

## Physics 142 – Fall 2008 – Workshop module 10

1. A uniformly charged disk rotates in a plane perpendicular to a uniform magnetic field. The area of the disk is not changing and the B field is constant. So, the magnetic flux through the disk is constant. How is it that an EMF is formed between the center of the disk and the outer edge of the disk? Does this not contradict Faraday's law? ... Who is this Faraday anyway? We don't need no stinkin' Faraday's law ...
2. Heart pacemakers usually consist of an RC circuit. The capacitor charges up to a certain voltage and then discharges. Discuss how such a thing might help the heart. How would you adjust the heartbeat timing? Why do you think it is a bad idea for someone with a pacemaker to walk in a room containing a piece of equipment with a large magnetic field?
3. A stiff wire bent in the form of a semicircle of radius A is rotated with a frequency  $\nu$  in a uniform magnetic field. What are the frequency and amplitude of the emf induced in the loop?



4. Consider the circuit below. With switch  $S_1$  closed and the other two switches open, the circuit has time constant  $\tau_1$ . With switch  $S_2$  closed and the other two switches open, the circuit has time constant  $\tau_2$ . With switch  $S_3$  closed and the other two switches open, the circuit oscillates with period  $T$ . Show that

$$T = 2\pi\sqrt{\tau_1\tau_2}$$

