

HW # 1 Solutions,

(1) see HW 1-1. m

(2) Nelson 4.3

a.) $R \sim 50 \text{ nm}$

$$D = \frac{k_B T}{6 \pi \eta R} = \frac{(1.38 \times 10^{-23} \text{ J} \cdot \text{K}^{-1})(300 \text{ K})}{6 \pi (10^{-3} \text{ Pa} \cdot \text{s})(5 \times 10^{-8} \text{ m})}$$

$$= 4 \times 10^{-12} \text{ m}^2/\text{s}$$

$$= 4 \text{ } \mu\text{m}^2/\text{s}$$



$$j_d = -D \frac{dc}{dx} = \frac{D c_0}{L}$$

c.) $v = 400 \text{ mm/day} = 4.6 \text{ } \mu\text{m/s}$

$$j_{obs} = c_0 v$$

d.) $\frac{j_d}{j_{obs}} = \frac{D c_0}{L} \cdot \frac{1}{c_0 v} = \frac{D}{L v} = \frac{(4 \times 10^{-12} \text{ m}^2/\text{s})}{(1 \text{ m})(4.6 \text{ } \mu\text{m/s})} \sim 10^{-6}$

There must be active transport.

3,

