國立雲林科技大學
100學年度碩士班暨碩士在職專班招生考試試題

系所：化材系
科目：物理化學

1. Ammonia initially at 25℃and 1 bar pressure is heated at constant pressure until the volume has become three times of original one. Calculate (a) Q per mole, (b) W per mole, (c) ΔU per mole, and (d) ΔS per mole. Given: ammonia is considered to be an ideal gas. $C_p = 25.9+33.0 \times 10^{-3}T-30.5 \times 10^{-7}T^2$ in J/(Kmol) (20%)

2. Two blocks of the same metal with same size are at different temperatures, T_1 and T_2. Both metals are brought together and allowed to come to the same temperature. (a) Derive the entropy change (ΔS) for the above procedure with C_p, T_1, and T_2 if C_p is constant. (b) Is the above procedure spontaneous? (20%)

3. Please explain following items.

(a)Give a P-V chart of reversible Carnot Cycle and define the efficiency. (5%)

(b)Give a P-V chart of reversible Otto Cycle and define the efficiency. (5%)

(c)Nernst equation (5%)

(d)Debye temperature (5%)

4.Comelli et al. report the excess volume of mixing propionic acid with oxane at 313.15 K as $V^E = x_1 x_2 \{a_0 + a_1(x_1-x_2)\}$,where x_1 is the mole fraction of propionic acid, and x_2 that of oxane, $a_0 = -2.4697$ cm^3mol^{-1} and, $a_1 = 0.0608$ cm^3mol^{-1}. The density of propionic acid at this temperature is 0.97174 g cm^{-3} ; that of oxane is 0.86398 g cm^{-3}.

(a)Derive an expression for the partial molar volume of each component at this temperature(15%)

(b)Computer the partial molar volume for each component in an equimolar mixture(10%)

5.The excess Gibbs energy (G^E)of solutions of A and B at 300K was found to fit the expression

$$G^E = RT\, x\,(1-x)\{0.486 - 0.108\,(2x-1) + 0.019\,(2x-1)^2\}$$

Where x is the mole fraction of A . Calculate the Gibbs energy of mixing when a mixture of 2 mole of A and 3 mole of B is prepared.（15%）