

Chl 751 Major Exam 6-5-10

Max marks 150

Max time 2 hrs

Q1. Derive an expression for Geometric mean based M-S diffusivities, \bar{D}_{ij} , for a multicomponent mixture diffusing in liquid. One can start from binary pair infinite-dilution diffusivities \bar{D}_{ij}^0 . Also, Derive ~~an~~ arithmetic mean based expression. (20+20)

Q2. Derive Stokes-Einstein relation. Point out the most common errors in derivations which exist in text books. (20+10)

Q3. Derive an expression for binary pair diffusivity for a binary mixture diffusing in solids. Make use of the approximation,

$$df/dz \approx \frac{f(z+\Delta z) - f(z)}{\Delta z}$$

Why can't one combine these diffusivities in a M-S type combination (such as $[B]$ making) to describe multicomponent diffusion in solids? Derive the binary pair diffusivity making use of $df/dz \approx \frac{f(z+\Delta z) - f(z-\Delta z)}{2\Delta z}$.

(20+10+20)

Q4. Assume at Fick's 2 law for multicomponent diffusion. Which approximation is inherently wrong in the derivation and why?.

(20+10)

Just