Chapter 10 Study Questions

1. For a reaction where $\Delta H = -20$ kJ,
   a) Draw an energy diagram.
   b) Is this reaction endothermic or exothermic?
   c) In this reaction, which has greater heat content (enthalpy), reactants or products?
   d) Is heat released or used up?

2. Classify each of the following processes as endothermic or exothermic.
   a) combustion of natural gas
   b) condensation of water vapor
   c) splitting of carbon dioxide into carbon and oxygen
   d) solidification of melted wax
   e) formation of sodium chloride (NaCl) from it elements
   f) evaporation of alcohol

3. Napthalene, $C_{10}H_8$, is often the active ingredient in mothballs. ΔH for the complete combustion of 1.00 mole of napthalene is -5159 kJ.
   a) Write a balanced *thermochemical* equation for the complete combustion of napthalene.
   b) Is this reaction endothermic or exothermic?
   c) How many moles of carbon dioxide are produced when 258 kJ are given off?
   d) How much heat is produced during the combustion of 1.86 g of napthalene?

4. Use Hess' Law and the following equations:
$$Pb(s) + \tfrac{1}{2} O_2(g) \rightarrow PbO(s) \qquad \Delta H = -217.9 \text{ kJ}$$
$$3 Pb(s) + 2 O_2(g) \rightarrow Pb_3O_4(s) \qquad \Delta H = -734.7 \text{ kJ}$$
   to calculate ΔH for the following reaction, and indicate whether it is endothermic or exothermic: $6 PbO(s) + O_2(g) \rightarrow 2 Pb_3O_4(s)$.

5. A 48.0 gram sample of lead absorbs 392 joules when it is heated from 25.0°C to 90.0°C. What is the specific heat of lead?

6. A styrofoam cup "calorimeter" is used to calculate the heat change when 5.03 g of NH_4Cl are dissolved in 60.0 g water. The initial temperature of the water in the cup is 24.78°C. After the NH_4Cl is added, the temperature in the cup is 19.23°C.
   a) What is the temperature change of the water?
   b) Is this process endothermic or exothermic?
   c) Calculate the heat change *in Joules* when the NH_4Cl is dissolved in the water. (Assume that the heat change for the solution is the same as that of water alone and that you can ignore the mass of solid in the water. So use only the mass of water and the specific heat of water, 4.18 J/g °C, in calculating the heat change.)
   d) Calculate the number of moles of NH_4Cl dissolved.
   e) Calculate the heat change per mole of NH_4Cl in kJ/mol.

Summary of Chapter 10: Energy

Potential and Kinetic Energy
Law of conservation of energy
1st and 2nd Laws of Thermodynamics
State functions
Temperature
endothermic, exothermic
heat content diagrams
specific heat
calorimetry: calculation of heat change from temperature change

$$Q = s \times m \times \Delta T$$

Heat content = enthalpy
change in heat content (ΔH)
thermochemical equations
ΔH/mole conversions
Hess' Law
Fossil fuels
        Petroleum, Natural Gas, Coal
Greenhouse effect
Entropy