

# Thermochemistry Worksheet

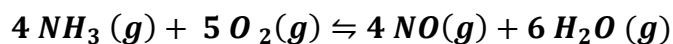
**Specific Heat Capacity Equation:  $q = m \cdot C_p \cdot \Delta T$**

**Heat transferred or absorbed = mass  $\times$  specific heat  $\times$  ( $T_{\text{final}} - T_{\text{initial}}$ )**

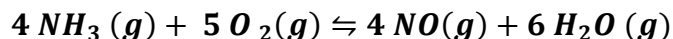
- 1) Calculate the amount of energy required to raise the temperature of 145 grams of water from 22.3°C to 75°C. (*Specific Heat of Water* = 4.184 J/ g°C)
  
  
  
  
  
  
  
  
  
  
- 2) The specific heat capacity of iron is 0.45 J/ g°C. If 47 Joules of energy is required to raise the temperature 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?

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

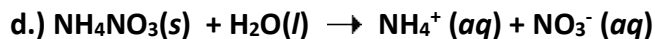
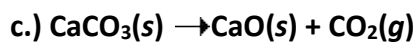
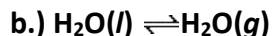
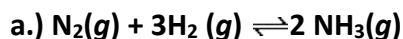
- 1.) Calculate the Enthalpy ( $\Delta H$ ) required to react ammonia with oxygen to form nitric oxide gas and water based on the reaction below. Use the values on the chart to calculate  **$\Delta H = \text{Products} - \text{Reactants}$** . Is the reaction exothermic or endothermic?



- 2.) Calculate the Entropy ( $\Delta S$ ) change for the reaction in Problem #1. Use the values on the chart to calculate  **$\Delta S = \text{Products} - \text{Reactants}$** .



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



- 4.) Use the Gibb's Free Energy equation  **$\Delta G = \Delta H - T\Delta S$**  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  **$\Delta G = \Delta H - T\Delta S$**  to determine the reaction below will be spontaneous at STP. Assume Enthalpy ( $\Delta H$ ) = 30.91 kJ/mol and Entropy ( $\Delta S$ ) = 93.2 J/mol·K.

