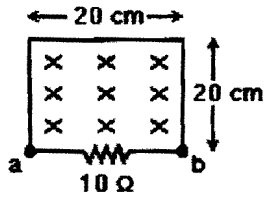
Name_Professor S. K. Sinha _____

$\mu = 4.\pi.10^{-7} = 1.26.10^{-6}$ N/A2

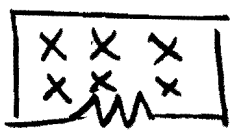
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Figure 30.1



1) In Figure 30.1, a wire and a 10 ohm resistor are used to form a circuit in the shape of a square, 20 cm by 20 cm. A uniform but non-steady magnetic field is directed into the plane of the circuit. The magnitude of the magnetic field is decreased from 0.90 T to 0.30 T in a time interval of 60 ms. The average induced current and its direction through the resistor, in this time interval, are closest to:

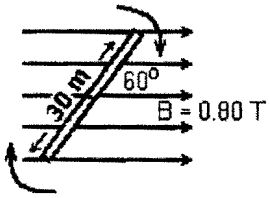
A) 40 mA, from a to b
B) 40 mA, from b to a
C) 60 mA, from a to b
D) 24 mA, from b to a
E) 24 mA, from a to b



$\langle \mathcal{E} = \left\langle -\frac{\partial \Phi}{\partial t} \right\rangle = -\frac{\Delta \Phi}{\Delta t}$

$\frac{.60\,T \cdot .04\,m^2}{.06} = .4$

Figure 30.4



$\frac{.4}{10} = .04\,mA$ from b to a by RHR

Wire is wound on a square frame, 30 cm by 30 cm, to form a coil of 4 turns. The frame is mounted on a horizontal shaft through its center (perpendicular to the plane of the diagram). The coil is in clockwise rotation, with a period of 0.01 s. A uniform, horizontal, magnetic field of 0.80 T is present. At a given instant, the plane of the coil forms a 60° angle with the horizontal, as shown.

2) In Figure 30.4, at that instant, the emf induced in the coil is closest to:

A) 11 V B) 18 V C) 16 V D) 9 V E) 13 V

τ should have been .1 sec

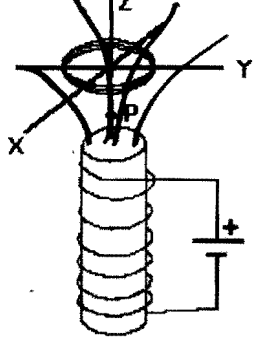
$\tau = .1 \Rightarrow f = 10 \Rightarrow \omega = 20\pi$

$\Phi = (.09)(.8)\sin(\omega t).4 \Rightarrow \mathcal{E} = (.09)(.8)\,20\pi\cos(\omega t)$

A B n

but when $\omega t = 60 \Rightarrow \cos(\omega t)$

$\mathcal{E} = .72 \cdot 4\pi \approx 9V$ A-1 $\mathcal{E} = .072 \cdot 20 \cdot \pi \cdot \frac{1}{2} \cdot 4$



3) In Figure 30.5, a coil of wire is placed on the axis of a solenoid carrying a DC current. Which of the following will NOT result in an EMF being induced in the coil?

A) Move the coil toward point P. → since B fringes, you get more flux the closer you are

B) Rotate the coil about the z-axis. ← does not change flux

C) Rotate the coil about the y-axis. → changes flux

D) Rotate the coil about the x-axis.

E) Change the current in the solenoid. → changes B and thus flux

Situation 31.1

An 18 mH solenoid inductor is wound on a form 0.80 m in length and 0.10 m in diameter. A coil is tightly wound around the solenoid at its center. The coil resistance is 5.0 ohms. The mutual inductance of the coil and solenoid is 60 μH. At a given instant, the current in the solenoid is 300 mA, and is decreasing at the rate of 2.5 A/s.

4) In Situation 31.1, at the given instant, the induced emf in the solenoid is closest to:

A) 45 mV B) 30 mV C) 35 mV D) 40 mV E) 50 mV

$L = \frac{\Phi_1}{I}$ $\quad \mathcal{E} = L\frac{dI_1}{dt} - M\frac{dI_2}{dt}$ → must assume 0 → Emf is constant in this coil

$18\times10^{-3} \cdot 2.5 = 45\text{mV}$

thus I_2 = constant and thus M does not contribute

$I_2 = \frac{\mathcal{E}_2}{R} \propto \frac{dI_1}{dt}$

so $\frac{dI_2}{dt} \propto \frac{d^2I_1}{dt^2}$ at