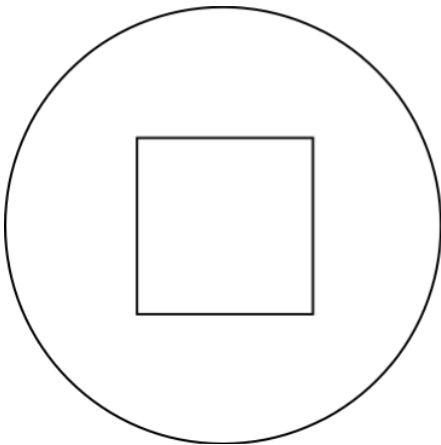


Physics 10164 - Exam 3A

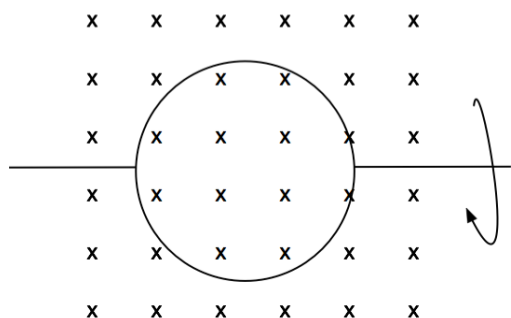
Partial credit will be given provided you show all work and are solving parts of the problem correctly. Points will be deducted if you don't show your work even if you get the right answer. Clearly indicate your answer with a circle or a box and remember to include correct units and significant figures.

1. (30 pts) Below, we are seeing an end-on view of a 150 turn solenoid that has a radius of 12 cm, length of 24 cm and a clockwise current of 3.1 Amps. Inside the solenoid is a small, single-turn square loop, 7.5 cm on a side. Over a time interval of 0.055 seconds, the current in the solenoid is reduced from 3.1 Amps to zero.
 - a) What is the initial direction of magnetic flux through the square loop? _____
 - b) How is that flux changing over the 0.055 sec time interval? (increasing, decreasing)
 - c) What is the direction of the magnetic field induced due to the square loop? _____
 - d) What is the direction of the current induced in the square loop? (cw, counter-cw)
 - e) What is the magnitude of the average induced EMF in the square loop during the 0.055 sec interval?



2. (40 pts) A generator provides voltage $\varepsilon_{\max} = 170$ with a frequency of 60 Hz. Below, the generator coil is shown turning through a constant external magnetic field.

- a) If the coil is oriented as shown at $t = 0$, at what time t will the coil have completed $1/4$ of a turn?



- b) What will be the voltage provided by the coil at the instant when $t = 0$? Explain.

- c) What will be the voltage provided by the coil at the instant it has completed $1/4$ of a turn? Explain.

- d) The coil provides an rms current of 85 Amps. If the generator output is sent through a transformer, the rms voltage is stepped up to 1800 Volts. What percentage of the power supplied is lost due to resistive heating in a 72 Ohm wire?

#3. (30 pts) An alternating current circuit has an voltage source $\varepsilon(t) = 311 \sin(120\pi t)$, a 27 Ohm resistor, and a 75 μF capacitor.

- a) What is the maximum current for this circuit?
- b) At the instant when the current is at its maximum value, what is (i) the voltage drop across the resistor, (ii) the voltage drop across the capacitor, and (iii) the voltage drop across the source?