10.9.14) \( k_{eff} = k_1v_1 + k_2v_2 \); \( v_1, v_2 \): Volume fractions

11.8.3) \( \frac{\partial C}{\partial t} = D \frac{\partial^2 C}{\partial x^2} + v_i \) ; I.C: \( t=0 \Rightarrow C = C_i \)

BC: \( \frac{\partial C}{\partial n} \bigg|_{n=0} = 0 \)

A t \( n \to 0 \Rightarrow C = C_i \)

11.8.4) \( \frac{\partial C_d}{\partial t} = D \frac{\partial^2 C_d}{\partial x^2} + v_d \) ; \( v_d = -k C_d \)

I.C: \( A t \; t=0, C = C_i \); BC: \( \frac{\partial C}{\partial n} \bigg|_{n=0} = 0 \)

11.8.7) \( \frac{\partial C}{\partial t} = D \frac{\partial^2 C}{\partial x^2} - r \); BC: \( \frac{\partial C}{\partial n} \bigg|_{n=0} = C(0) \)

I.C: \( C \bigg|_{t=0} \)

11.8.8) \( \frac{\partial C}{\partial t} = D \frac{\partial^2 C}{\partial x^2} + r \) I.C: \( A t \; t=0 \)

BC: \( \frac{\partial C}{\partial n} \bigg|_{n=0} = 0 \)

in strip: \( C = C_i \)
in enamel: \( C = 0 \)
in dentin: \( C = 0 \)

12.6.21) 1) \( D \frac{\partial^2 C}{\partial n^2} - R N = 0 \)

2) \( C \bigg|_{n=0} = C_i \); \( \frac{\partial C}{\partial n} \bigg|_{n=0} = 0 \)

3) \( C = -\frac{R N}{2D} (L^2 - n^2) + C_0 \)

4) \( n = \circ \)
5) \( N = 5.78 \times 10^{-4} \text{ [Million Cell/mL]} \)

6) \( C_5, \ C_5 = 1.09 \times 10^{-5} \text{ [mol/L]} \)

13.8.29) 1) \( D = 3.73 \times 10^{-10} \text{ m}^2/\text{s} \)
2) \( D = 3.8 \times 10^{-10} \text{ m}^2/\text{s} \)
3) \( C = 2.2 \text{ g/m}^3 \)
4) \( n = 6.66 \times 10^{-5} \text{ g/m}^2 \cdot \text{s} \)

5) Part one assumed long times and therefore steady-state while the other considers the time dependency early on. We expect part four to higher because the concentration at the core is lower initially.

6) The concept of \( K^* \) relates to concentration at the interface of two phases touching each other. Even though 2 patches have the same water content, their binding ability to water can be different. Thus, when the materials are in contact with skin, skin will be able to “pull” different amounts of water from the two materials, leaving the skin at 2 different moisture levels at the surface.

14.9.23) 1) \( h_m = 6.7 \times 10^{-4} \text{ m/s} \)
2) \( n = 6.7 \times 10^{-4} \text{ (film - bulk)} \)
3) \( h_m = 5.33 \times 10^{-5} \text{ m/s} \)

14.9.24) 1) For downstream, iodine levels 3265 km
2) For upstream, iodine levels 0.048 km
3) \( C = 2.08 \text{ g/cm}^3 \)
4) Dispersion/eddy/turbulence (not convection)