

# 國立宜蘭大學

## 101 學年度轉學招生考試

(考生填寫)

准考證號碼：

### 物理化學試題

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#### 《作答注意事項》

1. 請先檢查准考證號碼、座位號碼及答案卷號碼是否相符。
2. 考試時間：80 分鐘。
3. 本試卷共有 7 題，共計 100 分。
4. 請將答案寫在答案卷上（於本試題上作答者，不予計分）。
5. 考試中禁止使用大哥大或其他通信設備。
6. 考試後，請將試題卷及答案卷一併繳交。
7. 本考科可自行攜帶使用非程式型(不具備儲存程式功能)之電子計算機。

- Derive the Gibbs-Helmholtz equation. (10%)
- (a) Derive that the entropy change per mol of mixture gas is  $\Delta S = -R(x_1 \ln x_1 + x_2 \ln x_2)$ . (10%)  
(b) Calculate the entropy of mixing per mole of air, taking the composition by volume to be 79% N<sub>2</sub>, 20% O<sub>2</sub>, and 1% Ar. (10%)
- At 25°C 1 mol of ideal gas is expanded isothermally from 2 L to 20 L. Calculate  $\Delta U$ ,  $\Delta H$ ,  $\Delta S$ ,  $\Delta A$ , and  $\Delta G$ . (20%)
- Benzene has a normal boiling point at 760 Torr of 353.25K and  $\Delta_{\text{vap}}H_m = 30.76 \text{ kJ mol}^{-1}$ . If benzene is to be boiled at 30.00°C in a vacuum distillation, to what value of  $P$  must the pressure be lowered? (10%)
- Calculate the activity and activity coefficients for 0.330 mol fraction toluene in benzene. The vapor pressure of pure benzene is 9.657 kPa at 298K.  $P_2^* = 3.572 \text{ kPa}$  for toluene. The vapor pressure of pure benzene above the solution is  $P_1 = 6.677 \text{ kPa}$  and for toluene  $P_2 = 1.214 \text{ kPa}$ . (10%)
- The isotope  $^{90}\text{Sr}$  emits radiation by a first-order process and has a half-life of 28.1 years. If  $1 \mu\text{g}$  is absorbed by human at birth, how much of this isotope remains after 50 years? (10%)
- (a) Calculate the ratio of the mass of the water-rich layer to that of the aniline-rich layer, for a 20-wt% water mixture at 363K. The compositions along the tie line  $be$  are maintained at 363K. The composition at  $c$  is 20%; for  $L_1$  at  $b$ , it is 8%; and for  $L_2$  at  $e$ , it is 90%. (10%)  
(b) What are the compositions of  $L_1$  and  $L_2$  at this temperature? (10%)

