CHEM 1035 Homework #7

6.18 This reaction is exothermic, the sign on q is (-) negative because heat is removed from the system and goes to the surroundings.

6.29 Ethanol should have greater heat of combustion per mole because it has more bonds (one additional C-C, and 2 additional C-H bonds)

6.36 q = (c)(mass)ΔT = $\left(\frac{2.087\,J}{g \bullet K}\right)(0.10g)(-75-10) = -17.74J$

6.38 q = -688J, mass = 27.7g, c = 2.42 J/g-K

$$-688J = (2.42\frac{J}{g \cdot K})(27.7g)(32.5 - T_i)$$

$$T_i = 42.7^{\circ}C$$

6.44 $q_{alloy} = -q_{calorimeter}$

$$c_{alloy}(30.5g)(31.1-93.0) = -1\left[(4.184\frac{J}{g \cdot K})(50.0)(31.1-22) + (9.2\frac{J}{K})(31.1-22)\right]$$

$$-1888c_{alloy} = -1987$$

$$c_{alloy} = 1.05\frac{J}{g \cdot K}$$

6.46 $q_{hydrocarbon} = -q_{calorimeter}$

$$q_{hydrocarbon} = -1\left[(4.184\frac{J}{g \cdot K})(2.5L \times \frac{1000gH_2O}{L})(23.55-20.00) + (403\frac{J}{K})(23.55-20.00)\right]$$

$$q_{hdroocarbon} = -38530J = -38.53kJ$$

$$q_{hydrocarbon}/gm = -38.53kJ/1.500g = -25.71kJ/gm$$

6.56 a. $$100.gmFe \times \frac{1moleFe}{55.85gm} \times \frac{-1.65\times10^{3}kJ}{4moleFe} = -739kJ$$

b. $$-4.93\times10^{3}kJ \times \frac{2moleFe_2O_3}{-1.65\times10^{3}kJ} \times \frac{159.7gmFe_2O_3}{1moleFe_2O_3} = 954gm$$

6.59 a. $C_{12}H_{22}O_{11} + 12O_2 \rightarrow 12CO_{2,(g)} + 11H_2O_{(g)}$ $\Delta H_{rxn} = -5.64x10^3$ kJ

b. $$1.0gmC_{12}H_{22}O_{11} \times \frac{1moleC_{12}H_{22}O_{11}}{342.30gm} \times \frac{-5.64\times10^{3}kJ}{1moleC_{12}H_{22}O_{11}} = -16.48kJ$$

6.64 ½ $N_{2,(g)}$ + ½ $O_{2,(g)} \rightarrow NO_{(g)}$ $\Delta H = -90.3$ kJ
$NO_{(g)}$ + ½ $Cl_{2,(g)} \rightarrow NOCl$ $\Delta H = -38.6$ kJ

2($NOCl \rightarrow NO_{(g)}$ + ½ $Cl_{2,(g)}$ $\Delta H = 38.6$ kJ)
2($NO_{(g)} \rightarrow$ ½ $N_{2,(g)}$ + ½ $O_{2,(g)}$ $\Delta H = -90.3$ kJ)

$2NO_{(g)} \rightarrow N_{2,(g)} + O_{2,(g)} + Cl_{2,(g)}$ $\Delta H = 2(38.6) + 2(-90.3) = -103.4$ kJ

6.68 $P_{4,(s)} + 6Cl_{2,(g)} \rightarrow 4PCl_{3,(g)}$ $\Delta H = -1148$ kJ
$4PCL_{3,(g)} + 4Cl_{2,(g)} \rightarrow 4PCl_{5,(g)}$ $\Delta H = -460$ kJ

$P_{4,(s)} + 10Cl_{2,(g)} \rightarrow 4PCl_{5,(g)}$ $\Delta H = -1608$ kJ

6.76 a. $SiO_{2,(s)} + 4HF_{(g)} \rightarrow SiF_{4,(g)} + 2H_2O_{(l)}$

$$\Delta H^{o}_{rxn} = \sum \Delta H^{o}_{f}(prod) - \sum \Delta H^{o}_{f}(react)$$

ΔH_{rxn}^{o} = {[(-1614.9kJ)+2(-285.84kJ)]-[(-910.9kJ)+4(-273kJ)]}
= -2186.6-(-2002.9)
ΔH_{rxn}^{o} = -183.7 kJ

b. $2C_2H_{6,(g)} + 7O_{2,(g)} \rightarrow 4CO_{2,(g)} + 6H_2O_{(g)}$

ΔH_{rxn}^{o} = {[4(-393.5kJ)+6(-241.83kJ)]-[2(-84.67kJ)+7(0)]}
= -3025-(-169.34)
ΔH_{rxn}^{o} = -2856 kJ

6.78 $C_2H_{2,(g)} + 5/2\ O_{2,(g)} \rightarrow 2CO_{2,(g)} + H_2O_{(g)}$ $\Delta H_{rxn}^{o} = -1255.8$ kJ

$-1255.8kJ = \{[2(-393.5kJ)+(-241.83kJ)]-[(5/2)(0) + \Delta H_f^{o}(C_2H_2)]\}$
$-1255.8kJ = -1028.8 - \Delta H_f^{o}(C_2H_2)$
$\Delta H_f^{o}(C_2H_2) = -226.97$ kJ