69. (a) We use Eq. 29-10: $v_d = E/B = (10 \times 10^{-6}\,\mathrm{V}/1.0 \times 10^{-2}\,\mathrm{m})/(1.5\,\mathrm{T}) = 6.7 \times 10^{-4}\,\mathrm{m/s}$.

(b) We rewrite Eq. 29-12 in terms of the electric field:

$$n = \frac{Bi}{V\ell e} = \frac{Bi}{(Ed)\ell e} = \frac{Bi}{EAe}$$

which we use $A = \ell d$. In this experiment, $A = (0.010\,\mathrm{m})(10 \times 10^{-6}\,\mathrm{m}) = 1.0 \times 10^{-7}\,\mathrm{m}^2$. By Eq. 29-10, v_d equals the ratio of the fields (as noted in part (a)), so we are led to

$$\begin{aligned} n &= \frac{Bi}{EAe} = \frac{i}{v_d Ae} \\ &= \frac{3.0\,\mathrm{A}}{(6.7 \times 10^{-4}\,\mathrm{m/s})(1.0 \times 10^{-7}\,\mathrm{m}^2)(1.6 \times 10^{-19}\,\mathrm{C})} \\ &= 2.8 \times 10^{29}/\mathrm{m}^3\ . \end{aligned}$$

(c) Since a drawing of an inherently 3-D situation can be misleading, we describe it in terms of horizontal *north, south, east, west* and vertical *up* and *down* directions. We assume $\vec{B}$ points up and the conductor's width of 0.010 m is along an east-west line. We take the current going northward. The conduction electrons experience a westward magnetic force (by the right-hand rule), which results in the west side of the conductor being negative and the east side being positive (with reference to the Hall voltage which becomes established).