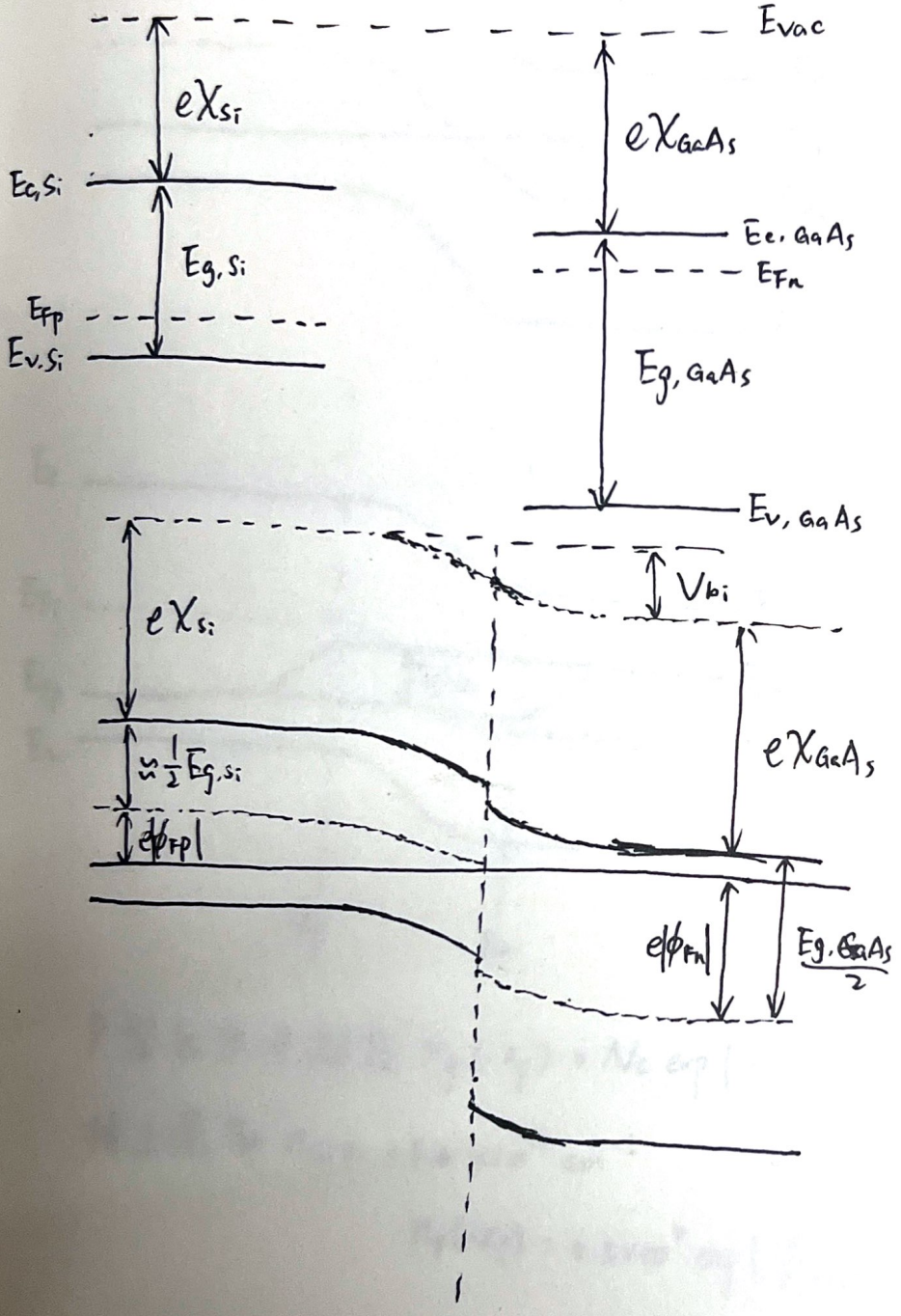
1. $E_{g,Si} = 1.12eV$, $E_{g,GaAs} = 1.42eV$

$\chi_{Si} = 4.05V$, $\chi_{GaAs} = 4.07eV$, $\Delta E_c = -0.02eV$, $\Delta E_v = E_{g,GaAs} - E_{g,Si} - \Delta E_c$
$= 0.32eV$

