Name _____ Block ___

Thermochemistry Worksheet

Specific Heat Capacity Equation: $q = m \cdot Cp \cdot \Delta T$

Heat transferred or absorbed = mass X specific heat X (T_{final} - $T_{initial}$)

1) Calculate the amount of energy required to raise the temperature of 145 grams of water from 22.3˚C to 75˚C. $(Specific\ Heat\ of\ Water\ =\ 4.184\ J/\ g{\cdot}^{\circ}C)$

2) The specific heat capacity of iron is 0.45 J/ g·C. If 47 Joules of energy is required to raise the temperature of a sample of iron from 25˚C to 90˚C, what is the mass of the sample?

3) A 35.2 gram sample requires 1251 Joules of energy to heat the sample by 25˚C. What is the specific heat capacity of the sample?

Name _____ Block ___

Enthalpy, Entropy, and Gibb's Free Energy Problems:

1.) Calculate the Enthalpy (ΔH) required to react ammonia with oxygen to form nitric oxide gas and water based on the reaction below. Use the values on the chart to calculate **ΔH = Products – Reactants**. Is the reaction exothermic or endothermic?

$$4\,NH_3\,(g) + 5\,O_2(g) \leftrightharpoons 4\,NO(g) + 6\,H_2O\,(g)$$

2.) Calculate the Entropy (ΔS) change for the reaction in Problem #1. Use the values on the chart to calculate **ΔS = Products – Reactants**.

$$4\,NH_3\,(g) + 5\,O_2(g) \leftrightharpoons 4\,NO(g) + 6\,H_2O\,(g)$$

3.) Which of the following processes will lead to an increase in the entropy of the system?

a.) $N_2(g) + 3H_2\,(g) \rightleftharpoons 2\,NH_3(g)$
b.) $H_2O(l) \rightleftharpoons H_2O(g)$
c.) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
d.) $NH_4NO_3(s) + H_2O(l) \rightarrow NH_4^+\,(aq) + NO_3^-\,(aq)$

4.) Use the Gibb's Free Energy equation **ΔG = ΔH - TΔS** to determine if the reaction in Problem #1 will be spontaneous at STP. **(NOTE: Gibb's Free Energy requires units to be in kilojoules!)**

5.) Use the Gibb's Free Energy equation **ΔG = ΔH - TΔS** to determine the reaction below will be spontaneous at STP. Assume Enthalpy (ΔH) = 30.91 kJ/mol and Entropy (ΔS) = 93.2 J/mol·K.

$$Br_2\,(l) \rightarrow Br_2\,(g)$$