CEN 3313

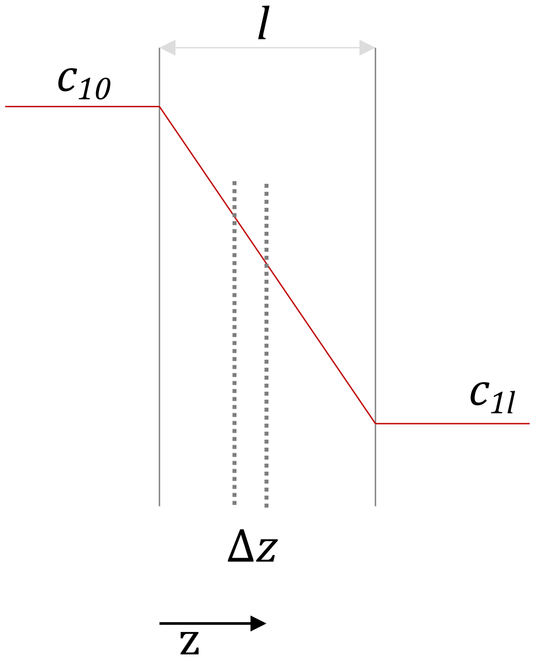
MASS TRANSFER

Assoc. Prof. Ayşe Karakeçili

Assoc. Prof. Berna Topuz

Fick's Law of Diffusion

Steady diffusion across a thin film. On each side of the film is a well-mixed solution of one solute, species 1. Both these solutions are dilute. The solute diffuses from the fixed higher concentration, located at z<0 on the left-hand side of the film, into the fixed, less concentrated solution, located at z>l on the right-hand side.



Solute Accumulation = (Rate of diffusion into the layer at z) - (Rate of diffusion out of the layer at z+Δz)

$$0 = D\frac{d^2 c_1}{dz^2}$$

(boundary conditions?????????)

z = 0 $c_1 = c_{10}$

z = l $c_1 = c_{1l}$

$$j_1 = -D\frac{dc_1}{dz} = \frac{D}{l}(c_{10} - c_{1l})$$

Your Turn:

If the concentration difference for diffusion across a thin film is doubled, what happens to the flux?

Your Turn:

Derive the concentration profile and the flux for a single solute diffusing across a **thin membrane.** As in the preceding case of a film, the membrane separates two well-stirred solutions. Unlike the film, the membrane is chemically different from these solutions.

References

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