2.1

$$n_i = B T^{3/2} e^{\frac{-E_g}{2\left(\frac{kT}{q}\right)}}$$

$$1.67 * 10^{11} = 5.23 * 10^{23} (T)^{3/2} * \exp\left[\frac{-1.12}{2 \times 86.17 \times 10^{-6} \times T}\right] \Rightarrow T = 340.31\,K$$

2.2 $T = 100^\circ + 273 = 373\,k$

$$n_i = 5.23 * 10^{15} * (373)^{2/3} * \exp\left[\frac{-1.12}{2 * 86.17 * 10^{-6} * 373}\right] \longrightarrow n_i = 1.022 \times 10^{12} \text{ electron/cm}^3$$

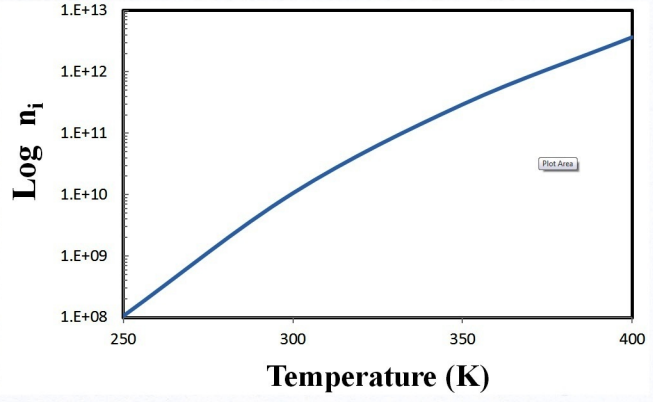
$$\frac{n_i}{5 \times 10^{22}} = \frac{1.022 \times 10^{12}}{5 \times 10^{22}} = 2.044 * 10^{-11}$$

2.3

$$\frac{n_{iX}}{n_{i300}} = 303 = \frac{5.23 \times 10^{13} T_2^{3/2} \exp\left[\frac{-1.12}{2 \times 86.17 \times 10^{-6} \times T_2}\right]}{5.23 \times 10^{13} (300)^{3/2} \exp\left[\frac{-1.12}{2 \times 86.17 \times 10^{-6} \times 300}\right]} \Rightarrow T_2 = 397.06\,K$$

2.4

T	n_i (electrons/cm^3)
250k	1.061×10^{8}
300k	1.062×10^{10}
350k	2.956×10^{11}
400k	3.678×10^{12}



Since n_i ranges over many orders of magnitude, log plot is preferred.

The log plot tells us exponential relation between T and n_i

2.5 $T = 100^\circ C + 273 = 373\,K$

$$\frac{n_{i\_373}}{5} = n_{i\_T} \qquad n_{i\_373} = 1.02 \times 10^{12}$$

$$\frac{1.02\times10^{12}}{5} = 5.23\times10^{13} * T^{3/2} * \exp\left[\frac{-1.12}{2\times86.17\times10^{-6}\times T}\right] \Rightarrow T = 343.64\,K$$

2.6 $n_o P_o = n_i^2$

$P_o \approx N_A \rightarrow n_o = \frac{n_i^2}{P_o} \approx \frac{n_i^2}{N_A} = \frac{(1.062\times10^{10})^2}{10^{17}} \rightarrow n_o = 1.128\times10^3$ electrons/cm^3

2.7 $\frac{10{,}000}{1} = \frac{5\times10^{22}}{N_D} \rightarrow N_D = 5\times10^{18}$

$n_o P_o = n_i^2 \rightarrow P_o = \frac{n_i^2}{n_o}$, $n_o \approx N_D$ $\Rightarrow P_o = \frac{n_i^2}{N_D} = \frac{(1.062\times10^{10})^2}{5\times10^{18}} \rightarrow P_o = 22.6$ holes/cm^3

2.8 @ $T = 385\,K$ $n_i = 1.844\times10^{12}$ holes/cm^3

$$n_o P_o = n_i^2 \rightarrow n_o = \frac{n_i^2}{N_A} = \frac{(1.844\times10^{12})^2}{6\times10^{18}} \rightarrow n_o = 5.669\times10^5 \text{ electrons/cm}^3$$

2.9 $P_o = \frac{n_i^2}{N_D} = \frac{(1.5\times10^{10})^2}{5\times10^4} \rightarrow P_o = 4\times10^{15}$ holes/cm^3

2.10 $n_o P_o = n_i^2$

$N_A \approx P_o \rightarrow n_i \approx \sqrt{n_o N_A} \Rightarrow n_i = 2.121\times10^{11}$ cm^{-3}

$$n_i = 2.121\times10^{11} = B\,T^{3/2}\exp\frac{-E_g}{2\left(\frac{K}{g}\right)T} \Rightarrow T = 344.3\,K$$