$$n_o = \frac{n_o^2}{p_o} = \frac{(1.8 \times 10^4)^2}{1.3 \times 10^{10}}$$
 or $n_o = 2.49 \times 10^{-1} \text{ cm}^{-1}$

(b) Sillicon:

$$\sigma = \frac{1}{\rho} - c\mu_s n_s$$

over

$$n_o = \frac{1}{\rho c \mu_o} = \frac{1}{(8)(1.6 \times 10^{-1})(1350)}$$

OC.

$$n_{\rm o} = 5.79 \times 10^{10}~{\rm cm}^{-3}$$

pend

$$p_o = \frac{n_c^2}{n_o} = \frac{(1.5 \times 10^{10})^2}{5.79 \times 10^{10}} \Rightarrow p_o = 3.89 \times 10^2 \text{ cm}^{-1}$$

Note: For the doping concentrations obtained in part (b), the assumed mobility values are valid.

5.9

$$\sigma_{\cdot} = cm(\mu_{\cdot} + \mu_{\cdot})$$

Then

$$10^{-4} = (1.6 \times 10^{-4})(1000 + 600)n$$

OF

Negra

$$n_i^{\dagger} = N_c N_c \exp \left(\frac{-E_c}{kT} \right)$$

con

$$E_x = kT \ln \left(\frac{N_x N_y}{\alpha_z^2} \right) = (0.0259) \ln \left[\frac{\left(10^{11}\right)^2}{\left(3.91 \times 10^4\right)^2} \right]$$

OF

$$E_x=1.122~eV$$

Noorm

$$n_i^2(500K) = (10^{10})^2 \exp\left[\frac{-1.122}{(0.0259)(500/300)}\right]$$

= 5.15×10^{24}

OF

$$v_c(500K) = 2.27 \times 10^{11} \text{ cm}^{-1}$$

Then

$$\sigma_{r} = (1.6 \times 10^{-19})(2.27 \times 10^{19})(1000 + 600)$$

540

$$\sigma_{i}(500K) = 5.81x10^{+1} (\Omega - cm)^{-1}$$

5.10

(a) (i) Silicon: $\sigma_i = en(\mu_i + \mu_j)$

$$\sigma_{i} = (1.6x10^{-1})(1.5x10^{-1})(1350 + 480)$$

 $\sigma_c = 4.39 \times 10^{-6} (\Omega - cm)^{-6}$

(iii) Ge:

$$\sigma_{i} = (1.6x10^{-11})(2.4x10^{11})(3900 + 1900)$$

or

$$\sigma_{_1} = 2.23 \times 10^{-1} (\Omega - cm)^{-1}$$

(iii) GaAs:

$$\sigma_{\tau} = (1.6\pi 10^{-11})(1.8\pi 10^{4})(8500 + 400)$$

ONT

$$\sigma_i = 2.56 \times 10^{-6} \; (\Omega - cm)$$

(b) $R = \frac{L}{\sigma A}$

(i)
$$R = \frac{200 \times 10^{-6}}{(4.39 \times 10^{-6})(85 \times 10^{-6})} \Rightarrow$$

$$R = 5.36 \times 10^{9} \ \Omega$$

(ii)
$$R = \frac{200 \times 10^{-4}}{(2.23 \times 10^{-4})(85 \times 10^{-4})} \Rightarrow$$

$$R = 1.06 \times 10^{\circ} \Omega$$

(iii)
$$R = \frac{200 \times 10^{-1}}{(2.56 \times 10^{-1})(85 \times 10^{-1})} \Rightarrow$$

$$R = 9.19 \times 10^{11} \Omega$$

5.11

(a)
$$\rho = 5 = \frac{1}{\epsilon \mu_* N_e}$$

Assume $\mu_{\pi} = 1350 \text{ cm}^2 / V - s$

T been

$$N_x = \frac{1}{(1.6 \times 10^{-12})(1350)(5)} \Rightarrow$$

$$N_e = 9.26 \times 10^{14} \text{ cm}^{-1}$$

$$T = 200K \rightarrow T = -75C$$

 $T = 400K \rightarrow T = 125C$

$$T = -75C_{+}N_{+} = 10^{10} \text{ cm}^{-1} \Rightarrow$$

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