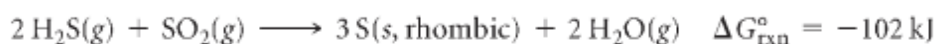


平成 29 年度 反応の化学b 期末試験問題

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.

Consider the following reaction at 298 K:



Compute ΔG_{rxn} under the following conditions:

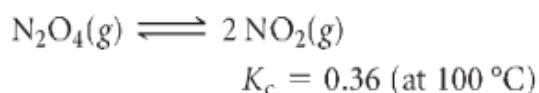
$$P_{\text{H}_2\text{S}} = 2.00 \text{ atm}; P_{\text{SO}_2} = 1.50 \text{ atm}; P_{\text{H}_2\text{O}} = 0.0100 \text{ atm}$$

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 and the
Equilibrium Constant

Consider the following reaction.



A reaction mixture at 100 °C initially contains $[\text{N}_2\text{O}_4] = 0.0250 \text{ M}$. Find the equilibrium concentrations of NO_2 and N_2O_4 at this temperature.

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 $567 \text{ M}^{-1} \cdot \text{s}^{-1}$.

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

- (a) Find the activation energy for the reaction in kJ/mol.
(b) Use the results from (a) and the given rate constant at either of temperatures to predict the rate constant at 525 K.

問 4.

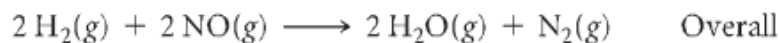
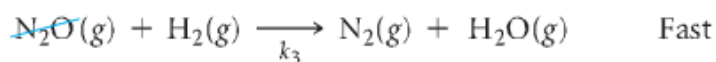
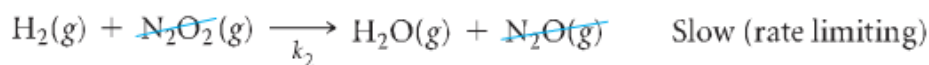
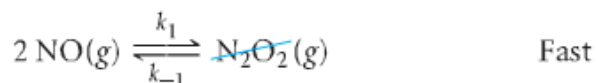
The reaction between hydrogen and nitric oxide is given by the following equation:



The experimentally observed rate law for the reaction is as follows:

$$\text{Rate} = k[\text{H}_2][\text{NO}]^2$$

Show the following mechanism is consistent with the experimentally observed rate law.



問 5.

Calculate the root mean square velocity of gaseous xenon atoms at 25 °C.

気体定数 $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$. Xe の原子量を 131 とする.