There was some confusion between *number and number density.*

Let N be the number of molecules in volume V. Then the number density is n=N/V. In the book, N is written as n, n is written as c, and n_B is written as [B].

The flux of molecule *i* is given by

$$f_i = -D_i \frac{dn_i}{dr}$$

The rate of change of the *total number* of molecules at distance r is given by

$$\frac{dN_i}{dt} = -Af_i = -4pr^2 f_i$$

The rate of change of the *number density* of molecules is given by

$$J_B \equiv \frac{dn_B}{dt} = -4pr^2 \left(D_A + D_B\right) \frac{dn_B}{dr}$$

Note the sign error in Eq. (4-14) in the book .

The rest of the derivation is correct. If I have time, I'll fill it in later. The final result is

$$k_s = J_B / n_B = 4pR(D_A + D_B)\,.$$

In the kinetic model, the quantity $n_S V_{AB}$ is the number of solvent molecules in a sphere of radius $R_{AB.}$ This quantity is simply the ratio of the volume of the sphere to the volume of one solvent molecule. That is,

$$n_S V_{AB} = \frac{\left(R_A + R_B\right)^3}{R_{AS}^3} = 8 f^3$$