

# 108 lab 5 pre-lab

For silicon, intrinsic carrier concentration ( $n_i$ ) is:

$$n_i \approx \frac{1.5 \cdot 10^{10}}{\text{cm}^3}$$

Step 1)

part 1.

$$N_0 \approx N_D = \frac{1 \cdot 10^{15}}{\text{cm}^3}$$

$$P_0 \approx \frac{(n_i)^2}{N_0} = \frac{(1.5 \cdot 10^{10} / \text{cm}^3)^2}{(1 \cdot 10^{15} / \text{cm}^3)}$$

$$P_0 \approx 225 \cdot 10^3 / \text{cm}^3$$

part 2.

$$P_0 \approx N_A = \frac{1 \cdot 10^{17}}{\text{cm}^3}$$

$$N_0 \approx \frac{(n_i)^2}{N_A} = \frac{(1.5 \cdot 10^{10} / \text{cm}^3)^2}{(1 \cdot 10^{17} / \text{cm}^3)}$$

$$N_0 \approx 2.25 \cdot 10^3 / \text{cm}^3$$

$$\text{part 3 } V_0 = V_T \ln \left( \frac{N_A N_D}{(n_i)^2} \right)$$

$$V_0 = (26 \text{ mV}) \ln \left( \frac{\frac{10^{17}}{\text{cm}^3} \cdot \frac{10^{15}}{\text{cm}^3}}{\left( \frac{1.5 \cdot 10^{10}}{\text{cm}^3} \right)^2} \right)$$

$$V_0 = (26 \text{ mV}) \ln(444.44 \text{ E} 9)$$

$$V_0 = (26 \text{ mV})(26.8201)$$

$$V_0 = 697.3223 \text{ mV}$$