

冶金熱力學 試題

注意：請一律使用試務中心提供的計算機

1. An ideal gas at 300 K has a volume of 15 liters at a pressure of 15 atm. Calculate (1) the final volume of the system, (2) the work done by the system, (3) the heat entering or leaving the system, (4) the change in the internal energy, and (5) the change in the enthalpy when the gas undergoes

a. a reversible isothermal expansion to a pressure of 10 atm

b. a reversible adiabatic expansion to a pressure of 10 atm

The constant volume molar heat capacity of the gas, c_v , has the value $1.5R$. (25%)

$R = 8.314 \text{ joules/degree} \cdot \text{mole} = 82.06 \text{ cm}^3 \cdot \text{atm/degree} \cdot \text{mole}$.

2. The initial state of one mole of a monatomic ideal gas is $P = 10 \text{ atm}$ and $T = 300\text{K}$.

Calculate the change in the entropy of gas for (a) an isothermal decrease in the pressure to 5 atm, (b) a reversible adiabatic expansion to pressure of 5 atm, (c) a constant-volume decrease in the pressure to 5 atm. (15%)

3. The molar volumes of solid and liquid lead at the normal melting temperature (327) of lead are, respectively, 18.92 cm^3 and 19.74 cm^3 . Calculate the pressure which must be applied to lead in order to increase its melting temperature by 20 centigrade degrees.

$\Delta H_{\text{pb}} (\text{s} \rightarrow \text{l}) = 4810 \text{ J}$. (15%)

4. The activity coefficient of Zn in liquid Zn-Cd alloys at 435 can be represented as

$$\ln \gamma_{\text{Zn}} = 0.875X_{\text{Cd}}^2 - 0.30X_{\text{Cd}}^3$$

Derive the corresponding expression for the dependence of $\ln \gamma_{\text{Cd}}$ on composition and calculate the activity of cadmium in the alloy of $X_{\text{Cd}} = 0.5$ at 435 . (15%)

5. 試證 $[\partial(G/T)/\partial T]_p = -H/T^2$ (15%)

6. 解釋名詞：(15% , 每小題 3%)

(a) Extensive property, (b) Intensive property, (c) Gibbs phase rule, (d) allotropy, (e) Raoult's law