Physics 142 – Fall 2014 – Workshop module 9

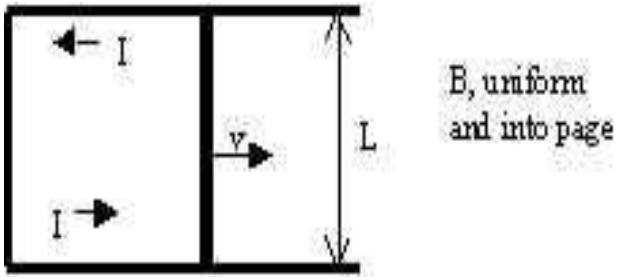
1. Quickly review the concept of electromagnetic induction. Break up into 3 groups if possible. Create two problems for the rest of the class to figure out … be tricky! Each group should go to the board and present their problems for the class to discuss.

   Group 1 should consider two circular loops lying next to each other in a plane. Current of either charge flows with a time-dependence in either direction in one of the loops. What is the direction of the induced current in the other loop?

   Group 2 should do the same … except the two loops in this case are not in the same plane, rather they are coaxial with one lying near the other … like two rings on one finger.

   Group 3 should consider a long, straight current carrying wire with a time–dependent current of either charge going in either direction. Near, but not encircling, this wire they should place a circular conducting loop … in ANY orientation. What is the direction of the induced current in the loop?

2. In the figure below, a rod with length L=0.0650 m moves in a magnetic field with a magnitude B=1.20 T. The emf induced in the moving rod is 0.320 V. a) What is the speed of the rod? b) If the total circuit resistance is 0.800 Ohms, what is the induced current? c) What force (magnitude and direction) does the field exert on the rod as a result of this current? Can you think of different ways to explain the existence of this force?



3. Two closely wound circular coils have the same number of turns, but one has twice the radius of the other. How are the self-inductances of the two coils related?

4. Two coils are wound on the same form so that the magnetic field from one coil produces flux through the turns of the second coil. When the current in the first coil is decreasing at a rate of -0.0850 A/s, the induced emf in the second coil has magnitude 7.3×10^{-3} V. a) What is the mutual inductance of the pair of coils? B) If the second coil has five turns, what is the flux through each turn when the current in the first coil equals 1.60 A? c) If the current in the second coil increases at a rate of 0.0500 A/s, what is the induced emf in the first coil?

5. A stiff wire bent in the form of a semicircle of radius A is rotated with a frequency ν in a uniform magnetic field. What are the frequency and amplitude of the emf induced in the loop?