ChE 548

Spring 2005

Homework Assignment 1

Problem 1.
Consider the two flux equations describing diffusion in a binary system:

$$\underline{j}_A = -\rho D_{AB} \nabla w_A \qquad \text{and} \qquad \underline{j}_B = -\rho D_{BA} \nabla w_B$$

Prove $D_{AB} = D_{BA}$.

Problem 2.
Consider diffusion in a binary mixture under isothermal conditions. Find the simplest relationship between the two diffusivities, D_{AB} and D_{BA}, in the following two expressions, assuming that the frame of reference is with respect to the mass-averaged velocity.

$$\mathbf{j}_A = -D_{AB} \nabla \rho_A \qquad \text{and} \qquad \mathbf{j}_B = -D_{BA} \nabla \rho_B$$

Problem 3.
Consider the two flux equations describing diffusion in a binary system:

$$\underline{j}_A = -\rho D_{AB} \nabla w_A \qquad \text{and} \qquad \underline{J}_A^* = -cD_{AB}^* \nabla x_A$$

Prove $D_{AB} = D_{AB}^*$.

Problem 4. Problem BSL 2nd Ed: 17.A.1

Problem 5. Problem BSL 2nd Ed: 17.A.5

Problem 6. Problem BSL 2nd Ed: 17.A.10

Problem 7. Problem BSL 2nd Ed: 17.B.3