共 5 題，每題 20 分，共 100 分

1. For an ideal gas, integrate dV(T,P) along a path which is given by the following functional form in the P-T plane joining (P_1,T_1) and (P_2,T_2) to determine $V_2(P_2,T_2)-V_1(P_1,T_1)$. The functional form of P-T variation is given by

$$T = T(P) = aP^{\nu} + bP^{\mu} + cP^{\gamma} + d\exp\left(\frac{P}{P_0}\right) + f\ln\left(\frac{P}{P_0}\right)$$

where a, b, c, d, f, P_0, ν, μ, and γ are real constants. Units of P_0 are the same as of pressure. (20 points)

2. From 298 K up to its melting temperature of 1048 K, the constant- pressure molar heat capacity of RbF is given as

$$C_p = 33.3 + 38.5 \times 10^{-3}\,T + 5.06 \times 10^{5}\,T^{-2} \text{ joules/degree}$$

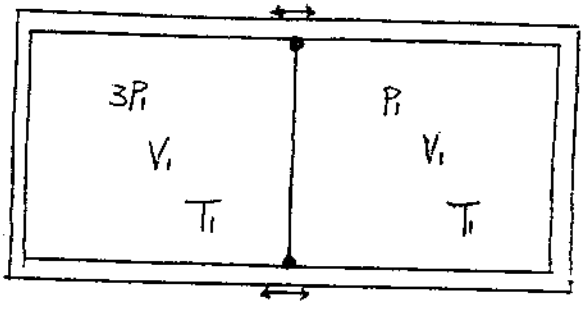
and from the melting temperature to 1200 K, the constant-pressure molar heat capacity of liquid RbF is given as

$$C_p = -47.3 + 3.49 \times 10^{-3}\,T + 1467 \times 10^{5}\,T^{-2} \text{ joules/degree}$$

At its melting temperature the molar heat of fusion of RbF is 26,400 joules. Calculate the increase in the entropy of 1 mole of RbF when it is heated from 300 to 1200 K. (20 points)

(背面仍有題目，請繼續作答)

3. Consider a two compartment chamber in which a diaphragm separates the two compartments. The diaphragm is secured by hinges (see figure). The volumes on either side are the same, V_1 each, and the temperature is uniform at T_1. On one side there are 3 moles of an ideal gas while on the other side there is only one mode. Thus, on one side the pressure is $3P_1$ while on the other side it is P_1. The entire assembly is placed inside an adiabatic enclosure. Subsequently, the hinges are loosened such that the diaphragm can slide in an attempt to equalize the pressure. Gas, however, does not cross-over from one compartment into the other. Determine the final, equilibrium volumes of the two compartments by maximizing the entropy. (20 points)



4. Assuming that the densities of graphite and diamond at 1200K are 2.22 and 3.515 gm/cm^3, respectively, determine the pressure required to convert graphite into diamond at 1200 K, where

$C_{diamond} = 9.12 + 13.2\times10^{-3}\,T - 6.19\times10^{5}/T^2$

$C_{graphite} = 17.2 + 4.27\times10^{-3}\,T - 8.79\times10^{5}/T^2$

$S^0_{d,298} = 2.44$; $S^0_{gr,298} = 5.694$; $H^0_{d,298} = 1{,}900$; $H^0_{gr,298} = 0$; 1 atm=101.32 kPa

(20points)

5. Determine the isothermal compressibility, β, isobaric expansivity, α, and the difference $C_p - C_v$ for a Van der Waal's gas. Also show that when a=0 and b=0, these parameters reduce to those corresponding to an ideal gas. (20 points)