

招生學年度	100	招生類別	碩士班
系所班別	生命科學系 生物技術碩士班(甲組)、材料科學與工程學系碩士班		
科目	物理化學		
注意事項	本考科可使用掌上型計算機		

物理化學

1. One mole of glucose ($C_6H_{12}O_6$) is oxidized according to the equation
 $C_6H_{12}O_{6(s)} + 6 O_{2(g)} \rightarrow 6 CO_{2(g)} + 6 H_2O_{(l)}$ $\Delta_r U^\ominus = -2808 \text{ kJ/mol}$, $\Delta_r S^\ominus = 182.4 \text{ J/K}$. Calculate (a) $\Delta_r H^\ominus$ (10 分) (b) the maximum

non-expansion work of this reaction at 310 K. (10 分).

2. The density of ice is 0.917 g/cm^3 and that of liquid water is 0.999 g/cm^3 . Calculate $\Delta_r G$ (water \rightarrow ice) at 2 bar and 0°C . (molar mass of $H_2O = 18 \text{ g/mol}$, $1 \text{ bar} = 10^5 \text{ Pa}$, $dG = VdP - SdT$) (20 分)

3. For a macroscopic object of mass 1 kg moving with speed 1 m/sec in a one-dimensional box of length 1 m. Find the quantum number n .
 $(E_n = n^2 h^2 / 8mL^2, h = 6.62 \times 10^{-34} \text{ J sec})$ (20 分)

4. Some reactions are zero-order in the reactant. One example is the decomposition of ammonia. In one experiment, the partial pressure of ammonia decreased from 21 kPa to 10 kPa in 770 sec. (a) Derive the integrated rate law (10 分) (b) Calculate the rate constant (10 分)

5. Explain or Write down the equations:

(a) the Second Law of Thermodynamics (5 分)

(b) the van der Waals equation for a real gas (5 分)

(c) time-independent Schrödinger Equation (5 分)

(d) activated complex (5 分)