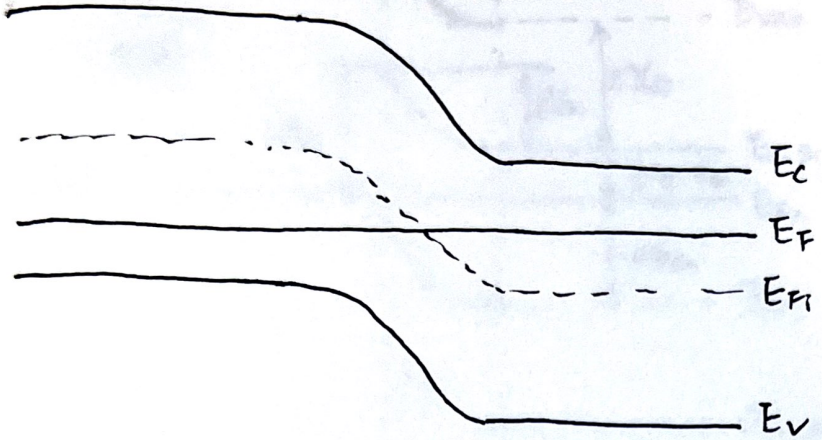


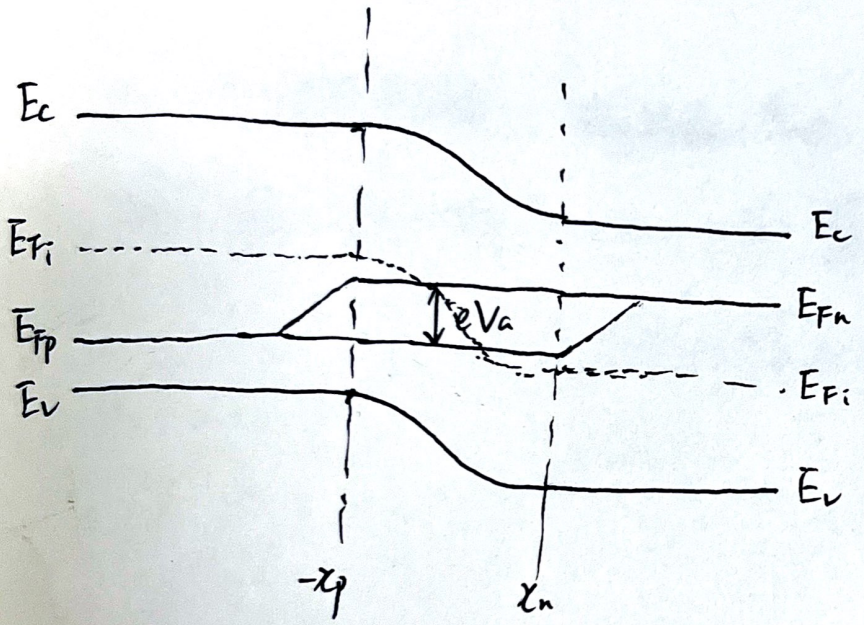
$$V_{bi} = (\chi_{Si} - \chi_{GaAs}) + \frac{1}{2q}(E_{g,Si} - E_{g,GaAs}) + (|\phi_{Fp}| + |\phi_{Fn}|)$$

$$= \frac{\Delta E_c}{q} + \frac{1}{2q}\Delta E_g + \frac{kT}{q}\ln\left(\frac{N_A}{n_{i,Si}} \cdot \frac{N_D}{n_{i,GaAs}}\right) = -0.02 - 0.15 + 0.0259 \times \ln\left(\frac{10^{32}}{2.1\times10^{16}}\right)$$

$$= -0.17 + 0.0259 \times (16\ln 10 - \ln 2.1) = 0.7650V$$

2.





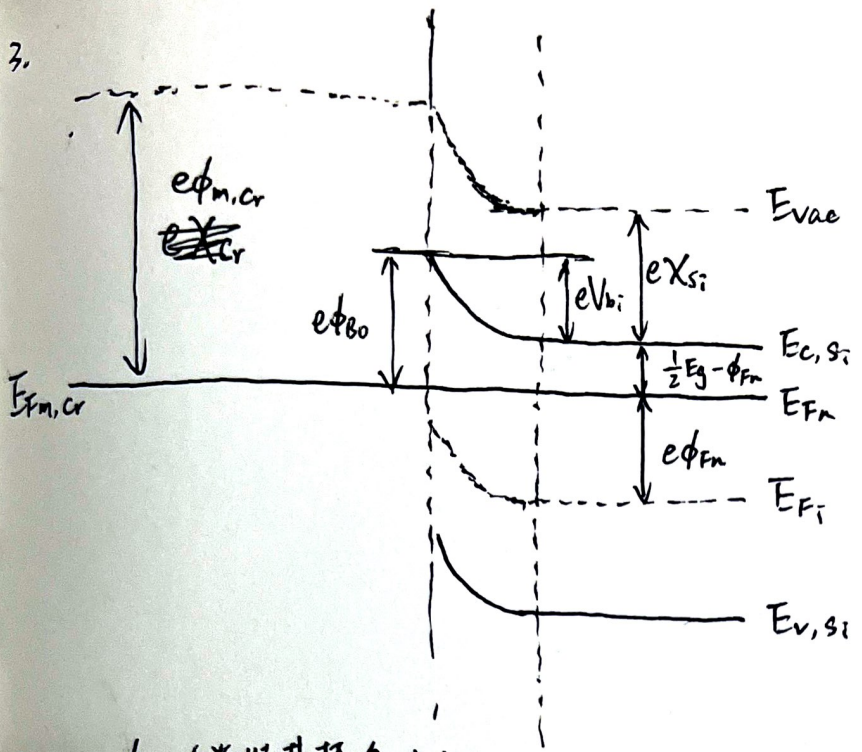
P型区少子浓度 $n_p(-x_p) = N_c \exp\left(\frac{E_{Fn}-E_c}{kT}\right) = \frac{n_i^2}{N_A}\exp\left(\frac{qV_a}{kT}\right)$

按上题取 $n_{i,Si} = 1.0\times10^{10}\ cm^{-3}$

$$n_p(-x_p) = 0.5\times10^{4}\exp\left(\frac{0.61}{0.0259}\right) = 8.463\times10^{13}\ cm^{-3}$$

同理可得 $p_n(x_n) = \frac{n_i^2}{N_D}\exp\left(\frac{qV_a}{kT}\right) = n_p(-x_p)\cdot\frac{N_A}{N_D} = 3.385\times10^{3}\ cm^{-3}$

3.



ϕ_{Bo} (肖特基势垒高度) = ~~$\chi_{Cr} - \chi_{Si}$~~ $\phi_{m,Cr} - \chi_{Si} = 4.6 - 4.05 = 0.55V$

$V_{bi} = \phi_{Bo} - \frac{1}{2}E_g + \phi_{Fn} = 0.55 - 0.56 + \frac{kT}{q}\ln\left(\frac{N_D}{n_i}\right)$ ，其 $n_i = 1.0\times10^{10}\ cm^{-3}$

$= 0.0259 \times (\ln 3 + 5\ln 10) - 0.01$

$= 0.3167\ V$