ชื่อ ..... รหัสประจำตัว .....

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination : Semester II (#3)	Academic Year	:	2003
Date : 19 February 2004	Time	:	9.00-12.00
Subject : 230-630 Advanced Transport Phenomena I	Room	:	A400

- ข้อสอบมี 5 ข้อ จำนวน 10 หน้า ต้องทำทุกข้อ คะแนนเต็ม 80 คะแนน
- ควรใช้เวลาทำข้อสอบโดยเฉลี่ย 2 นาที/คะแนน

ข้อที่	คะแนนเต็ม	ได้คะแนน
1	15	
2	10	
3	20	
4	15	
5	20	
รวม	**80**	

- ขอให้นักศึกษาทำข้อสอบในที่ว่างซึ่งได้เตรียมไว้สำหรับข้อสอบแต่ละข้อ โดยอาจใช้เนื้อที่ด้านหลัง ทำข้อสอบเพิ่มเติมได้
- อนุญาตให้นำหนังสือ เอกสาร เครื่องคำนวณ และอุปกรณ์อื่นๆ เข้าห้องสอบได้

สุธรรม สุขมณี
ผู้ออกข้อสอบ
5 กุมภาพันธ์ 2547

1) Predict D_{AB} for an equimolar mixture of N_2 and C_2H_6:
   (a) At 323.7 K and 1 atm. (5 points)
   (b) At 323.7 K and 40.8 atm. (10 points)

- This page is provided for problem #1 -

2) Verify the relations between fluxes used for interrelating expressions in mass units and those in molar units in binary systems using only the definitions of concentrations, velocities, and fluxes:

$$\frac{j_A}{\rho\omega_A\omega_B} = \frac{J_A^*}{cx_Ax_B}$$

(10 points)

3) Derive an expression for the steady concentration distribution (C_A) and mass transfer rate (W_A) of gas A in the hollow porous cylinder with a constant effective mass diffusivity of D_A, an inside radius of κR, an outside radius of R and a length of L. The concentration of A inside and outside the cylinder are $C_{A\kappa}$ and C_{AR} respectively. For the diffusion of gas A in porous medium at constant temperature and pressure, one may assume that the molar flux of A relative to stationary plane as : $N_{Ar} = -D_A \frac{dC_A}{dr}$ (20 points)

- This page is provided for problem #3 -

4) Estimate the rate of absorption of CO_2 (component *A*) from a carbon dioxide bubble 0.5 cm in diameter rising through pure water (component *B*) at 18 °C and at a pressure of 1 atm. The following data may be used: $D_{AB} = 1.46\times10^{-5}$ cm^2/s, $c_{A0} = 0.041$ g-mole/liter, $v_t = 22$ cm/s, $\rho_B = 1$ g/cm^3, $\mu_B = 1$ cP.

(a) Using liquid falling film model (5 points)

(b) Using a surface-averaged mass transfer coefficient k_m (10 points)

- This page is provided for problem #4 -

5) Moisted air with an uniform temperature of 30 ^{o}C and a pressure of 122 kPa (ρ = 1.4 kg/m^3, c = 48.3 mole/m^3, μ = 0.01822 mPa.s) is flowing in a smooth circular pipe of diameter 54.1 mm with a mass flow rate of 69.7 kg/h. Beginning at z = 0 to z = L, there is a absorbing device that remove water vapor (component A) from an air stream (component B) to the tube wall with a constant molar concentration of water vapor c_{A0} of 0.097 mole/m^3. If the bulk concentration of water vapor at z = 0 (c_{Ab1}) and z = L (c_{Ab2}) are 1.21 mole/m^3 and 0.242 mole/m^3 respectively and the diffusivity of water vapor in air (D_{AB}) at 30 ^{o}C is 1.78×10^{-5} m^2/s. Find the average molar flux of water vapor at the tube wall (N_{A0}). (20 points)

- This page is provided for problem #5 -