(一)

1. (20%) Derive from the first law of thermodynamics and related definitions

   (1) (10%) $C_p - C_v = [P + (\partial E/\partial V)_T](\partial V/\partial T)_p$
   (2) (10%) for an ideal gas, if $(\partial E/\partial V)_T = 0$, then
   (a) $C_p - C_v = nR$ (5%)
   (b) $(\partial H/\partial V)_T = 0$ (5%)

2. (15%) Evaluate the reversible work of compression in calories on 100g of a condensed phase when the pressure is increased from 10 to 100 atm at a constant temperature of 20℃. Given compressibility $\beta = 8 \times 10^{-5}$ atm^{-1}, density of condensed phase $\rho = 0.8$ g/c.c. at 20℃ , 1 atm
   List any assumptions you make in the evaluation.

3. In the application of Clausius-Clapeyron equation to phase changes, one usually assumes that the molar heat of vaporization or latent heat of evaporation, ΔH_v, remains constant over the interval of interest. However, a more accurate formulation can be carried out if the variation of heat of vaporization with temperature is taken into account.
   1) (10%) Now try to derive this modified equation $P = P(\Delta C_p, T)$ instead of the original $P = P(\Delta H_v, T)$
   2) (5%) Also show that the modified equation $P = P(\Delta C_p, T)$ can be simplified to $\ln P = (\Delta C_p/R) \ln T + I_1/RT + I_2$ if C_p is independent of temperature, where I_1 and I_2 are integration constants.

(二) 解釋名詞 (每小題5分)

1. Raoult Law
2. Henry's Law
3. Ideal solutions
4. Regular solutions
5. Activity
6. Margules series
7. Henrian standard state
8. Gibbs phase rules
9. Entropy of mixing
10. Ellingham Diagrams