Problem 4.2

a)

$$R = \rho\frac{d}{A}$$
$$\vec{j} = \frac{I}{A} = -ne\vec{v_d}$$

$$\begin{aligned}\vec{v_d} &= -\frac{I}{Ane} = -\frac{V}{RAne} = -\frac{V}{\rho\frac{d}{A}Ane} = -\frac{V}{\rho dne} \\ &= -\frac{3}{-1.6\times10^{-2}\times0.01\times2\times10^{15}\times10^{6}\times1.6\times10^{-19}} \\ &= 58.59\ m/s\end{aligned}$$

$$\vec{E} = -\vec{v_d}\times\vec{B} = -58.59\times0.1T = -5.859N/C$$
$$V = -\int\vec{E}\cdot d\vec{l} = -\int_0^{0.002} -5.859dl = 1.1718\times10^{-2}V$$

b)

$$V_H = -\int -\vec{v_d}\times\vec{B} = -\int_{y1}^{y2}\frac{V}{\rho dne}B = -(y2-y1)\frac{VB}{\rho dne}$$

Given that $y_2 - y1 > 0$, $V_H > 0$ if $e < 0$ and $V_H < 0$ if $e > 0$