國立雲林科技大學 109 學年度
碩士班招生考試試題

系所：化材系
科目：物理化學

1. Calculate the entropy change for the reversible and isothermal expansion (V_i to V_f) of n moles gas [Cv (heat capacity of constant volume) = constant] which is in a closed system and obeys the following equation of state :

   P (V - b) = n R T   where b = constant   (18 %)

2. $\left(\dfrac{\partial U}{\partial T}\right)_P = C_v$ for a perfect gas , show that

   $C_{P,m} - C_{V,m} = R$ (12 %)

3. The equilibrium constant for the following reaction is 0.164 at 298 K.

   $$I_{2(s)} + Br_{2(g)} \; <=> \; 2\ IBr_{(g)}$$
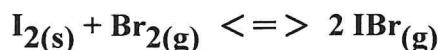
   Bromine gas is introduced into a container with excess solid iodine. The pressure and temperature are held at 0.164 atm and 298 K, respectively. Assume that the vapor pressure of solid iodine is negligible and that all gases are perfect gases. Calculate $\Delta_r G^0$ (J/mole) and the partial pressure (atm) of

   $IBr_{(g)}$ at equilibrium for the above reaction. (R = 8.314 J K^{-1} mol^{-1})   (20 %)

4. Definition: (10%)
   1) Entropy $\Delta S > 0$
   2) The second law of thermal dynamics
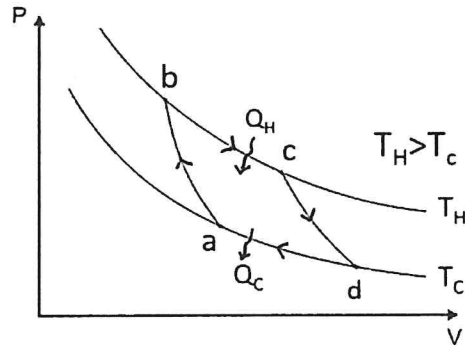   3) Partial properties
   4) Raoult's law
   5) Fugacity coefficient

5. Please derive $\eta = 1 - \frac{T_c}{T_H}$ by Carnot's theorem with the following figure.

(20%)

6. Please derive Gibbs-Duhem equation with constant pressure and constant temperature. (20%)

$$\sum x_i d\overline{M_i} = 0$$