mole/0.315 moles) = 3.17. As a result, the molar heat of combustion of hexane is *4150 kJ/mol*.

2) If I burn 22.0 grams of propane (C_3H_8) in a bomb calorimeter containing 3.25 liters of water, what's the molar heat of combustion of propane if the water temperature rises 88.5^0 C?

$$\Delta H = mC_p\Delta T$$
$$\Delta H = (3250 \text{ grams } H_2O)(4.184 \text{ J/g}^0\text{C})(88.5^0 \text{ C})$$
$$\Delta H = 1.20 \times 10^3 \text{ kJ}$$

Because 22.0 grams of propane corresponds to 0.500 moles, the molar heat of combustion of propane is twice the number we computed above, or *2.40×10^3 kJ/mol*.

3) As it turns out, the data from the two experiments described above would not give the correct molar heats of combustion for the compounds stated. Explain why this is, based on your knowledge of how bomb calorimetry works.

The experimental data ignores the mass and heat capacity of the bomb itself. Because the bomb has a finite mass and heat capacity, one would have to determine the amount of energy absorbed by the bomb to truly determine the amount of heat given off in each combustion.