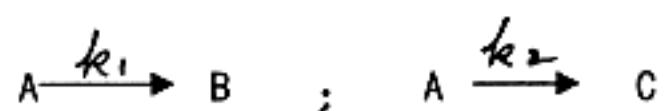1. *(20%)* Please describe: (1) physical adsorption and chemisorption.

    (2) The Langmuir adsorption isotherm.

2. *(20%)* Derive the integrated rate equation for a parallel first reaction, and then have equations for [A], [B], [C] in exponential form. (assume that only A is present initially)

$$A \xrightarrow{k_1} B \quad ; \quad A \xrightarrow{k_2} C$$

3. *(20%)*　(1) State the Arrhenius law.

(2) A second-order reaction in solution has a rate constant (k) of 5.7×10^{-5} dm^3 mol^{-1} s^{-1} at 40°C. Calculate the activation energy (E) and the preexponential factor (A), assuming the Arrhenius law to apply. (R is the gas constant, equal to 8.314 J K^{-1} mol^{-1})

4. *(20%)* Describe or explain the following terms.

(1) van der Waals forces, (2) n-type semiconductor, (3) Boltzmann distribution law, (4) the capacity of buffer solution,

5. *(20%)* An enzymatic reaction is represented as

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftarrows}} ES; \quad ES \xrightarrow{k_2} P + E$$
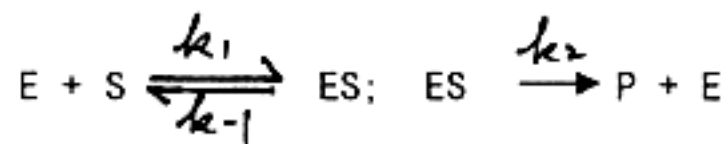
The concentration of enzyme-substrate complex [ES] is assumed to maintain at a constant value throughout the reaction.

Please derive an equation to express the reaction rate.