

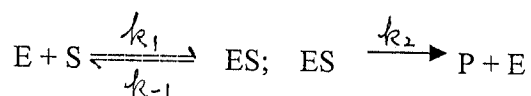
## Physical Chemistry

1. (20%) Please describe the following terms:

- (1) physical adsorption and chemisorption
- (2) Langmuir adsorption isotherm
- (3) Boltzmann distribution law
- (4) van der Waals forces

2. (20%) For a second-order reaction  $A + B \longrightarrow$  products with rate =  $k[A][B]$  and initial concentrations  $[A]_0 = [B]_0 = a$ , calculate the rate coefficient if half of the reactants were reacted in 9 seconds.

3. (20%) An enzymatic reaction is represented as



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.

4. (20%) (1) State the Arrhenius law.

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

5. (20%) Please make a statement to describe what is (a) DNA, (b) DNA chip.