

a) In p-region, $p = N_a = 2 \times 10^{16} \text{ cm}^{-3}$.
 $n = n_i^2 / N_a = 5 \times 10^3 \text{ cm}^{-3}$.
 In n-region, $n = N_d = 2 \times 10^{17} \text{ cm}^{-3}$.
 $p = n_i^2 / N_d = 5 \times 10^2 \text{ cm}^{-3}$.

b).

$$\chi_n = \sqrt{\frac{2\epsilon_s}{q} \frac{N_a}{N_d} \frac{1}{N_a + N_d} V_b}$$

$$V_b = \frac{k_B T}{q} \ln \frac{N_a N_d}{n_i^2}$$

$$E_{\max} = \frac{q N_d \chi_n}{\epsilon_s}$$

$$V_b \approx 0.0259 \ln \left(\frac{2 \times 10^{16} \times 2 \times 10^{17}}{1 \times 10^{20}} \right) \approx \cancel{1.24 \times 10^{-12}} \quad 0.81 \text{ V.}$$

$$\chi_n \approx \sqrt{\frac{2 \times 11.7 \times 8.854 \times 10^{-12}}{1.6 \times 10^{-19}} \frac{2 \times 10^{16}}{2 \times 10^{17}} \frac{1}{2 \times 10^{16} + 2 \times 10^{17}} \quad 0.81}$$

$$\approx 2.18 \times 10^{-5} \text{ m.}$$

$$E_{\max} = \frac{1.6 \times 10^{-19} \times 2 \times 10^{17} \times 2.18 \times 10^{-5}}{11.7 \times 8.854 \times 10^{-12}}$$

$$= 6.73 \times 10^3 \text{ V/m}$$

