

Question 2: Diffusion of a nutrient to a microorganism

A spherical microorganism resides in the center of a glass of juice. The juice contains glucose (“A”) at a mole fraction of x_{AEXT} . The organism consumes glucose quickly, so that at its surface the concentration of glucose is zero.

$$D_{AB} = 0.69 \times 10^{-5} \text{ cm}^2/\text{s}$$

$$x_{AEXT} = 0.05$$

$$\rho = 1.06 \text{ g/cm}^3$$

$$d_{MICROBE} = 2.0 \times 10^{-6} \text{ m} \quad (r_{MICROBE} = 1.0 \times 10^{-4} \text{ cm})$$

Find:

- i) What is the concentration profile of glucose near the microbe? What is concentration of glucose $1 \mu\text{m}$ from surface?
- ii) What is the total molar flow of glucose at surface?