[물리화학2] Homework 3

1. 기질이 하나인 경우에 효소 반응이 단수 Michaelis-Menten 메커니즘을 따른다고 가정하자. 한 온도에서 특정 기질 S와 동위원소가 치환된 S^*에 대한 반응 속도 연구를 하였다.

(1) 우선, S와 S^*에 대해서 별개의 반응속도 실험을 하였다고 가정하자. 기질의 농도가 아주 낮을 경우에 두 속도의 비를 반응속도 매개변수 k_{cat}와 K_M으로 나타내시오. 기질의 농도가 아주 높은 경우도 마찬가지로 나타내시오.

(2) S와 S^*가 같이 존재하는 경쟁 동위원소 효과를 연구한다고 가정하자. 앞의 두 극한에서 속도의 비는 얼마인가?

2. (1) It is found that in chain polymerization, the average chain length is 200 units when the initiator concentration is 0.01M. What should the concentration of the initiator be if the desired chain length is 300 units? Assume all other parameters remain unchained.

(2) Suppose it takes 10 min to achieve a degree of polymerization of 100 units. How long does it take to achieve a degree of polymerization of 200 units in stepwise polymerization?

3. In the photobromination of cinnamic acid, radiation at 435.8 nm with an intensity of 1.4×10^{-3} J.s was 80.1% adsorbed in a liter of solution during an exposure of 1105 s. The concentration of Br_2 decreased by $7,5 \times 10^{-5}$ mol/L during this period.

   (1) What is the intensity of light adsorbed (I_{abs})?
   (2) What is the quantum yield (ϕ)?

4. The following results were obtained for the action of an ATPase on ATP at 20 ℃, when the concentration of the ATPase was 20 nmol dm^{-3}.

[ATP]/(μmol dm^{-3})	0.60	0.80	1.4	2.0	3.0
ν /(μmol $dm^{-3}\,s^{-1}$)	0.81	0.97	1.30	1.47	1.69

   (1) Obtain Lineweaver-Burk Plot.
   (2) Determine the Michaelis constant, the maximum velocity of the reaction, the turnover frequency, and catalytic efficiency of the enzyme.

5. The luminescent decay of a certain molecule yields the following data:

T (sec)	0	1	2	3	4	5	10
I (intensity)	100	43.5	18.9	8.2	3.6	1.6	0.02

Where I is the relative intensity.

   (1) Calculate the mean life time τ for the process.
   (2) Is it fluorescence or phosphorescence? Why?