說明: 1. 請依序作答並標明題號
2. 計算題必須寫出計算過程, 只寫答案不予計分
3. R=8.3145 $JK^{-1}mol^{-1}$, F= 96500 $C \cdot mol^{-1}$

1) A particle of mass m is confined between two impenetrable walls a distance L apart. The potential energy of the particle is 0 everywhere inside the box. (a) Write the Schrödinger equation for the particle. (5%) (b) Calculate the solution for the wavefunction $\psi(x)$ (the boundary conditions: $\psi(0)=0$ and $\psi(L)=0$). (5%) (c) Calculate the energy of the particle. (5%)

2) Although Al and In are both in Group 13/III, Al forms Al^{3+} ions, whereas indium forms both In^{3+} and In^+ ions. Explain it. (10%)

3) The Boltzmann formula for the entropy is $S=k\ln W$, $k=1.3807 \times 10^{-23}$ JK^{-1}. Calculate the entropy of one mole N_2O at T=0K (hint: in the crystal the orientations NNO and ONN are equally likely). (10%)

4) The enthalpy of vaporization of CCl_4 is 33.05 kJ mol^{-1}, and its vapor pressure at 57.8 °C is 405 Torr. What is the vapor pressure of CCl_4 at 25 °C? (10%)

5) (a) Write down the Nernst equation. (5%) (b) Calculate the potential of the cell $Ag(s)|Ag^+(aq)(0.001M)||Ag^+(aq)(0.01M)|Ag(s)$ at 25 °C. (5%)

6) Calculate the concentration of N_2O_5 remaining 600 s after the start of its decomposition at 65°C when its initial concentration was 0.04 M. The reaction is $2N_2O_5(g) ---> 4NO_2(g) + O_2$. The rate law is $d[N_2O_5]/dt=-k[N_2O_5]$, $k=5.2 \times 10^{-3}$ s^{-1} . (10%)

7) The term symbol for the ground state of N_2^+ ion is $^2\Sigma_g$. What is the total spin and total orbital angular momentum of the molecule? (10%)

8) The Wavenumber of the fundamental vibrational transition of $^{35}Cl_2$ is 564.9 cm^{-1}. Calculate the force constant of the bond in N m^{-1}. (10%)

9) Explain (a) Q branch in vibration-rotation spectra (5%) (b) phase rule (5%) (c) tunnelling effect (5%).