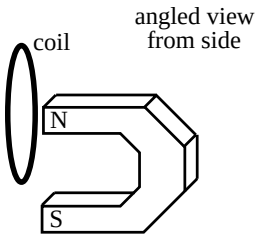
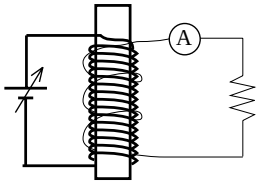
Faraday's Law -- Conceptual Questions

1.) As you found when we dealt with Gauss's Law, it is possible to have an electric flux. Is it possible to have a magnetic flux? If so, how would it be defined?

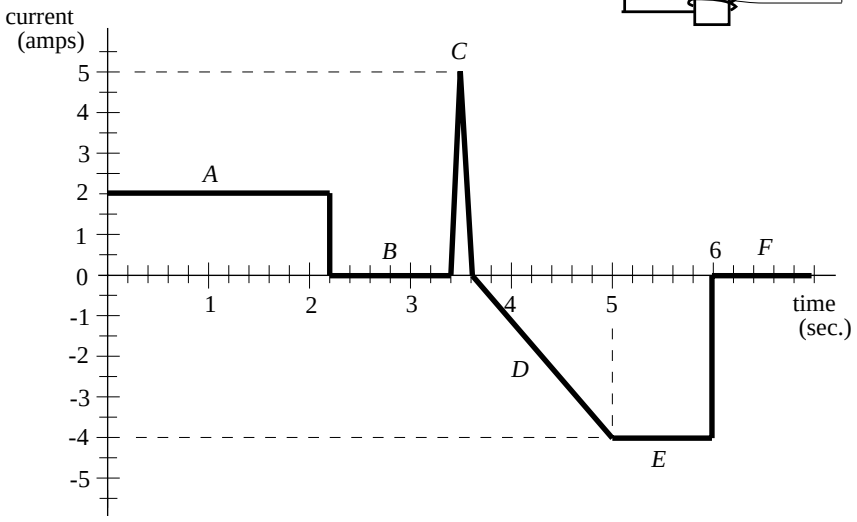


2.) A coil is placed in the vicinity of a horseshoe magnet.
   a.) Once in place, is there a flux through the coil?
   b.) Once in place, is there a current in the coil? If so, why? Also, if so, in what direction will the current flow?

3.) The coil alluded to in *Problem 2* is placed in the vicinity of the same horseshoe magnet, but this time the coil is rapidly pulled away from the magnet.
   a.) Is there an initial flux through the coil?
   b.) What happens to the flux as the coil is pulled away?
   c.) From the standard perspective associated with magnetic fields and charges moving in magnetic fields, would you expect a current to flow in the coil as the coil was pulled away from the magnet? If so, why? Also, in what direction would the current flow?
   d.) From Faraday's perspective, would you expect a current to flow in the coil as the coil was pulled away from the magnet? If so, how would Faraday explain the current? Also, how would he determine the direction of current flow?

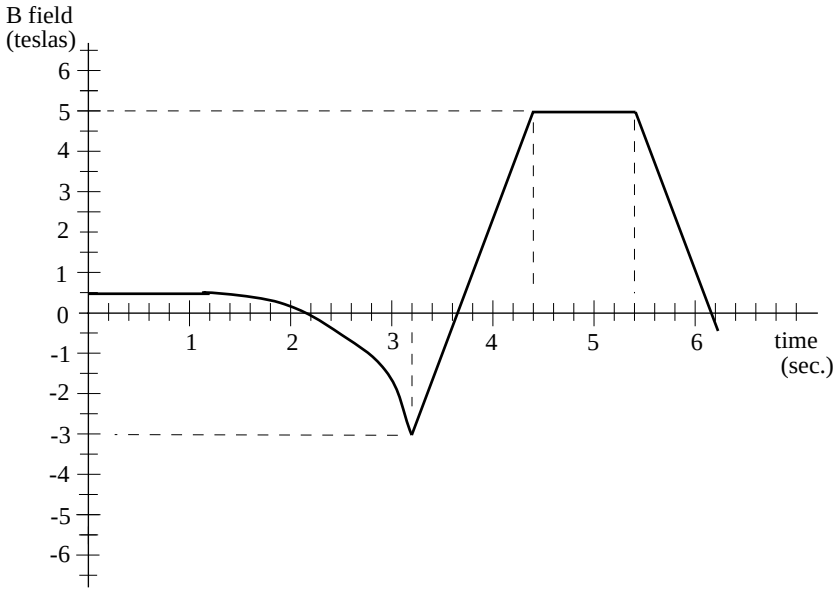


4.) Two coils share a common axis but are electrically isolated from one another (that is, they aren't electrically connected). The coil on the left is attached to a variable power supply (we'll call this *the primary circuit*). The coil on the right is attached only to a resistor and ammeter (we'll call this *the secondary circuit*). One of the more hyperactive students in the crowd



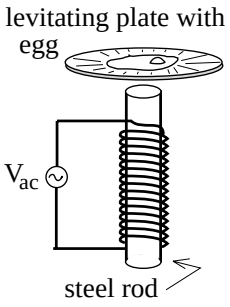
begins to play with the voltage across the primary coil power supply while a second student records, then graphs the current in the SECONDARY coil. That graph is shown in the sketch. There are six time intervals identified by letters on the graph (i.e., *A* corresponds to the current during the period between *t = 0* and *t = 2.2 seconds*, etc.). Explain what must be happening to the power supply in the *primary circuit* during each of those time periods.

5.) The magnetic field down the axis of a coil varies with time as graphed to the right. On the graph, sketch the induced EMF set up in the coil.



6.) If the graph in *Problem 5* had been of the EMF set up in the coil as a function of time, what could you say about the magnetic flux through the coil?

7.) An AC source is attached to a coil that has a vertical, steel bar down its axis. When the power is turned on, an alternating magnetic field is set up along the axis of the bar. An aluminum plate is centered over the bar at its upper end. When power is provided to the coil, the plate levitates.



a.) Is aluminum a magnetizable material?

b.) Why does the plate levitate?

c.) An egg is broken onto the plate. What will happen to the egg . . . and why?

8.) What is inductance? How is it comparable to resistance and capacitance?

9.) How do transformers work?

10.) What's the difference between a generator and an electric motor?