

Broelectronics
Sheet 1

Problem 1:

$$M_s = -P_s (S_o - S_i)$$

$$P_s = \frac{D_s}{d}$$

$$M_{Na^+} = -2 \times 10^{-8} (155 - 10) \times 10^{-3} = -2.72 \times 10^{-9} \text{ mM/Sec.cm}^2$$

$$\frac{\text{cm}}{\text{sec}} \times \frac{\text{mM}}{\text{cm}^3}$$

$$D_{Na^+} = P_{Na^+} \times d = 2 \times 10^{-8} \times 10^{-8} = 2 \times 10^{-16} \text{ cm}^2/\text{Sec}$$

$$M_K = -2 \times 10^{-16} (5 - 136) \times 10^{-3} = 2.62 \times 10^{-7} \text{ mM/Sec.cm}^2$$

$$D_K = P_K \times d = 2 \times 10^{-6} \times 10^{-8} = 2 \times 10^{-14} \text{ cm}^2/\text{Sec}$$

$$M_{Cl^-} = -4 \times 10^{-6} (112 - 78) \times 10^{-3} = -1.36 \times 10^{-7} \text{ mM/Sec.cm}^2$$

$$D_{Cl^-} = 4 \times 10^{-6} \times 10^{-8} = 4 \times 10^{-14} \text{ cm}^2/\text{Sec.cm}$$

Given 1

$$P_{Na^+} = 2 \times 10^{-8} \text{ cm/s}$$

$$P_K = 2 \times 10^{-6} \text{ cm/s}$$

$$P_{Cl^-} = 4 \times 10^{-6} \text{ cm/s}$$

$$d = 100 \text{ \AA}$$

Given 5

$$T = 20 + 273 = 293$$

$$P_{Na^+} = 2 \times 10^{-8} \text{ cm/s}$$

$$P_K = 2 \times 10^{-6} \text{ cm/s}$$

$$P_{Cl^-} = 4 \times 10^{-6} \text{ cm/s}$$

Problem 5:

$$V_m = \frac{P_{Cl^-}}{F} \ln \left(\frac{P_{Na^+} [Na^+]_o + P_K [K^+]_o + P_{Cl^-} [Cl^-]_i}{P_{Na^+} [Na^+]_i + P_K [K^+]_i + P_{Cl^-} [Cl^-]_o} \right)$$

$$= \frac{8.31 \times 293}{9.648 \times 10^4} \ln \left(\frac{(2 \times 10^{-8} \times 145 \times 10^{-3}) + (2 \times 10^{-6} \times 4 \times 10^{-3}) + (4 \times 10^{-6} \times 4 \times 10^{-3})}{(2 \times 10^{-8} \times 12 \times 10^{-3}) + (2 \times 10^{-6} \times 155 \times 10^{-3}) + (4 \times 10^{-6} \times 120 \times 10^{-3})} \right)$$

$$= 0.025 \ln \left(\frac{2.64 \times 10^{-8}}{7.9024 \times 10^{-7}} \right) = -0.085 \text{ V}$$