Chapter 5   Thermochemistry   Extra Credit   Name: _____

1. Label the following reactions/processes as endothermic or exothermic:

(A) Ice melts at 0 °C.   _____

(B) When an ionic solid is added to water, the temperature of the water decreases.   _____

(C) Gasoline is burned in a car engine.   _____

(D) When HNO_3 (aq) reacts with NaOH (aq), the temperature of the resulting solution increases. _____

2. Carry out the following conversions:

(A) 145 J to cal

(B) 210 kcal to J

(C) 95 Cal to kJ

3. A system does 175 J of work and loses 45 J of heat. What is the change in internal energy of this system?

4. How much heat, in joules and in calories, must be added to a 275.0 g iron block with a specific heat of 0.449 J/g °C to increase its temperature from 100. °C to its melting temperature of 1535 °C?

5. How much would the temperature of 275 g of water increase if 36.5 kJ of heat were added?

6. A piece of unknown substance weighs 44.7 g and requires 2110 J to increase its temperature from 23.2 °C to 89.6 °C.

   (A) What is the specific heat of the substance?

   (B) If it is one of the substances found in the table of specific heats in Chapter 5, what is the identity of the substance.

7. How many grams of water can be heated form 20.0 °C to 45.0 °C by the heat released from 215.0 g of Iron that cools from 95.0 °C to 25.0 °C? The specific heat of Iron is 0.45 J/g°C.

8. How many milliliters of water at 23 °C with a density of 1.00 g/mL must be mixed with 180 mL (about 6 oz) of coffee at 95 °C so that the resulting combination will have a temperature of 60 °C? Assume that coffee and water have the same density and the same specific heat.

9. Dissolving 3.0 g of $CaCl_2(s)$ in 150.0 g of water in a calorimeter (Figure) at 22.4 °C causes the temperature to rise to 25.8 °C. What is the approximate amount of heat involved in the dissolution, assuming the heat capacity of the resulting solution is 4.18 J/g °C? Is the reaction exothermic or endothermic?

10. When 1.0 g of fructose, $C_6H_{12}O_6(s)$, a sugar commonly found in fruits, is burned in oxygen in a bomb calorimeter, the temperature of the calorimeter increases by 1.58 °C. If the heat capacity of the calorimeter and its contents is 9.90 kJ/°C, what is q for this combustion? What is ΔH for the reaction in kJ/mole?

11. Consider the reaction

$N_2 + 3H_2 \rightarrow 2NH_3$ $\Delta H^0_{rxn} = -92$ kJ

How many kilojoules are released when 50.0 g of NH_3 are formed?

12. Calculate $\Delta H°$ for the process $Zn(s) + S(s) + 2O_2(g) \rightarrow ZnSO_4(s)$

from the following information:

$Zn(s)+S(s)\rightarrow ZnS(s)$ $\Delta H°=-206.0kJ$

$ZnS(s)+2O_2(g)\rightarrow ZnSO_4(s)$ $\Delta H°=-776.8kJ$

13. Calculate ΔH for the process $Hg_2Cl_2(s)\rightarrow 2Hg(l)+Cl_2(g)$

from the following information:

$Hg(l)+Cl_2(g)\rightarrow HgCl_2(s)$ $\Delta H=-224kJ$
$Hg(l)+HgCl_2(s)\rightarrow Hg_2Cl_2(s)$ $\Delta H=-41.2kJ$
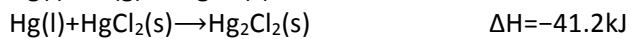
14. Using the data in the appendix of text, calculate the standard enthalpy change for each of the following reactions:

(A) $Si(s) + 2F_2(g) \longrightarrow SiF_4(g)$

(B) $2C(s) + 2H_2(g) + O_2(g) \longrightarrow CH_3CO_2H(l)$

(C) $CH_4(g) + N_2(g) \longrightarrow HCN(g) + NH_3(g)$

(D) $CS_2(g) + 3Cl_2(g) \longrightarrow CCl_4(g) + S_2Cl_2(g)$