Thermodynamics and Electrochemistry

Wake Up: Free Energy

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1. The oxidation of iron is represented in the chemical equation below. Which of the following correctly explains whether or not the reaction is thermodynamically favorable?

$$4\,\mathrm{Fe\,(s)} + 3\,\mathrm{O_2\,(g)} \rightleftharpoons 2\,\mathrm{Fe_2O_3\,(s)} \quad \Delta H^{\circ} = -1650\,\mathrm{kJ\,mol^{-1}}$$

A) There are more particles (including particles in the gas state) in the reactants than in the product, thus $\Delta S < 0$. Because ΔH is large and negative, the reaction will be thermodynamically favorable at low temperatures.

B) There are more particles (including particles in the gas state) in the reactants than in the product, thus $\Delta S < 0$. Because ΔH is large and negative, the reaction will be not be thermodynamically favorable at any temperature.

C) There are more particles (including particles in the gas state) in the reactants than in the product, thus $\Delta S > 0$. Because ΔH is large and negative, the reaction will be thermodynamically favorable at all temperatures.

D) There are more particles (including particles in the gas state) in the reactants than in the product, thus $\Delta S > 0$. Because ΔH is large and negative, the reaction will be not be thermodynamically favorable at any temperature.