

國立臺北科技大學九十七學年度碩士班招生考試

系所組別：3712 有機高分子研究所甲組

第二節 物理化學 (選考) 試題

填准考證號碼

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第一頁 共一頁

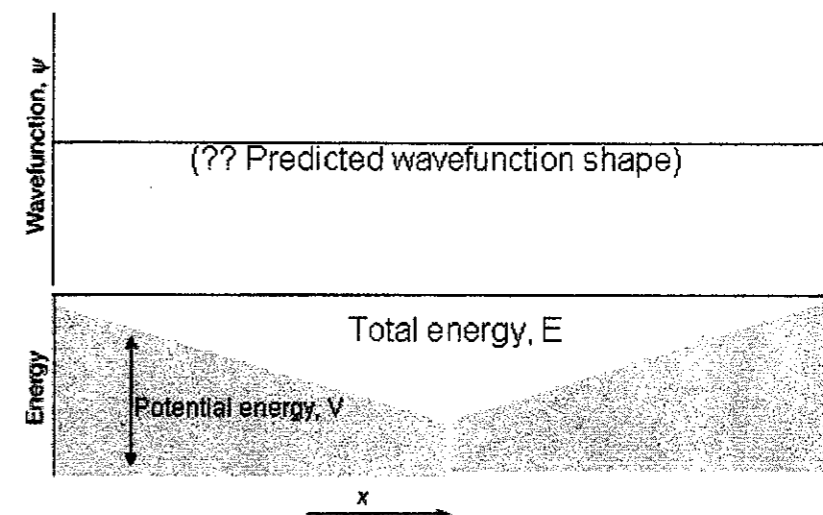
注意事項：

1. 本試題共 7 題，配分共 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. Heat capacity at constant pressure is always larger than that at constant volume. Why? Please give your answer without any equation (10%).
2. Define the following terms:
 - (a) black body radiation (5%)
 - (b) collision mean free path (5%)
 - (c) adsorption isotherm (5%)
 - (d) degenerate (5%)
 - (e) tunneling (5%)
 - (f) Franck-Condon principle (5%).
3. The Helmholtz energy is equal to "maximum work function". Give your molecular interpretation for this relation. (10%)
4. At 518 °C, the half-life for the decomposition of a sample of gaseous acetaldehyde (ethanal) initially at 363 Torr was 410 s. When the pressure was 169 Torr, the half-life was 880 s. Determine the order of reaction. (10%)
5. In a constant-volume adiabatic calorimeter, the combustion of 0.5173 g of ethanol causes the temperature to rise from 25.000 °C to 29.289 °C. The heat capacity of the system, including the bomb, the reactants, and the other contents of the calorimeter is 3576 J/K.
 - (a) Please calculate the molar internal energy of combustion of ethanol at 25.000 °C. (10%)
 - (b) What is the $\Delta_r H^\circ$ for this combustion reaction? (10%)

The ethanol combustion reaction is following:
 $C_2H_5OH(l) + O_2(g) = CO_2(g) + H_2O(l)$

6. Please predict the general shape of a wavefunction without solving the Schrödinger equation explicitly. Given that the total energy is a constant and the variation of potential energy is shown below: (Please copy the following figure to your answer sheet and draw the predicted wavefunction directly onto the answer sheet). (10%)



7. Please describe the Heisenberg uncertainty principle and show your work to justify this uncertainty principle. (10%)

The gas constant in various units

R
8.314 47 J K ⁻¹ mol ⁻¹
8.205 74 × 10 ⁻² L atm K ⁻¹ mol ⁻¹
8.314 47 × 10 ⁻² L bar K ⁻¹ mol ⁻¹
8.314 47 Pa m ³ K ⁻¹ mol ⁻¹
62.364 L Torr K ⁻¹ mol ⁻¹
1.987 21 cal K ⁻¹ mol ⁻¹