淡江大學98學年度碩士班招生考試試題

系別：化學工程與材料工程學系　　科目：化 工 熱 力 學

准帶項目請打「V」	
V	簡單型計算機

本試題共 壹 頁，壹 大題

30分 1. A possible constitutive equation for the excess Gibbs free energy of a binary liquid mixture at temperature T is

$G^E = B\,RT\,X_1\,X_2$

where X_1 and X_2 are the mole fractions of components 1 and 2, respectively. R is the gas constant. B is a dimensionless quantity and is a function of T.

(10分) (1) Determine the activity coefficients for components 1 and 2, respectively.

(10分) (2) Determine the dimensionless excess enthalpy (H^E/RT) for this system.

(10分) (3) Determine the dimensionless excess entropy (S^E/R) for this system.

20分 2. Ten pounds mass of steam initially at 20 psia and 300 °F is compressed isothermally in a reversible process until it reaches a final state of saturated liquid. Determine Q (heat) and W (work) for the process.

Data: Initial properties are V=22.36 ft^3/lb_m , U=1108.7 Btu/ lb_m, S=1.7805 Btu/ lb_m°R.
Final properties are V=6.472 ft^3/lb_m , U=1100.0Btu/ lb_m S=1.6356 Btu/ lb_m °R.

20分 3. Determine the number of degrees of freedom at equilibrium of a chemically reactive system containing solid sulfur S and the three gases O_2, SO_2 and SO_3.

30分 4. The virial equation truncated after two terms is a good representation of isothermal volumetric data for low pressures

$$Z = 1 + (BP/RT)$$

where Z is the compressibility factor, and B is a parameter which is a function of temperature.

(20分) (1) The residual enthalpy ΔH' is defined as

$$\Delta H' = \int_0^P [\,T\,(\frac{\partial V_m}{\partial T})_P - V_m\,]\,dP \qquad \text{(constant T)}$$

where V_m is the molar volume.

Determine ΔH' / RT for gases at low pressures.

(10分) (2) The residual entropy ΔS' is defined as

$$\Delta S' = \int_0^P [\,(\frac{\partial V_m}{\partial T})_P - \frac{R}{P}\,]\,dP \qquad \text{(constant T)}$$

Determine ΔS' / R for gases at low pressures.