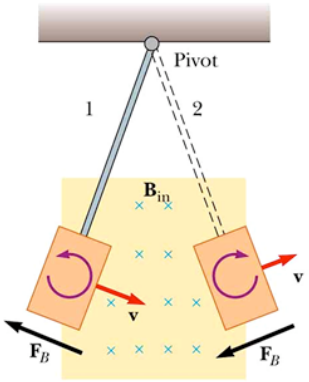
Physics 196 Name _____
Test 3 - 120 Points

You must choose six of the nine problems below to complete.
*You must cross out the those that will **NOT** be graded. Watch your sig figs. and units.*

1. A flat loop of wire consisting of a single turn of cross-sectional area 7.60 cm^2 is perpendicular to a magnetic field that increases uniformly in magnitude from 0.500 T to 3.20 T in 0.97 s. What is the resulting induced current if the loop has a resistance of 2.60 ohms? What is the direction of the current in the coil? (10 points)

I =

2. Formation of **Eddy Currents** are developed in the plate which is swinging through the magnetic field (10 points)

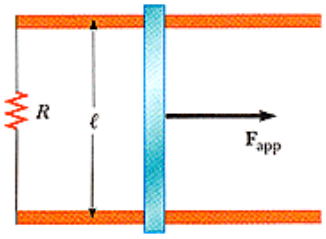


a. because of the changing direction of the current in the plate.
b. because of the changing magnetic flux through the plate.
c. because of the changing magnetic field through the plate.
d. because Lenz's Law states that a current should be induced due to a changing velocity.
e. because Lenz's Law states that the induced magnetic field will cause a current in the opposite direction of the velocity.

Due to **Lenz's Law** the **direction of the induced magnetic field** in 1 and 2 is

a. out of the page since the magnetic flux is increasing. Into the page because the magnetic flux is decreasing.
b. into of the page since the magnetic flux is decreasing. Out of the page because the magnetic flux is increasing.
c. into of the page since the magnetic flux is increasing. Out of the page because the magnetic flux is decreasing.
d. out of the page since the magnetic flux is decreasing. Into the page because the magnetic flux is increasing.
the the left because the current is CCW.

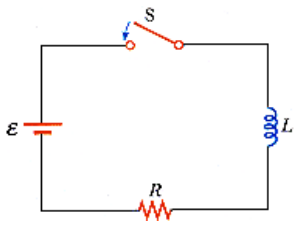
3. The figure shows a top view of a bar that can slide without friction. The resistor is 6.70 ohms and a 2.50 T magnetic field is directed perpendicularly downward, into the paper. Let *l* = 1.20 m. (a) Calculate the applied force required to move the bar to the right at a constant speed of 1.80 m/s. (b) At what rate is energy delivered in the resistor? (10 points)



F =

P =

4. Consider the circuit, taking emf = 8 V, L = 4.50 mH, and R = 7.60 ohms. (10 points)



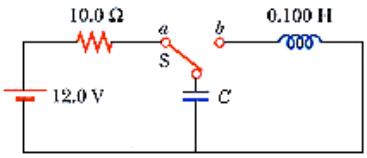
(a) What is the inductive time constant of the circuit?
(b) Calculate the current in the circuit 270 μs after the switch is closed.
(c) What is the value of the final steady-state current?
(d) How long does it take the current to reach 60% of its maximum value?

t =

I =

I =

t =



5. The switch is connected to point a for a long time (C = 2.50 μF). Suppose that the switch is thrown to point b. (10 points)

(a) What is the frequency of oscillation of the LC circuit?
(b) Determine the maximum charge that appears on the capacitor.
(c) Determine the maximum current in the inductor.
(d) Determine the total energy the circuit possesses at t = 3.00 s.

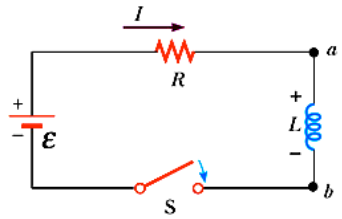
f =

Q =

I =

E =

6) Derive this equation. Draw the graph. (10 points) $I = \frac{\varepsilon}{R}(1 - e^{\frac{-Rt}{L}})$



7. A series ac circuit contains the following components: R = 157 ohms, L = 245 mH, C = 2.00 μF, and a source with ΔV_{max} = 215 V operating at 50.0 Hz. Calculate the following quantities. (10 points)

(a) the inductive reactance (b) the capacitive reactance (c) the impedance (d) the maximum current (e) the phase angle between current and generator voltage (f) Does the current lead or lag the voltage?

a.

b.

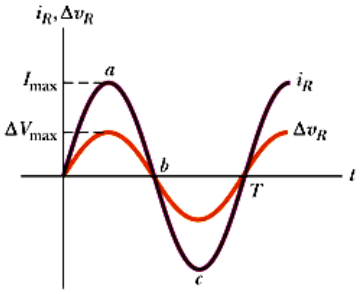
c.

d.

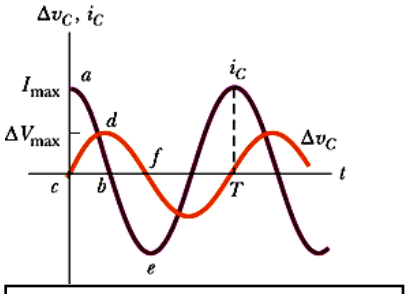
e.

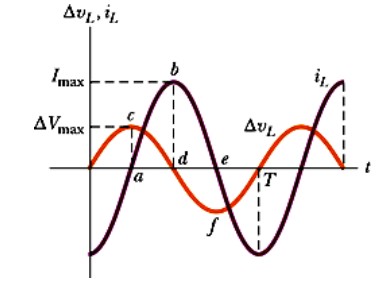
f.

8.Write the similar equation for each graph using the first as a template. (10 points)



$$i_R = \frac{V_{max}}{R}\sin(\omega t)$$

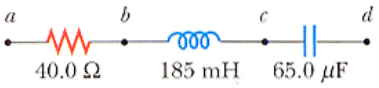




In an AC circuit, when will the current be at a maximum for an **inductive circuit**? For a **capacitive circuit**?

a. The frequency of the source does not matter. What matters is that the voltage either leads or lags the current.
b. When the frequency is a minimum the current will be a maximum in an inductive circuit. When the frequency is a maximum the current will be a maximum in a capacitive circuit.
c. When the frequency is a maximum the current will be a maximum in an inductive circuit. When the frequency is a minimum the current will be a maximum in a capacitive circuit.
d. Whenever the frequency goes to zero the current goes to a maximum.
e. Whenever the frequency goes to infinity the current goes to zero.

9. An AC source with ΔVmax = 170 V and f = 25.0 Hz is connected between points a and d in the figure. Calculate the maximum voltages between the following points. (a) a and b (b) b and c (c) c and d (d) b and d
(10 points)



a.

b.

c.

d.