Thermochemistry-Calorimetry and Heat of Reaction/SS Name:____ _____

For complete credit show all the work for the calculations and give the answers in the correct significant figures.

Specific heat of water = 4.184 J/g^{o}C; density of water 1 g/mL

1) Calculate the heat capacity of a sample of radiator coolant if the temperature rises from 5 to 107 ^{o}C requires 932 J. (Ans: 9.14 J/^{o}C)

2) How much heat in KJ is released when the temperature of
   a) 47.0 g water drops from 45.4 to 10.0 ^{o}C? (Ans: -6.96 KJ)

   b) 209 g iron drops from 400.0 to 22.6 ^{o}C? (sp.heat iron = 0.449 J/g^{o}C) (Ans: -35.4 KJ)

3) To bring 36.2 g of sulfur from 25.0 ^{o}C to its melting point the sulfur must absorb 2402 J of heat. What is the melting point of sulfur? (sp heat of sulfur = 0.705 J/g^{o}C)) (Ans: 119.0 ^{o}C)

4) A 65.0 mL of 0.600 M HI at 18.46 ^{o}C is mixed with 84.0 mL of a solution containing excess of KOH at 18.46 ^{o}C in a foam cup calorimeter. The temperature rises to 21.96 ^{o}C. Calculate the ΔH (enthalpy) of the reaction. (Ans: -55.9 KJ/mol)

(***Strategy***: a) write the balanced equation (for mol ratio); b) calc heat absorbed by cal (use sp heat equation); c) heat absorbed by cal is heat given off during reaction (which is the reverse of answer of *b, i.e. change the sign*); d) calc mol of HI (it is already the limiting reagent); e) use q value from *c* to find ΔH (ΔH is q/mol))

5) Use the equations given to calculate the enthalpy change for the equation given below.

N_2H_4 (g) + $2H_2O_2$ (l) $\longrightarrow$ N_2 (g) + $4H_2O$ (l) ΔH = ? (Ans: -818.2KJ)

Given:

a) N_2H_4 (g) + O_2 (g) $\longrightarrow$ N_2 (g)+ $2H_2O$ (l) ΔH = -622.2 KJ

b) H_2 (g) + ½ O_2 (g) $\longrightarrow$ H_2O (l) ΔH = -285.8 KJ

c) H_2 (g) + O_2 (g) $\longrightarrow$ H_2O_2 (l) ΔH = -187.8 KJ

6) Use the equations given to calculate the enthalpy change for the equation given below.

$BrCl\ (g) \longrightarrow Br\ (g) + Cl\ (g)$ $\quad \Delta H = ?$ (Ans: 219 KJ)

Given:

a) $Br_2\ (l) \longrightarrow Br_2\ (g)$ $\quad \Delta H = +30.91$ KJ

b) $Br_2\ (g) \longrightarrow 2Br\ (g)$ $\quad \Delta H = +192.9$ KJ

c) $Cl_2\ (g) \longrightarrow 2Cl\ (g)$ $\quad \Delta H = +243.4$ KJ

d) $Br_2\ (l) + Cl_2\ (g) \longrightarrow 2BrCl\ (g)$ $\quad \Delta H = +29.2$ KJ

7) Use the standard enthalpies of formation from the Appendix to calculate the standard enthalpy change for the following reactions.
(ΔH_f^o in KJ/mol: $NH_4HCO_3 = -849.4$, $NH_3 = -46.11$, $H_2O = -285.8$; $CO_2 = 393.5$, $Fe_2O_3 = -824.2$, $SiO_2 = -910.9$)

a) $NH_4HCO_3(s) \longrightarrow NH_3(g) + H_2O(g) + CO_2\ (g)$ (Ans: +910.0 KJ)

b) $3Si\ (s) + 2Fe_2O_3 \longrightarrow 3SiO_2\ (s) + 4Fe(s)$ (Ans: -1084.3 KJ)