Warm-Up for April 27th, 2022

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April 27, 2022

1 Memory Bank

1. The *magnetic flux* through a surface $\mathcal{S}$ is

$$\Phi_{\rm m} = \int_{\mathcal{S}} \mathbf{B} \cdot d\mathbf{a} \tag{1}$$

2. **Faraday's Law** states that the *induced emf* in a conductor forming the boundary of $\mathcal{S}$ is

$$\epsilon = -\frac{d\Phi_{\rm m}}{dt} \tag{2}$$

2 Magnetic Flux, EMF, and Faraday's Law

1. Rederive the formula for the magnetic field within a solenoid that has n turns per unit length and current I (assume the length L is much longer than the radius R).

2. What is $\Phi_{\rm m}$ through a coil with radius r inside the solenoid, and oriented for maximum $\Phi_{\rm m}$?

3. If $I(t) = I_0 + kt$, what is the induced emf in the coil?

4. For cases (a) - (c) in Fig. 1, state the reason for the relative orientation (or lack of) currents in the left and right coils.

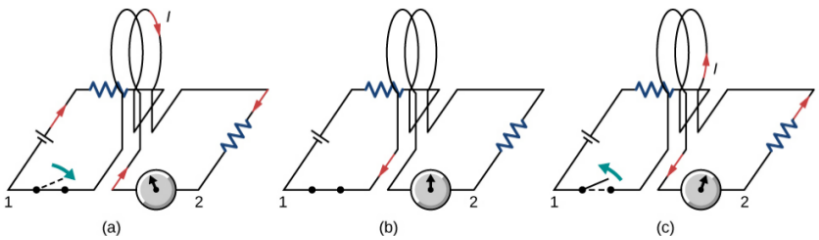

Figure 1: The prototypical experiment that reveals Faraday's Law. Connecting an emf to a circuit with a coil induces an emf in a separate circuit with a corresponding coil.