

Name: _____

Date: _____

Gibbs Free Energy Practice Problems

$$^{\circ}\text{C} = (^{\circ}\text{F} - 32) * 5/9$$

$$^{\circ}\text{F} = ^{\circ}\text{C} * 9/5 + 32$$

$$\text{K} = ^{\circ}\text{C} + 273$$

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



The reaction occurs at 68 $^{\circ}\text{F}$, the change in heat (ΔH) = 19,070 cal, and the change in entropy (ΔS) = 90 cal/K.

68 $^{\circ}\text{F}$ = 293 K, therefore the equation is set up in the following way:

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G = 19,070 \text{ cal} - (293 \text{ K}) (90 \text{ cal/K})$$

$$\Delta G = -7300 \text{ cal} = -7.3 \text{ kcal}$$

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



The reaction occurs at 68 $^{\circ}\text{F}$, the change in heat (ΔH) = 4103 cal, and the change in entropy (ΔS) = 2.4 cal/K.

68 $^{\circ}\text{F}$ = 293 K, therefore the equation is set up in the following way:

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G = 4103 \text{ cal} - 293 \text{ K} (2.4 \text{ cal/K})$$

$$\Delta G = 3399.8 \text{ cal} = 3.4 \text{ kcal}$$

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

The reaction with ATP in #1. The change in Gibbs free energy (ΔG) is negative for exothermic reactions and can only be negative for spontaneous reactions. However, the activation energy required would still cause this reaction to occur slowly.

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

The reaction with glutamate and NH_3 in #2. The change in ΔG (free energy) is positive, meaning free energy is absorbed, making this reaction endergonic.

Energy Practice Problems And Answers

Paul A. Tipler, Gene Mosca



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