[물리화학2 5차숙제]

1. (1) A reaction follow the Eley-Rideal mechanism in which A_2 undergoes a dissociate adsorption.
$$A_2 + B \rightarrow P$$
    (1-1) Write down the Langmuir isotherm.
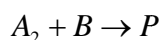
    (1-2) What is the rate law in this reaction?

  (2) Describe the Stern model for the electrical double layer.

  (3) State the Auger effect.

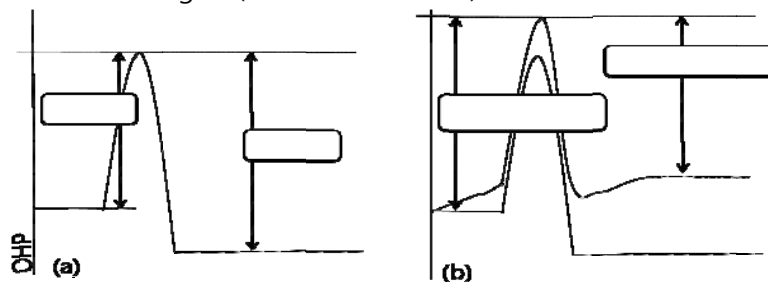 (4) The rate law in charge transfer reaction is given as :
$$v_{O_x} = k_c [O_x]$$
  Derive the following equation from rate law,
$$j_c = F k_c [O_x]$$
  What are the unit of **k_c** in current density equation.

2. (1) Fill-up the four blanks using α (transfer coefficient).

  (2) Determine the effect that increasing the overpotential from 0.50 V to 0.60 V has on the current density in the electrolysis of 1.0 M NaOH (aq), which is 1.22 mAcm^2 at 0.50 V and 25℃. Take $\alpha = 0.50$.

3. (1) 표면흡착의 응용에 관한 하나의 예로서 활성탄에 대한 산 흡착능력을 측정하는 것이 있다 (탄소의 한 형태인 활성탄은 많은 기공을 가지며 물에 있는 불순물을 흡착하기 위하여 사용한 다. 대표적으로 수족관에서 사용한다.). 주어진 양의 활성탄 입자를 아세트산 용액에 넣었다. 초 기 농도가 다른 여러 아세트산 용액을 제조하였다. 산의 일부가 활성탄에 흡착하는데, 평형이 이루어진 후에 산의 농도 변화를 측정하였다. 아래의 실험 데이터를 Langmuir 흡착 등온식에 의해 plot하여 흡착에 대한 평형상수를 결정하라.

초기농도 (M)	농도변화 (M)
0.7001	0.00665
0.3694	0.00588
0.1515	0.00553
0.0437	0.00283
0.0196	0.00153

(2) How many molecules of oxygen strike 1 cm^2 of surface in 1sec when the pressure is 10-6 torr and the temperature is 298 K?

(3) Write down the rate law for the deuteration of NH_3 in which D_2 adsorbs dissociatively, and NH_3 adsorbs at different site.

4. V. V. Losev and A. P. Pchel'nikov (*Soviet Electrochem*. **6**, 34 (1970)) obtained the following current-voltage data for an indium anode relative to a standard hydrogen electrode at 293 K:

-E/V	0.388	0.365	0.350	0.335
j/(A m^{-2})	0	0.590	1.438	3.507

Use these data to calculate the transfer coefficient and the exchange current density. What is the cathodic current density when the potential is 0.365 V?

5. An early stud of the hydrogen overpotential is that of H. Bowden and T. Rideal (*Proc. Roy. Soc*. **A120**, 59 (1928)), who measured the overpotential for H_2 evolution with a mercury electrode in dilute aqueous solutions of H_2SO_4 at 25℃. Determine the exchange current density and transfer coefficient, α, from their data:

j/(mA m^{-2})	2.9	6.3	28	100	250	630	1650	3300
λ /V	0.60	0.65	0.73	0.79	0.84	0.89	0.93	0.96

Explain any deviations from the result expected from the Tafel equation.