Thursday Reading Assessment: Unit 3, Magnetic Forces and Fields

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1 Memory Bank

- $\vec{F} = I\vec{L} \times \vec{B}$ ... Lorentz Force on a Current
- $B = (\mu_0 I)/(2\pi r)$ ... The magnetic field B *caused* by the current I a distance r away.
- $\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

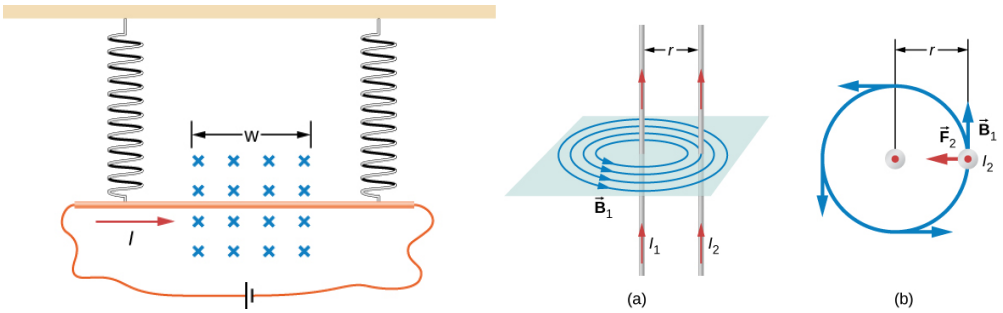

Figure 1: (Left) A current-carrying rod suspended by springs in a B-field. (Right) Current 1 causes a B-field to exert a Lorentz force on wire 2. Note that the RHR-2 determines the vector direction of the B-field.

2 Force on a Wire

1. Consider Fig. 1 (left). A metal rod of mass m and length L is hung from the ceiling using two springs of spring constant k. A uniform magnetic field of magnitude B pointing perpendicular to the rod and spring exists in a region of space covering a length w of the copper rod. The ends of the rod are then connected by flexible copper wire across the terminals of a battery. Determine the change in the length Δy of the springs when a current I runs through the copper rod, in terms of the other given variables.

3 Ampere's Law

1. Consider Fig. 1, in which the current I_1 *creates* a B-field $\vec{B}$ that encircles I_1. Each wire has a length of 1 meter, is separated by 1 meter from the other, and carries a current of 1 amp in the same direction as the other. What is the force that I_1 exerts on I_2?