

Chapter 7: Solutions to Problems 8-10, 12-15

8.

$$q_e = \frac{-sh + [s^2h^2 + 4us(1-2h)]^{0.5}}{2s(1-2h)}$$

$$q_e \approx \frac{u}{hs}$$

$$q_e = \frac{-(0.1)(0.8) + [(0.1)^2(0.8)^2 + 4(10^{-6})(0.1)(1-2(0.8))]^{0.5}}{2((0.1)(1-2(0.8)))} = 0.0000125$$

$$q_e \approx \frac{10^{-6}}{(0.8)(0.1)} = 0.0000125$$

$$q_e = \frac{-(0.5)(0.8) + [(0.5)^2(0.8)^2 + 4(10^{-6})(0.5)(1-2(0.8))]^{0.5}}{2((0.5)(1-2(0.8)))} = 0.0000025$$

$$q_e \approx \frac{10^{-6}}{(0.8)(0.5)} = 0.0000025$$

$$L = sq(2ph + q)$$

$$L = (0.1)(0.0000125)(2(0.9999875)(0.8) + 0.0000125) = 0.000002 \text{ or } 2.0 \times 10^{-6}$$

$$L = (0.5)(0.0000025)(2(0.9999975)(0.8) + 0.0000025) = 0.000002 \text{ or } 2.0 \times 10^{-6}$$

9.

$$T_1(p) = 4N_e$$

$$T_0(p) = 2 \left(\frac{N_e}{N} \right) \ln(2N)$$

Assuming $N_e = N = 2000$,

$$T_1(p) = 4(2000) = 8000$$

$$T_0(p) = 2 \ln(2(2000)) = 16.59$$

Assuming $N_e = N = 100$,

$$T_1(p) = 4(100) = 400$$

$$T_0(p) = 2 \ln(2(100)) = 10.60$$

$$10. \quad H_e = \frac{4N_e u}{4N_e u + 1}$$

$$H_e = \frac{0.1}{0.1 + 1} = 0.0909$$

$$H_e = \frac{1}{1 + 1} = 0.5$$

$$H_e = \frac{10}{10 + 1} = 0.9091$$

$$H_e = 1 - \frac{1}{(8N_e u + 1)^{0.5}}$$

$$H_e = 1 - \frac{1}{(2(0.1) + 1)^{0.5}} = 0.0871$$

$$H_e = 1 - \frac{1}{(2(1) + 1)^{0.5}} = 0.4226$$

$$H_e = 1 - \frac{1}{(2(10) + 1)^{0.5}} = 0.7818$$

12.

$$u\left(\frac{1}{2N}\right) = \frac{1 - e^{-(N_e/N)s}}{1 - e^{-2N_e s}} \quad \text{or} \quad u\left(\frac{1}{2N}\right) \approx s\left(\frac{N_e}{N}\right)$$

$$u\left(\frac{1}{2N}\right) = \frac{1 - e^{-(20/100)(0.1)}}{1 - e^{-2(20)(0.1)}} = 0.02 \quad u\left(\frac{1}{2N}\right) \approx 0.1\left(\frac{20}{100}\right) = 0.02$$

$$u\left(\frac{1}{2N}\right) = \frac{1 - e^{-(100/100)(0.1)}}{1 - e^{-2(100)(0.1)}} = 0.095 \quad u\left(\frac{1}{2N}\right) \approx 0.1\left(\frac{100}{100}\right) = 0.1$$

$$u\left(\frac{1}{2N}\right) = \frac{1 - e^{-(200/100)(0.1)}}{1 - e^{-2(200)(0.1)}} = 0.18 \quad u\left(\frac{1}{2N}\right) \approx 0.1\left(\frac{200}{100}\right) = 0.2$$

$$14. \quad \hat{u} = \frac{x}{2N}$$

$$\hat{u} = \frac{20}{2(200,000)} = 0.00005$$

$$\hat{u} = \frac{\text{incidence}}{2}$$

$$\hat{u} = \frac{0.00001}{2} = 0.000005$$

$$15. \quad \hat{u} = sQ$$

$$\hat{u} = 1\left(\frac{10}{500000}\right) = 0.00002$$