明 新 科 技 大 學

九十六學年度研究所 ☑ 碩 士 班 ☐ 碩士在職專班 招生考試試題卷

系所名稱	科目	准考證號碼 (請考生填入)	考試日期	節次	第 1 頁/共 2 頁
化學工程研究所	化工熱力學與化工動力學		96 年 5 月 6 日	第二節	

答案須寫在答案卷內，否則不予計分。

1. Determine the degree of freedom of the following systems: (10%)
   (1) carbon dioxide at critical point
   (2) water + methanol + ethanol in vapor-liquid region at 760mmHg
   (3) water + benzene in liquid immiscible region at 25°C
   (4) naphthalene + phenol at eutectic point under 1 atm

2. What pressure (bar) would be exerted by ethane at a specific volume of 524 cm^3/g mole and 340°C? The ideal gas equation is used for this estimation. (10%)

3. An ideal solution is formed from 30% A, 20% B and 50% C (in mol%) at 50°C, 1atm.
   (1) To what pressure (atm) must the system be reduced to form the first bubble of vapor at 50°C?
   (2) What is the composition of this bubble vapor?
   The vapor is an ideal gas mixture. The vapor pressure of the components at 50 °C are $P_A^0 = 0.9$ atm, $P_B^0 = 0.85$ atm and $P_C^0 = 0.7$ atm respectively. (10%)

4. The reaction rate of a chemical reaction at 227℃ is 10 times of the rate at 127℃. Use Arrhenius law to determine the activation energy of this reaction. (gas constant R=8.314 J/mol.K) (10%)

5. Pure gas A (reaction A→ 3R；$-r_A = (2\ min^{-1} C_A)$ with volumetric flow rate 0.2m^3/min is fed into a steady mixed flow reactor. Find the final conversion of A if the reactor volume is 0.2 m^3. (Hint：for any constant ε_A，$C_A/C_{A0} = (1-X_A)/(1+\varepsilon_A X_A)$ (20%)

6. For the second order reaction：$2A \xrightarrow{k} C + D$, the rate equation can be expressed as $-dC_A/dt = kC_A^2$, the rate constant at 25℃ is $10^{-2} M^{-1} sec^{-1}$. If the initial concentration of A is 1 M, how long will it take for a sample of A to decay to half of its original concentration? (20%)

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7. 1 g mole of an ideal gas is reversibly and adiabatically expanded from an initial volume of 2000cc to 10000cc. The initial temperature is 398K. (20%)
   (1) How much work (Joule) is done?
   (2) What is the final temperature (K)?
   (3) What is the final pressure (atm)?

   The specific heat C_v of the gas is $\frac{5}{2}R$.