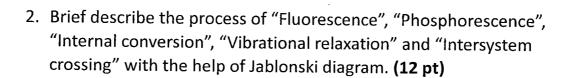
- 1. The Arrhenius equation is expressed by k=Ae^{-Ea/RT}
 - (a) What is the physical meaning of E_a? (5 pt)
 - (b) Explain the physical meaning of e^{-Ea/RT} in the Arrhenius equation. (5 pt)



- 3. (a) Please write down the three necessary and sufficient conditions for the validity of the Langmuir equation. (9 pt)
 - (b) A gas A_2 adsorbs onto a surface M as represented by $A_2(g) + 2M(surface) \leftrightarrow 2AM(surface)$

Assume that the adsorption process follows the Langmuir isotherm,

i.e. $\theta = \frac{K^{1/2}[A]^{1/2}}{1+K^{1/2}[A]^{1/2}}$ where θ = fractional coverage and [A]= partial pressure of A₂, and K=k_a/k_d.

Derive the above expression of Langmuir isotherm for the adsorption process. (10 pt)

- 4. Two moles of H₂ gas which is assumed as ideal gas were compressed isothermally at 300K from 1 bar to 5 bar against a constant pressure of 5 bar. Calculate: (Gas constant R=8.314 J·K⁻¹·mol⁻¹) (15 pt)
 - (a) The work done by the system (W),
 - (b) The heat absorbed by the system (q),
 - (c) The change of the entropy (\triangle S),
 - (d) The change of the Helmholtz energy (\triangle A),
 - (e) The change of the Gibbs energy ($\triangle G$).

参考用

所別:生物醫學工程研究所碩士班 生醫材料與技術組(一般生) 科目:物理化學 共 Z 頁 第 Z 頁 本科考試可使用計算器,廠牌、功能不拘 *請在試卷答案卷(卡)內作答



5. For the reaction $A+B \rightarrow X$ consider the following mechanism:

$$A + B \xrightarrow{k_1} AB \tag{1}$$

$$AB \xrightarrow{k_2} X \tag{2}$$

Derive the rate law using the steady state approximation to eliminate the concentration of AB. (7pt)

- 6. Consider the equation for changes in Gibbs free energy in terms of the following cases of $\triangle H$ and $\triangle S$:
 - (a) Case 1: \triangle H<0 and \triangle S<0
 - (b) Case 2: $\triangle > 0$ and $\triangle S < 0$
 - (c) Case 3: \triangle H<0 and \triangle S>0
 - (d) Case 1: \triangle H>0 and \triangle S>0

For each case, indicate what conditions would lead to positive values of Δ G. Also, indicate the temperatures for which the process or reaction is spontaneous. (12 pt)

- 7. The rate constants for a reaction are determined experimentally. At 550°K, the rate constant is 3X10⁻⁶ dm³·mol⁻¹·s⁻¹ and at 800°K, the rate constant is 6X10⁻³ dm³·mol⁻¹·s⁻¹. Determine the activation energy of this reaction. (Gas constant R=8.314 J·K⁻¹·mol⁻¹) (10 pt)
- 8. Explain the following terms: (15 pt)
 - (a) Hess's Law
 - (b) Absorption and adsorption
 - (c) Ideal solution
 - (d) Pauli exclusion principle
 - (e) Michaelis constant

注:背面有試題