Chemistry II

Worksheet 3-1 Name_____

Energy & Enthalpy

Show your work for every calculation. Round your answer to the correct number of significant figures and record your final answer with correct units on the line provided.

1. a. What is heat?

   b. Under what conditions is heat transferred from one object to another?

2. Calculate ΔE (change in internal energy) in kilojoules and determine if the process is endothermic or exothermic for each case below.
   a. A system absorbs 85 kJ of heat from its surroundings while doing 29 kJ of work on the surroundings. ΔE = _____ endo/exo?_____

   b. q = 1.50 kJ and w = -657 kJ ΔE = _____ endo/exo?_____

   c. The system releases 57.5 kJ of heat while doing 13.5 kJ of work on the surroundings. ΔE = _____ endo/exo?_____

   d. A balloon is heated by adding 900 J of heat. It expands, doing 422 J of work on the atmosphere. ΔE = _____ endo/exo?_____

   e. A chemical reaction releases 8.65 kJ of heat and does no work on the surroundings. ΔE = _____ endo/exo?_____

3. a. Under what conditions will the enthalpy change of a process equal the amount of heat transferred into or out of the system?

   b. During a constant-pressure process the system absorbs heat from the surroundings. Does the enthalpy of the system increase or decrease during the process?_____

4. A gas is confined to a cylinder under constant atmospheric pressure (See Figure 5.3 on p.170). When 418 J of heat is added to the gas, it expands and does 107 J of work on the surroundings. What are the values for ΔH and ΔE for this process?

   ΔH = _____ ΔE = _____

5. Two solid objects, A and B, have the same mass and are placed in boiling water and allowed to come to temperature there. Each is then lifted out and placed in separate beakers containing 1000 g of water at 10.0°C. Object A increases the water temperature by 3.50°C; B increases the water temperature by 2.60°C. Which object has the larger heat capacity? Explain your choice.

6. a. Which substance in Table 5.2 (p.184) requires the smallest amount of energy to increase the temperature of 50.0 g of that substance by 10 K? _____

   b. Calculate the energy needed for this temperature change. _____

7. The specific heat of ethylene glycol is 2.42 J/g°C. How many J of heat are needed to raise the temperature of 62.0 g of ethylene glycol from 15.2°C to 40.8°C? _____

8. A 15.0 g sample of nickel metal is heated to 100.0°C and dropped into 55.0 g of water, initially at 23°C. Assuming that all the heat lost by the nickel is absorbed by the water, calculate the final temperature of the nickel and water. The specific heat of nickel is 0.444 J/g°C.

   _____

9. a. When a 3.88 g sample of solid ammonium nitrate dissolves in 60.0 g of water in a calorimeter, the temperature drops from 23.0°C to 18.4°C. Calculate ΔH (in kJ/mol NH_4NO_3) for the solution process. Assume that the specific heat of the solution is the same as that of pure water and the solution volume is equivalent to the solvent volume.

   $NH_4NO_3(s) \rightarrow NH_4^+(aq) + NO_3^-(aq)$ _____

   b. Is this process endothermic or exothermic? _____