Print Names in Team: _____.

Physics 232	Mission 6: Faraday's Law & Applications

Please work each problem in the white space provided. Attach additional sheets if necessary. Print this one-sided and staple in the top left corner with a metal staple once complete. Each team turns in one document.

Problem 33 Suppose a magnetic field is zero everywhere except for a region $0 \leq x \leq L$ where a magnetic field of $B = 2.0\ T$ directed in the positive z-direction (out of the page). In other words, $\vec{B} = (2.0T)\hat{z}$ for $0 \leq x \leq L$ and $\vec{B} = 0$ elsewhere. Suppose a loop of wire travels in the positive x-direction in the xy-plane. Find the following: (assume the loop is a circle of radius less than L)

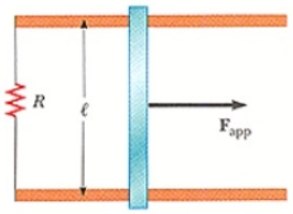
(a.) Find the direction of the induced current in the loop as the loop enters the region $0 \leq x \leq L$

(b.) Find the magnitude of the induced current in the loop as the loop is inside the region $0 \leq x \leq L$

(c.) Find the direction of the induced current in the loop as the loop leaves the region $0 \leq x \leq L$

Problem 34 Suppose $B_z(t) = \alpha \sin(kt)$ is the z-component of the magnetic field in the xy-plane where $\alpha = 2.0\ T$ and $k = 10\ Hz$. This means the magnitude changes the same way at all points in the plane. Suppose a 25 cm^2 loop with resistance 3.0 Ω is placed in the xy-plane. What current is induced in the loop at time t ?

Problem 35 The figure below shows a top view of a bar that can slide without friction. The resistor is 6.30 Ω and a 2.50 T magnetic field is directed perpendicularly downward, into the paper. Let $\ell = 1.20\ m$.

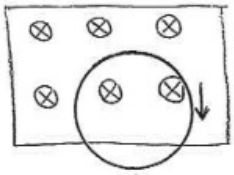


(a.) Calculate the applied force required to move the bar to the right at a constant speed of 1.90 m/s.

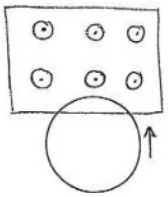
(b.) At what rate energy delivered in the resistor ?

Problem 36 Given the diagrams below, indicate the direction of the induced current in each case:

(a.) .

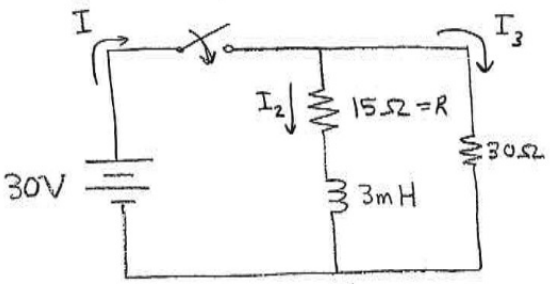


(b.) .

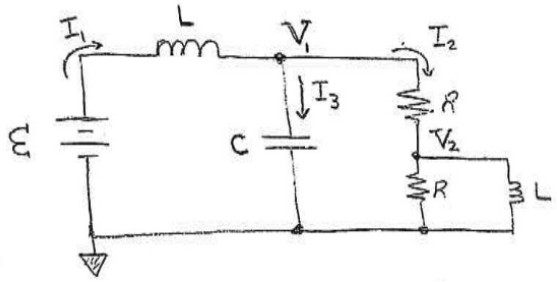


Problem 37 A solenoid of length 20.0 cm with N-turns has a current $I = 6.00\ A$ flowing. If the magnetic field strength near the center of the solenoid is measured to have a magnitude $0.0188\ T$ then what is N ? Assume the edge-effects are neglible.

Problem 38 Find the current as a function of time for the RL-circuit pictured below for $t > 0$. Assume the pictured switch is closed at time $t = 0$.



Problem 39 Find the currents and voltages indicated below (assume the circuit has been connected a long time)



Problem 40 Write Maxwell's Equations in both integral and differential form (name each one).

Problem 41 Show that Maxwell's Equations imply the local conservation of charge.