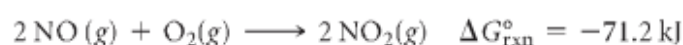


平成 28 年度 反応の化学b 期末試験問題

以下の問に答えよ。問題文は英語でも、解答の文章は日本語で良い。
数値は 3 桁まで求めよ。

問 1. Calculating ΔG_{rxn} under Nonstandard Conditions

Consider the following reaction at 298 K:



Compute ΔG_{rxn} under the following conditions:

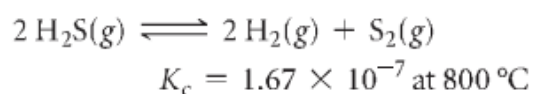
$$P_{\text{NO}} = 0.200 \text{ atm}; P_{\text{O}_2} = 0.400 \text{ atm}; P_{\text{NO}_2} = 8.00 \text{ atm}$$

Is the reaction more or less spontaneous under these conditions than under standard conditions?

気体定数 $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$.

問 2. Finding Equilibrium Concentrations from Initial Concentrations in Cases with a Small Equilibrium Constant

Consider the following reaction for the decomposition of hydrogen disulfide:



A 0.500-L reaction vessel initially contains 0.0125 mol of H_2S at 800 $^{\circ}\text{C}$. Find the equilibrium concentrations of H_2 and S_2 .

注) decomposition ; 分解, sulfide ; 硫化物, vessel 容器

問 3. Using the Two-Point Form of the Arrhenius Equation

The reaction between nitrogen dioxide and carbon monoxide is given by the following equation:

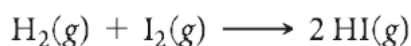


The rate constant at 701 K was measured as $2.57 \text{ M}^{-1} \cdot \text{s}^{-1}$ and that at 895 K was measured as $567 \text{ M}^{-1} \cdot \text{s}^{-1}$. Find the activation energy for the reaction in kJ/mol.

気体定数 $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$

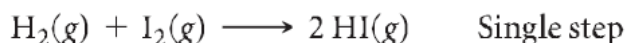
問 4.

Consider the following gas-phase reaction:

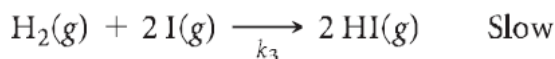
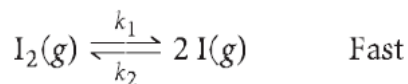


The reaction was experimentally determined to be first order in H_2 and first order in I_2 . Consider the following proposed mechanisms.

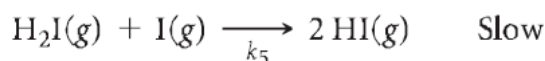
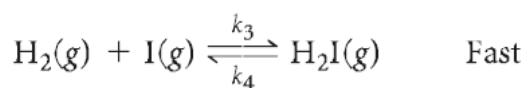
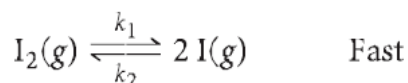
Proposed mechanism I:



Proposed mechanism II:



Proposed mechanism III:



問. Proposed mechanism II, III のいずれにおいても、rate law が
 $\text{Rate} = k[\text{I}_2][\text{H}_2]$

と、Proposed mechanism I と同じになることを示しなさい。