淡江大學 95 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

1. Find expressions for $(\partial S/\partial V)_T$, $(\partial U/\partial P)_T$, and $(\partial H/\partial P)_T$ for a gas whose behavior can be described by the equation

$$P(V - nb) = n R T.$$

where S is the entropy, U is the internal energy, H is the enthalpy, V is the volume, P is the pressure, T is the absolute temperature, R is the gas constant, n is the number of moles, and b is a constant.

2. Consider a steady-flow heat exchanger which operates cocurrently. Heat is transferred from a hot stream, flowing from left to right, to a cold stream flowing in the same direction. The heat exchanger accepts hot stream at 400 K and 1 mol/s, and discharges at 350 K. The cold stream enters at 300 K. The minimum temperature difference between the flowing streams is 10 K. Assume that both streams are ideal gases with $C_p = 3.5R$. The surroundings temperature is 300 K. Find the lost work. (Assume negligible kinetic- and potential-energy changes.)

3. The saturation vapor pressure of pure liquid refrigerant R-12 at 40 °C is 9.48 atm. The virial equation terminated at the second term is an adequate representation of the true volumetric behavior of this substance. Calculate the fugacity of liquid R-12 at 40 °C under a pressure of 100 atm nitrogen. (The density of liquid R-12 at these conditions averages 1.25 g/cm^3 and its molar mass is 120.875 g. The second virial coefficient is - 436.9 cm^3/mol at 9.48 atm and 40 °C.)