

國立臺北科技大學 105 學年度碩士班招生考試

系所組別：3510 化學工程與生物科技系化學工程碩士班甲組

第三節 化工熱力學與反應工程 試題

第一頁 共一頁

注意事項：

1. 本試題共六題，共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

1. The metal evaporation rate W ($\text{g} \cdot \text{cm}^{-2} \cdot \text{s}^{-1}$) in thin film deposition is :

$$W = 5.83 \times 10^{-2} \frac{P_v M^{1/2}}{T^{1/2}}$$

Since P_v is temperature-dependent, the vapor pressure-temperature relationship is defined as :

$$\log_{10} P_v = A - \frac{B}{T}$$

where P_v is pressure (torr), T is temperature (K) and M is molecular weight.

Calculate the evaporation rate for an aluminum ($M=27$) at 1219°C . (10%)

Data : $A=8.79$, $B=1.594 \times 10^4$.

2. You have just been delivered a tank containing a mixture of n-butane (83.3% by mol) and n-octane at 25°C and 1 bar. Your boss asks you to measure the viscosity of the mixture, so you have to take a sample for analysis. One technician says you should collect the sample in a test tube because the contents are in the liquid phase. Another technician says you should use a balloon because the contents of the tank are in the vapor phase. A third technician is looking at you waiting for your instructions. What do you do? State all your assumptions and justify your reasoning with calculations. (20%)

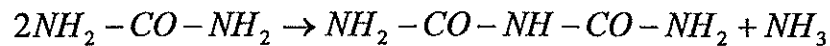
Additional data : The saturation pressures of n-butane and n-octane are 2.34 bar and 0.0175 bar, respectively.

3. A gas is found to obey the following equation of state:

$$P(V - b) = RT$$

Obtain the entropy and enthalpy departure from the ideal gas. (20%)

4. When a concentrated urea solution is stored it slowly condensed to biuret by the following elementary reaction :



To study the rate of condensation a sample of urea ($C=20$ mol/liter) is stored at 100°C and after 7 hr 40 min we find that 1 mol% has turned into biuret. Find the rate equation for this condensation reaction. (15%)

5. A specific enzyme acts as catalyst in the fermentation of reactant A . At a given enzyme concentration in the aqueous feed stream (25 liter/min) find the volume of plug flow reactor needed for 95% conversion of reactant A ($C_{A0}=2$ mol/liter). (15%)

The kinetics of the fermentation at this enzyme concentration is given by

$$A \rightarrow R, \quad -r_A = \frac{0.1C_A}{1+0.5C_A} \frac{\text{mol}}{\text{liter} \cdot \text{min}}$$

6. Chemical A reacts to form R ($k_1=6 \text{ hr}^{-1}$) and R reacts away to form S ($k_2=3 \text{ hr}^{-1}$). In addition R slowly decomposes to form T ($k_3=1 \text{ hr}^{-1}$). If a solution containing 1.0 mol/liter of A is introduced into a batch reactor, how long would it take to reach $C_{R,\text{max}}$, and what would be $C_{R,\text{max}}$? (20%)