

國立宜蘭大學

100 學年度轉學招生考試

(考生填寫)

准考證號碼：

物理化學試題

《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 九 題，一題 10-15 分，共計 100 分。
4. 請將答案寫在答案卷上。
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. 本試卷採雙面影印，請勿漏答。
8. 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。

- 一、 Benzoic acid, C_6H_5COOH , (MM= 122.0 g/mol) is a common standard used in bomb calorimeters, which maintain a constant volume. If 2.00g of benzoic acid gives off 52,872 J of energy when burned in the presence of excess oxygen at a constant temperature of $25.0^\circ C$, calculate (a) q (2%), (b) w (2%), (c) ΔU (2%) and (d) ΔH (4%) for the reaction. The reaction is:
 $C_6H_5COOH(s) + 15/2 O_2(g) \rightarrow 7CO_2(g) + 3 H_2O(l)$

- 二、 If a 2.00 mole sample of an ideal gas from a compressed gas cylinder goes from 230 atm to 1.00 atm and from a volume of 1.00 cm^3 to 195 cm^3 what is the entropy change for the expansion if it is assumed to be isothermal? (10%)

- 三、 The vapor pressure of water and ice at $-5.00^\circ C$ are 3.163 and 3.013 mmHg, respectively. Calculate ΔG for the transformation of 2.00 moles of water to ice at $-5.00^\circ C$? (10%)

- 四、 Calculate $(\frac{\partial U}{\partial V})_T$ for a van der Waals' gas for which $P = \frac{RT}{V-b} - \frac{a}{V^2}$ (10%)

- 五、 For the following reaction: $SO_2(g) + 1/2 O_2(g) \rightleftharpoons SO_3(l)$ the ΔG_f° data is given as below:

Substance	$SO_2(g)$	$O_2(g)$	$SO_3(l)$
ΔG_f° kJ/mol	-300.13	0.0	-368.0

- (a). Calculate the value of ΔG° for this equilibrium? (5%) (b). Calculate the value of K for this equilibrium? (5%) (c). If 0.010 bar of SO_2 and 0.020 bar of O_2 are enclosed in a system in the presence of some SO_3 liquid, in which direction would the equilibrium move; why? (5%)
 $P^\circ = 1 \text{ bar}$.

- 六、 The vapor pressure of mercury at 536 K is 103 torr. Estimate the normal boiling point of mercury, where the vapor pressure is 760 torr. The heat of vaporization of mercury is 58.7 kJ/mol? (10%)

- 七、 Calculate (a). ΔH_{mix} (1%) (b). ΔU_{mix} (1%) (c). ΔG_{mix} (4%) (d). ΔS_{mix} (4%) for a system that mixes 2.00 mol of benzene and 2.00 mol of toluene at $25^\circ C$?

- 八、 Calculate E for the following electrochemical cell at $25^\circ C$, $Cu | Cu^{2+} (0.100 M) || Zn^{2+} (0.0750 M) | Zn$. If $E^\circ (Cu^{2+}) = +0.339 \text{ V}$ and $E^\circ (Zn^{2+}) = -0.762 \text{ V}$. (10%)

背面尚有試題

九、For the reaction $\text{CO}_2 (+ \text{H}_2\text{O}) \rightleftharpoons \text{H}_2\text{CO}_3$ (The parentheses indicate that H_2O is not include in the equilibrium expression or in the rate equation) $\Delta H_{rxn}^0 = 4728 \text{ J/mol}$, at 25°C $k_1 = 0.0375 \text{ s}^{-1}$ and at 0°C $k_1 = 0.0021 \text{ s}^{-1}$; calculate: (a).the activation energy for the forward reaction (4%) (b).the activation energy for the reverse reaction (4%), (c). k_{-1} at 25°C (4%), and (d). k_{-1} at 0°C (3%)? Assuming that ΔH_{rxn}^0 is independent of the temperature in this range.