

## Practice Problem Set on Induction and Inductance

Practice only - Not to be turned in for credit!

### Question 1 (1 point)

What is Lenz's Law, and to what conservation law is it related?

### Question 2 (3 points)

A circular coil of wire with 350 turns and a radius of 7.5 cm is placed horizontally on a table. A uniform magnetic field pointing directly up is slowly turned on, such that the strength of the magnetic field can be expressed as a function of time as:  $B(t) = 0.02(\text{T/s}^2) \times t^2$ . What is the total EMF in the coil as a function of time? In which direction does the current flow?

### Question 3 (3 points)

A metal bar with a resistance of  $30\ \Omega$  is rotated around its center in a magnetic field of strength 0.5 T which is oriented perpendicularly to the plane of the bar's rotation. If the bar makes 3 full rotations per second, what is the electrical power dissipated in the resistor?

### Question 4 (3 points)

Use Gauss' Law and Ampere's Law to find both the capacitance per unit length and the inductance per unit length of a coaxial cable with an outer radius of 4.5 mm and an inner radius of 1.5 mm. Assume the space between the two conductors is filled with air.