明新科技大學九十三學年度研究所碩士班 [V]一般生 [V]在職生 招生考試入學試題卷

系所別	組別	科目	准考證號碼	考試日期	節次	時間
化工研究所		化工熱力學與化工動力學		93 年 5 月 2 日	第 1 節	100 分鐘

可使用非記憶型電子計算機；第 1~5 題為熱力學，請答在一張答案卷上，第 6~10 題為動力學，請答在另一張答案卷上。

1. Derive the thermodynamic equation of state
   $(\partial H/\partial P)_T = V - (\partial V/\partial T)_P$ (10%)
2. Two moles of an ideal gas expand isothermally from an initial volume of 1 L to a final 2 L at 25℃. What are the values of ΔG (in Joules) and ΔH (in Joules) for this process, the maximum work (W_{max}, in Joules) done in this process.(ln2=0.693, ln5=1.609, R : 8.314 J/mol. K) (10%)
3. Evaluate ΔG (in Joules) and ΔS (in J/K) when 1 mole each of an ideal gas A and B are mixed isothermally and isobarically at 25℃and 1 atm. (ln2=0.693, ln5=1.609, R : 8.314 J/mol. K) (10%)
4. Develop an expression for $(\frac{\partial T}{\partial P})_S$ as a function of only P, v, T and C_P. (10%)
5. 1 kg of water at 25°C and 1 atm is mixed adiabatically with 2 kg of water at 50 °C and 1 atm. What is the final temperature of the 3 kg of water? Assume that the specific heat keeps constant in the mixing process. (10%)
6. The first-order gas reaction $SO_2Cl_2 \rightarrow SO_2 + Cl_2$ has $k_1=2.20\times10^{-5}\ s^{-1}$ at 593 K. What percent of a gas sample of SO_2Cl_2 would be decomposed by heating at 593 K for 2.00 h? (10%)
7. The reaction A + B → C takes place in two steps by the mechanism $2A \xleftarrow{K_1} D$ followed by $B + D \xrightarrow{k_2} A + C$. The first step comes to a rapid equilibrium (constant K_1). Derive an expression for the rate of formation of C in terms of K_1, k_2, [A], [B]. (10%)
8. The second-order rate constant for a gas reaction is 1×10^3 liters $mol^{-1}\ s^{-1}$ at 25 °C. Calculate the value of the rate constant when the rate equation is written in terms of pressure in atmospheres. (10%)
9. For the decomposition of ozone : $2O_3 \leftrightarrow 3O_2$
   The rate law is $-\frac{d(O_3)}{dt} = k\frac{(O_3)^2}{(O_2)}$
   Derive a mechanism to explain this rate law. (10%)
10. Prove that in a first-order reaction, where $dn/dt = -kn$, the average life, that is, the average life expectancy of the molecules, is equal to $1/k$. (10%)