招 生 學 年 度	102	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		

1. The standard enthalpy of formation of $NH_{3(g)}$ at 298 K is -46.11 kJ/mol. Estimate its value at 400 K. Use: $C_{p,m}^O$ (H_2) = 28.824 $JK^{-1}mol^{-1}$, $C_{p,m}^O$ (N_2) = 29.125 $JK^{-1}mol^{-1}$, $C_{p,m}^O$ (NH_3) = 35.06 $JK^{-1}mol^{-1}$. (20 分)

2. Calculate the change in the molar Gibbs energy of liquid water treated as an incompressible fluid, when the pressure is increased isothermally from 1 bar to 2 bar at 298 K. (1 bar = 10^5 Pa, density of water = 1 g/cm^3) (20 分).

3. Estimate the vapor pressure of sea water at 20°C given that the vapor pressure of pure water is 2.338 kPa at that temperature and the solute is NaCl at 0.5 mol NaCl/ L water. (20 分)

4. An alternative mechanism that may apply when the concentration of O_2 is high and that of NO is low is one in which the first step is NO + $O_2 \rightarrow$ NO---O_2 (rate constant : k_a) and its reverse (rate constant: $k_{a'}$), followed by NO---O_2 + NO $\rightarrow$ NO_2 + NO_2 (rate constant : k_b). Prove that this mechanism leads to the observed third –order rate law when the concentration of NO is low. (Use the steady-state approximation) (20 分)

5. A point mass rotates in a circle with the quantum number L =2. Calculate the magnitude of its angular momentum and draw the vector diagram for all possible projections of the angular momentum on z-axis. ($E=L(L+1)\hbar^2/2I$) (20 分)