淡江大學八十七學年度日間部轉學生入學考試試題

系別：化學工程學系三年級　　科目：物理化學

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Problem One (20 points)

A certain gas obeys the van der Waals equation with a = 0.5 $m^6Pa\ mol^{-2}$. Its molar volume is found to be $5\times10^{-4}\ m^3\ mol^{-1}$ at 273 K and 3.0 MPa. From this information calculate the van der Waals constant "b". What is the compression factor for this gas at the prevailing temperature and pressure? Does the compression factor depend upon the equation of state used to calculate its value?

Hint:

$$p=\frac{nRT}{V-nb}-a\left(\frac{n}{V}\right)^2$$

Atkin., p52, 1.44

Problem Two (20 points)

A sample of argon at 1.0 atm pressure and 25 °C expands reversibly and adiabatically from 0.5 L to 1.0 L. Calculate its final temperature, the work done during the expansion, and the change in internal energy. The molar heat capacity of argon at constant volume is $12.48JK^{-1}mol^{-1}$.

Hint: assuming ideal gas behavior

$V_fT_f^c=V_iT_i^c$ ， c = Cv/R　Cv : molar heat capacity

Atkin. p112, Ex3.6

Problem Three (20 points)

Naphthalene melts at 80.2 °C. If the vapor pressure of the liquid is 10 Torr at 85.8 °C and 40 Torr at 119.3 °C, use the Clausius-Clapeyron equation to calculate (a) the enthalpy of vaporization, (b) the normal boiling point, and (c) the entropy of vaporization at the normal boiling point.

Hint: Clausius-Clapeyron equation:

$$\frac{d\ln p}{dT}=\frac{\Delta H_{vap}}{RT^2}$$

Integrate the equation with the assumption that the heat of vaporization is constant.

Aktin. p.204, 6.12

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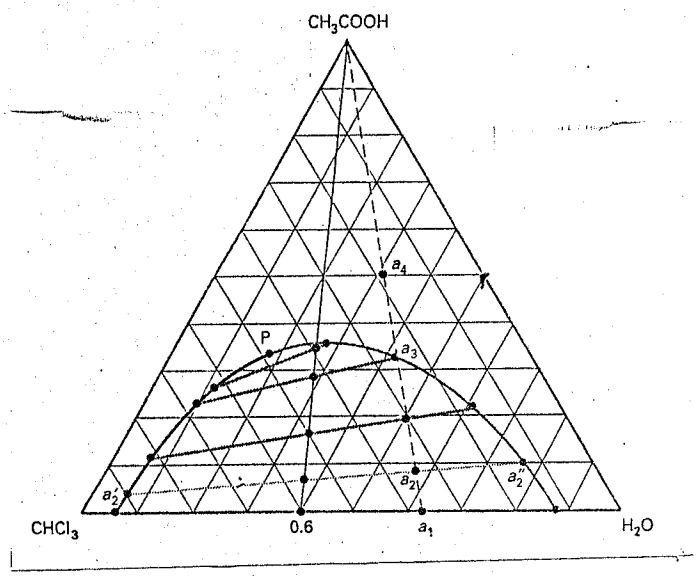
Problem Four (20 points)

A mixture is prepared consisting of chloroform (mole fraction = 0.6) and water. Describe the changes that occur when acetic acid is added to the mixture.

Hint: see the phase diagram.

Atkin. p261, Ex. 8.5



Problem Five (20 points)

The reaction mechanism

$$A_2 \leftrightarrow 2A \quad (fast)$$

$$A + B \rightarrow P \quad (slow)$$

involves an intermediate A. Deduce the rate law for the reaction.

Atkin. p895, 25.16