Monday Reading Assessment: Unit 3, Magnetic Forces and Fields

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March 30, 2020

1 Memory Bank

- $V_{\rm H} = Blv$ ... The Hall voltage, given external B-field, height of conductor, l, and the drift velocity v.
- $V_{\rm H} = (IBl)/(nqA)$ ... The Hall voltage, given external B-field, height of the conductor, l, the number density, n, the charge per carrier, q, and the conductor area A.
- $\vec{F} = I\vec{L} \times \vec{B}$ ... The Lorentz force on a current.

2 The Hall Effect

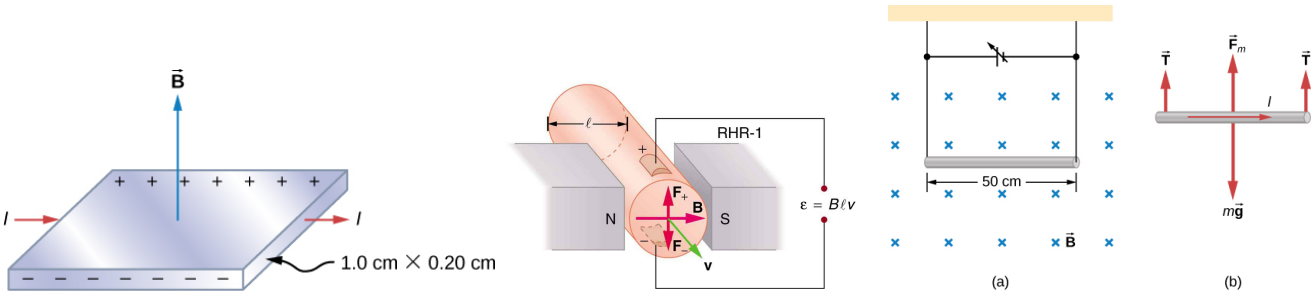

Figure 1: (Left) A geometry in which the Hall effect occurs. (Middle) A Hall-probe is used to measure fluid flow. (Right) A force is placed on a wire in a B-field.

1. Figure 1 (left) shows a silver ribbon whose cross section is 1.0 cm by 0.20 cm. The ribbon carries a current of 100 A from left to right, and it lies in a uniform magnetic field of magnitude 1.5 T. Using a density value of $n = 6 \times 10^{28}$ electrons per cubic meter for silver, find the Hall potential between the edges of the ribbon.

2. A Hall probe is used to measure fluid flow (Fig. 1, middle). Suppose a small tube carries fluid moving at velocity v, in a 0.8 T B-field, and the tube is 1 cm wide. The Hall voltage is 0.5×10^{-6} Volts. What is v?

3 Magnetic Forces on a Wire

1. Consider Fig. 1, right, in which a 0.5 T B-field suspends a 10 gram wire of length 0.5 meters. What is the current in the wire, and in which direction?