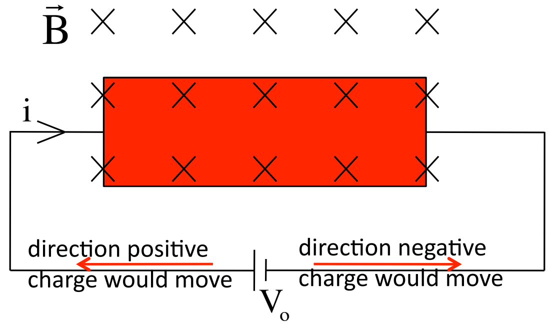
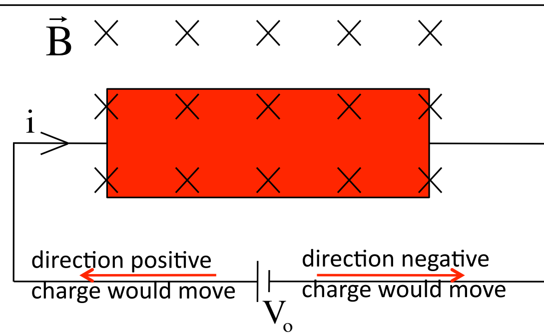
Problem 29.51



The bar is perpendicular to the earth's magnetic field (B is into the page in this case). If positive charge moves through the circuit, it will move clockwise in the circuit and will interact with the magnetic field in such a way as to be forced upward (this from F = qvxB). If negative charge is what moves, it will move counterclockwise in the circuit and will interact with the magnetic field in such a way as to be ALSO forced upward (this from F = -qvxB). In other words, either we end up with the upper bar being electrically positive (with a corresponding "high" voltage along that edge) or electrically negative (with a corresponding "low" voltage along that edge). A voltmeter can be used to determine which it is, and with that information we will know if positive or negative charge is what actually moves.



As for the actual problem: The book goes through a fairly complete job of relating the current, magnetic field, Hall voltage (defined as the voltage difference between the top and bottom of the bar), the number of available, mobile charge carriers per unit volume "n," charge on a charge carrier and the thickness "t" of the bar. That relationship allows us to write:

$$\Delta V_H = \frac{iB}{nqt}$$

$$\Rightarrow \quad B = \frac{nqt(\Delta V_H)}{i}$$

$$\Rightarrow \quad B = \frac{(8.46\text{x}10^{28}\ \text{m}^{-3})(1.6\text{x}10^{-19}\ \text{C})(.5\text{x}10^{-2}\ \text{m})(5.1\text{x}10^{-12}\ \text{V})}{(8\ \text{A})}$$

$$= 9.98\text{x}10^{-6}\ \text{T}$$