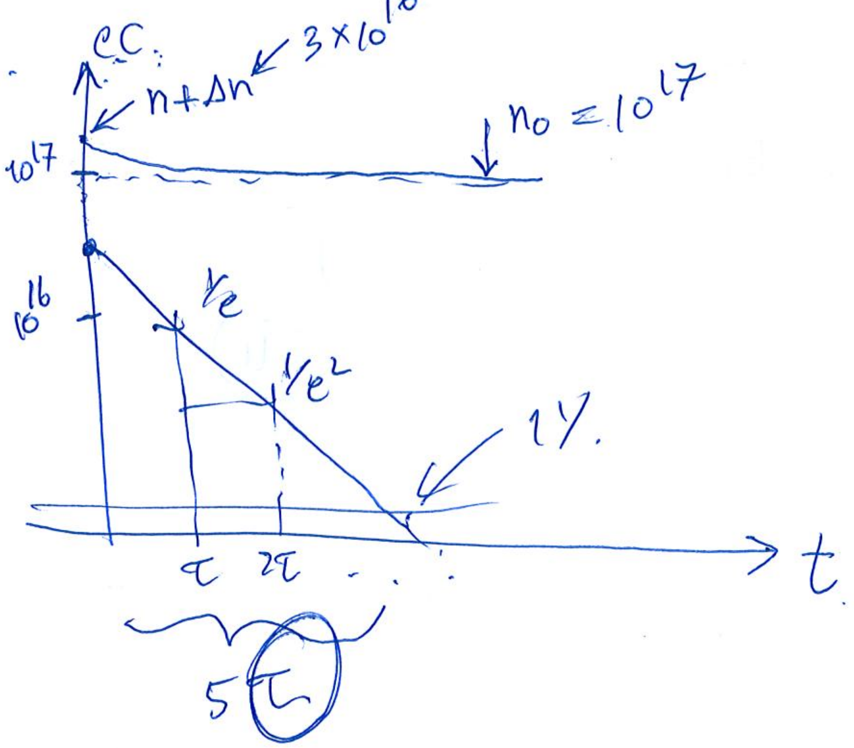
3.1 – 3.4 | 3.7 | 3.8

Equi | SS. | time-dependent.

3.8.

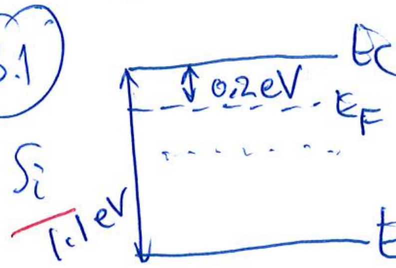


RT details

$kT \approx 26\,meV$

$0{,}026\ eV$

3.1



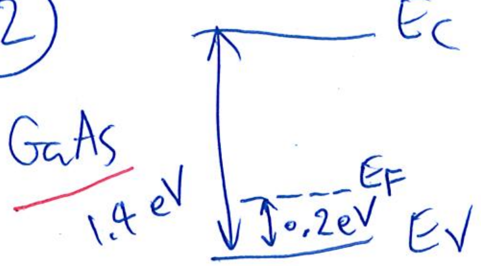
i) $f(E_C) = \dfrac{1}{1+e^{0.2/0.026}}$

$= 0{,}000456$

ii) $n_o = N_C \cdot f(E_C)$ } $1.28\times10^{16}\ cm^{-3}$

$N_C = 2.8\times10^{19}\ cm^{-3}$

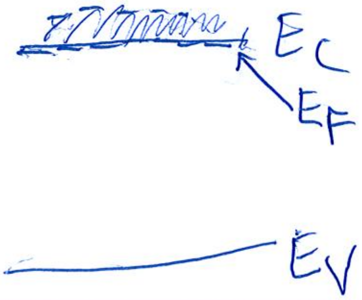
3.2



i) $1-f(E_V)$

ii) $N_V \cdot (1-f(E_V))$

3.3



$n_o = N_C \cdot f(E_C) = \dfrac{N_C}{2} = 1{,}4\times10^{19}\ cm^{-3}$

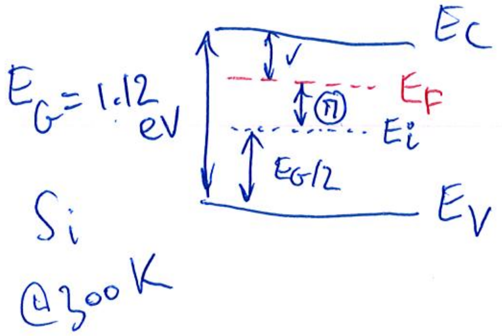
$f(E_C) = \dfrac{1}{1+e^{0/kT}} = \dfrac{1}{2}$

Si $5\times10^{22}\ \dfrac{\text{Si atoms}}{cm^3}$

metalli

3.4

$n_o = 10^{17}\ cm^{-3} \rightarrow p_o = ? = \dfrac{n_i^2}{n_o} = 10^{3}\ cm^{-3}$



(10^{10})

$n_o = n_i \exp \dfrac{E_F - E_i}{kT}$?

? $= kT \ln \dfrac{n_o}{n_i} = 0{,}026 \ln \dfrac{10^{17}}{10^{10}}\ eV$

$= 0.42\ eV$

3.4

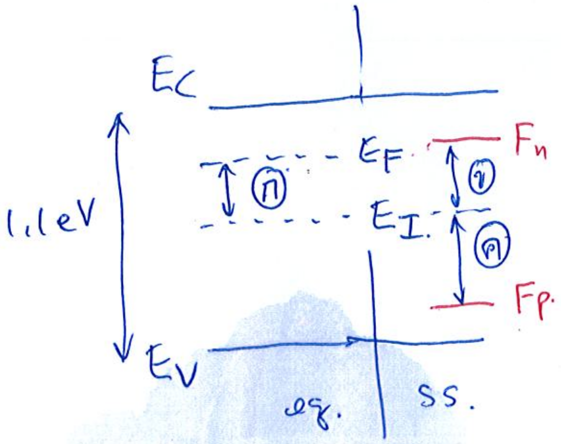
Equi.

Si

$As = 10^{17}\ cm^{-3} \longrightarrow n_0 = 10^{17}\ cm^{-3}$

$\downarrow$

$p_0 = 10^{3}\ cm^{-3}$ } equi



$n_0 = n_i \exp\left(\frac{E_F - E_i}{kT}\right)$

$\therefore\ n = kT \ln \frac{n_0}{n_i} = 0.026 \ln \frac{10^{17}}{10^{10}}\ eV$

$= 0.42\ eV.$

3.7

Excess.

(a) $\delta n = \delta p = g_{op} \cdot \tau = \frac{10^{16}}{1} \cdot 3 \quad \frac{EHP / \cancel{\mu s}}{cm^3\ \cancel{\mu s}}.$

$\therefore\ n = n_0 + \delta n = 1.3 \times 10^{17}\ cm^{-3}$

$p = p_0 + \delta p \simeq 3 \times 10^{16}\ cm^{-3}.$

(b). $\therefore\ v = kT \ln \frac{n}{n_i} = 0.026 \ln \frac{\ }{10^{10}} = 0.428\ eV$

$p = kT \ln \frac{p}{n_i} = 0.026 \ln \frac{\ }{10^{10}} = 0.388\ eV.$