**Gibbs Free Energy Practice Problems**

 **Temperature Conversions: K = °C + 273**

** Formula:**

 **1**. Calculate the Gibbs *free energy change* (**ΔG**) for the following chemical reaction:

 **ATP ADP + Pi**

 The reaction occurs at **20 °C**, the *change in enthalpy* (**ΔH**) = **19,070 cal**, and the *change in entropy*

 (**ΔS**) = **90 cal/K.** *Give your answer to the nearest tenth.*

 **2**. Calculate the *Gibbs free energy change* (**ΔG**) for the following chemical reaction:

 **glutamate + NH3 glutamine + H2O**

 The reaction occurs at **22 °C**, the *change in enthalpy* (**ΔH**) = **4103 cal**, and the *change in entropy*

 (**ΔS**) = **2.4 cal/K.** *Give your answer to the nearest tenth.*

**3.** Would either of the reactions above occur **spontaneously**? If so, which one(s) and why?

**4.** Are either of the above reactions **endergonic**? If so, which one(s) and why?

**5.** How does the Gibbs free energy in each of the two reactions change if the temperature were raised to normal body temperature (**98.6 °F = 37.0°C**)? *Give your answers to the nearest tenth.*

**Reaction #1** **Reaction #2**

The reaction occurs at **\_\_\_\_\_ °C**, the *change in enthalpy* The reaction occurs at \_\_\_\_\_ **°C**, the *change in enthalpy*

(**ΔH**) = **19,070 cal**, and the *change in entropy* (**ΔH**) = **4103 cal**, and the *change in entropy*

(**ΔS**) = **90 cal/K.** (**ΔS**) = **2.4 cal/K.**

**6.** Does an increase in reaction temperature make each of these reactions more or less likely to occur spontaneously? Explain your answer.