

# 國立宜蘭大學

## 九十八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 八大題，一題 10 - 15 分，共計 100 分。
4. 請將答案寫在答案卷上。(限用藍或黑色鋼筆、原子筆作答)
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。
8. 請利用有效數字運算並注意單位。

- 一、 Consider a 1.00 mole sample of hydrogen,  $H_2$ , that has a pressure of 2.00 atm and a volume of 5.00 L. Predict the temperature of this sample of gas use (a). the ideal gas law (3%) and (b). the van der Waals equation (where  $a = 0.244 \text{ atm}\cdot\text{L}^2/\text{mol}^2$ ,  $b = 0.0266 \text{ L/mol}$ )? (7%)
- 二、 (a). Calculate the work done when 2.00 mole of an ideal gas expands reversibly from 1.0 L to 5.0 L at 298.0 K. ? (5%) (b). Calculate the amount of work done when the gas expands irreversibly against a constant external pressure of 1.00 atm. ? (5%)
- 三、 Calculate the entropy change of 3.00 mole ice is heated from 250 K; 1 atm to water at 300 K; 1 atm. Take the heat capacities,  $C_p$ , of ice and water to be constant at 37.7 and 75.3  $\text{J K}^{-1} \text{ mol}^{-1}$ , respectively, and heat of fusion of ice is 6.02  $\text{kJ mol}^{-1}$ . (15%)
- 四、 2.00 moles of ideal gas is compressed isothermally and reversibly at 100.0 °C from 2.00 atm to 10.0 atm. Calculate  $q$  (2%) and  $w$  (3%) and each of the thermodynamic quantities  $\Delta U$  (1%),  $\Delta H$  (1%),  $\Delta G$  (3%),  $\Delta A$  (2%), and  $\Delta S$  (3%) ?
- 五、 The  $\Delta G^\circ$  for the following reaction is +3.40 kJ/mol :  $H_2(g) + I_2(s) \leftrightarrow 2HI(g)$   
(a). Calculate the equilibrium constant for the reaction ? (5%) (b). If the partial pressure of  $H_2$  at equilibrium is 0.50 bar, please calculate the partial pressure of hydrogen iodide in the mixture ? (5%)  $P^\circ = 1 \text{ bar}$
- 六、 The vapor pressure of solid benzene,  $C_6H_6$  is 2.24 Torr at  $-30^\circ\text{C}$  and 24.5 Torr at  $0^\circ\text{C}$ , and the vapor pressure of liquid  $C_6H_6$  is 46.3 Torr at  $10^\circ\text{C}$  and 118.5 Torr at  $30^\circ\text{C}$ . From these data, calculate the heat of fusion of  $C_6H_6$ ? (15%)
- 七、 20.57 wt% of para-dichlorobenzene,  $C_6H_4Cl_2$ , in hexane,  $T_m$  of  $C_6H_4Cl_2$  is  $52.7^\circ\text{C}$ , and  $\Delta H_{\text{fus}} = 17.15 \text{ kJ/mol}$ . Please determine how ideal of the calculating mole fraction value comparing with the expected mole fraction value ? All data are for  $25^\circ\text{C}$ . (15%)
- 八、 A reaction has  $k = 1.77 \times 10^{-6} \text{ 1/(M}\cdot\text{s)}$  at  $25.0^\circ\text{C}$  and an activation energy of 18.0 kJ/mol. (a) What order is the reaction ? (3%) (b). what is the value of the rate constant at  $100^\circ\text{C}$  ? (7%)