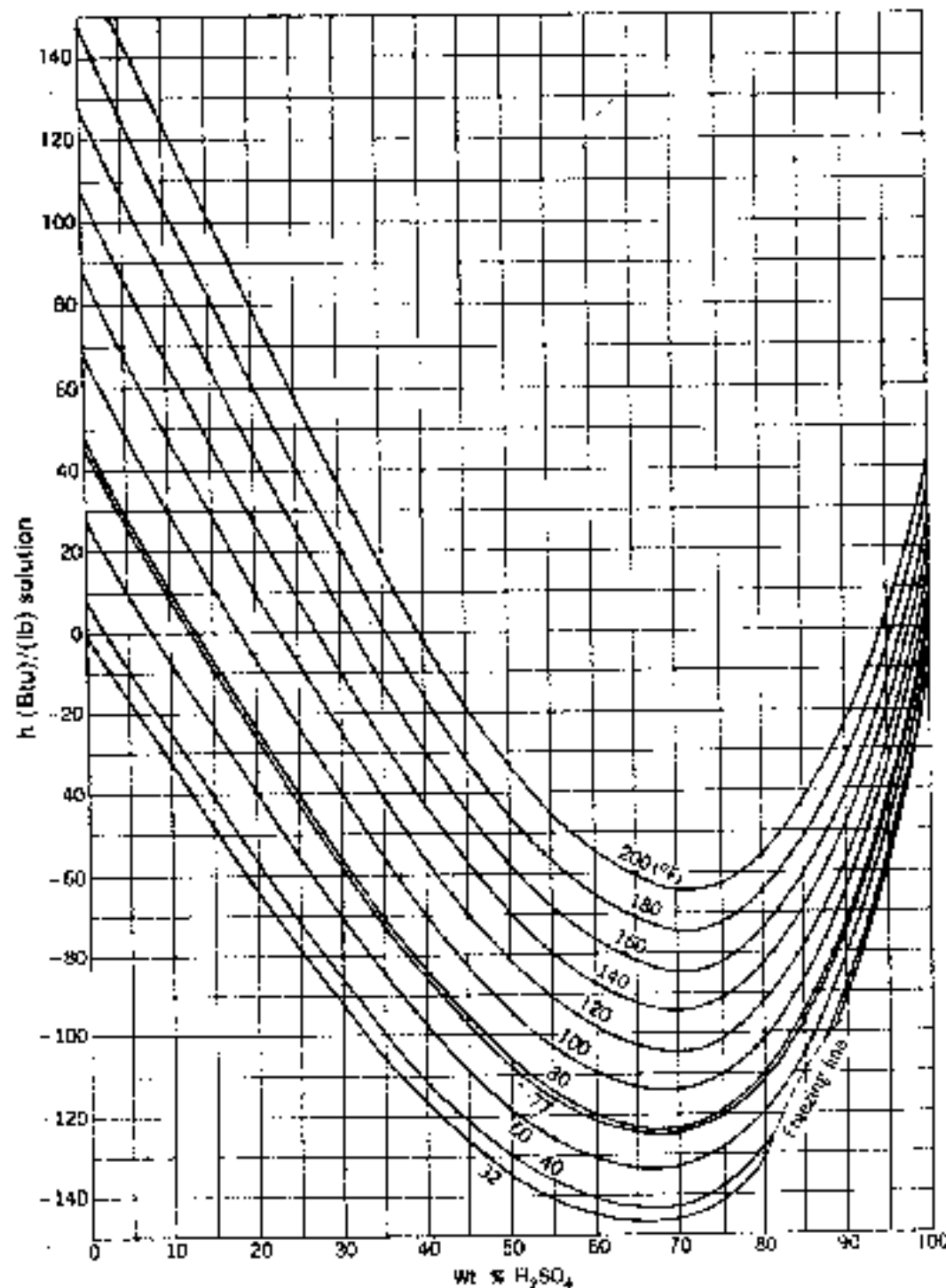


八十五學年度 化學工程學系 系(所) 甲組 組碩士班研究生入學考試

科目 化工熱力學及化學反應工程 科號 1502 共 3 頁第 1 頁 *請在試卷【答案卷】內作答

Problem 1(20%)

- (10%) a. 100 lb/min of 20wt% sulfuric acid solution at 100°F are continuously mixed with 100 lb/min of an 80 wt% sulfuric acid solution at 120°F. At what rate must heat be removed from the mixer if the solution is to be at 80°F?



Enthalpy-concentration diagram for sulfuric acid and water.

- (10%) b. The reversible transformation of gray tin to white tin occurs at 13°C and 1 atm, and the heat of transformation is 2092 J/mol. Please calculate the entropy change for the phase transformation.

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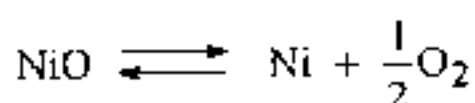
科目 化工熱力學及化學反應工程 科號 1502 共 3 頁第 2 頁 *請在試卷【答案卷】內作答

Problem 2 (20%)

At 80°C two compounds A and B have the same vapor pressure 700 mmHg. A mixture of A and B exhibit an azeotrope at 50 mol% with a vapor pressure of 1000 mmHg. Calculate the equilibrium vapor pressure and mole fraction over a liquid mixture containing 25 mol% of A. If the latent heats of vaporization of A and B are also the same, how do you expect the azeotrope composition to respond to an increase in temperature?

Problem 3 (20%)

The equilibrium constants for the decomposition of nickel oxide:



are 1.514×10^{-11} and 2.355×10^{-8} at 527 °C and 727 °C respectively. Calculate the equilibrium constant at 627 °C from the following data:

$$C_{P,\text{NiO}} = 11.18 + 2.02 \times 10^{-3}T \quad \frac{\text{cal}}{^\circ\text{C}\cdot\text{mole}}$$

$$C_{P,\text{Ni}} = 7.10 + 1.00 \times 10^{-3}T - 2.23 \times 10^{-5}T^{-2} \quad \frac{\text{cal}}{^\circ\text{C}\cdot\text{mole}}$$

$$C_{P,\text{O}_2} = 7.16 + 1.00 \times 10^{-3}T - 0.40 \times 10^{-5}T^{-2} \quad \frac{\text{cal}}{^\circ\text{C}\cdot\text{mole}}$$

Problem 4 (20%)

Show that C_{A1} for the reaction system below is given by:

$$C_{A1} = \frac{C_{A0}}{1 + \beta + \alpha\tau k - \{\beta^2 / [\beta + (1 - \alpha)\tau k]\}}$$

where

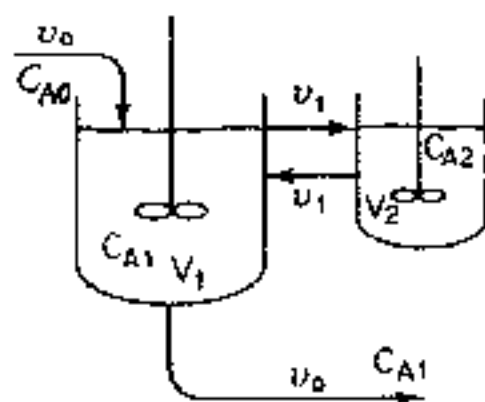
$$\alpha = \frac{V_1}{V_1 + V_2} \quad \beta = \frac{v_1}{v_0} \quad \tau = \frac{V_1 + V_2}{v_0}$$

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Note that the reaction occurring in the reactors is first order, i.e.:

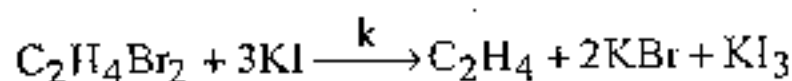
$$-r_A = kC_A$$



(b)

Problem 5 (20%)

Data for the reaction between ethylene bromide and potassium iodide in 99% methanol



are given in the table below. Determine the second order rate constant.

Time(ksec)	Fraction Dibromide reacted
29.7	0.2863
40.5	0.3630
47.7	0.4099
55.8	0.4572
62.1	0.4890
72.9	0.5396
83.7	0.5795

Temperature=59.72°C

Initial KI concentration = 0.1531 kmol/m³

Initial C₂H₄Br₂ concentration = 0.02864 kmol/m³