Ch31 (Homework)
Current Score : – / 24 **Due :** Monday, August 27 2018 02:29 PM CDT

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1. –/1 pointsSerPSE9 31.P.001.

A flat loop of wire consisting of a single turn of cross-sectional area 9.00 cm^2 is perpendicular to a magnetic field that increases uniformly in magnitude from 0.500 T to 2.10 T in 1.06 s. What is the resulting induced current if the loop has a resistance of 2.90 Ω?

[ ] mA

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2. –/1 pointsSerPSE9 31.P.004.WI.

A 24-turn circular coil of wire has diameter 0.93 m. It is placed with its axis along the direction of the Earth's magnetic field of 44.0 μT and then in 0.200 s is flipped 180°. An average emf of what magnitude is generated in the coil?

[ ] mV

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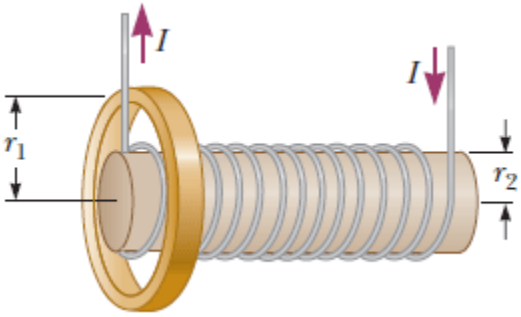
3. –/3 pointsSerPSE9 31.P.011.MI.

An aluminum ring of radius $r_1 = 5.00$ cm and a resistance of $4.25 \times 10^{-4}\ \Omega$ is placed around one end of a long air-core solenoid with 1 020 turns per meter and radius $r_2 = 3.00$ cm as shown in the figure below. Assume the axial component of the field produced by the solenoid is one-half as strong over the area of the end of the solenoid as at the center of the solenoid. Also assume the solenoid produces negligible field outside its cross-sectional area. The current in the solenoid is increasing at a rate of 270 A/s.



(a) What is the induced current in the ring?

[ ] A

(b) At the center of the ring, what is the magnitude of the magnetic field produced by the induced current in the ring?

[ ] μT

(c) At the center of the ring, what is the direction of the magnetic field produced by the induced current in the ring?

- to the left
- to the right
- upward
- downward

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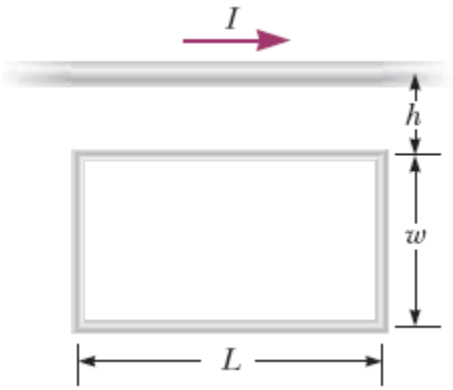
4. –/3 pointsSerPSE9 31.P.013.WI.

A loop of wire in the shape of a rectangle of width w and length L and a long, straight wire carrying a current I lie on a tabletop as shown in the figure below.



(a) Determine the magnetic flux through the loop due to the current I. (Use any variable stated above along with the following as necessary: μ_0 and π.)

Φ_B =

(b) Suppose the current is changing with time according to $I = a + bt$, where a and b are constants. Determine the magnitude of the emf that is induced in the loop if b = 20.0 A/s, h = 1.00 cm, w = 17.0 cm, and L = 1.50 m.

V

(c) What is the direction of the induced current in the rectangle?

- clockwise
- counterclockwise
- The magnitude is zero.

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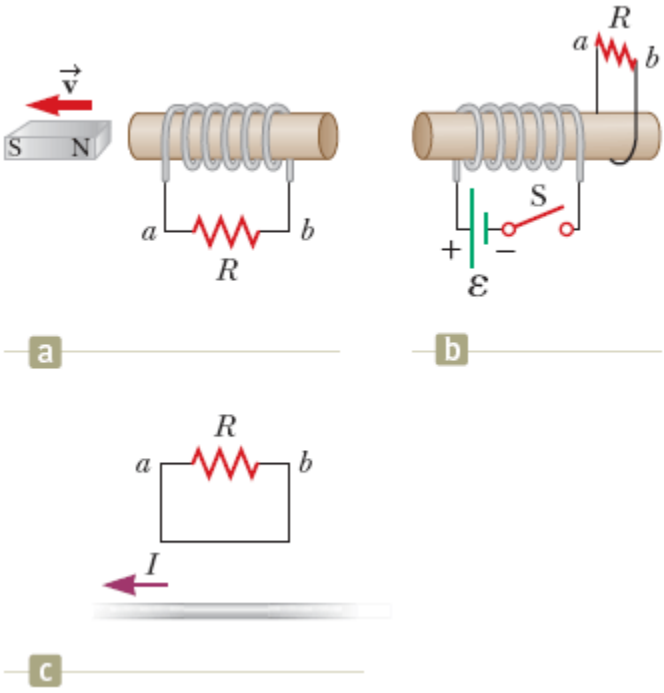
5. –/3 pointsSerPSE9 31.P.022.WI.

Use Lenz's law to answer the following questions concerning the direction of induced currents. Express your answers in terms of the letter labels *a* and *b* in each part of the figure below.



(a) What is the direction of the induced current in the resistor *R* in Figure a when the bar magnet is moved to the left?

- *a* to *b*
- *b* to *a*
- The magnitude is zero.

(b) What is the direction of the current induced in the resistor *R* after the switch S in Figure b is closed?

- *a* to *b*
- *b* to *a*
- The magnitude is zero.

(c) What is the direction of the induced current in the resistor *R* when the current *I* in Figure c decreases rapidly to zero?

- *a* to *b*
- *b* to *a*
- The magnitude is zero.

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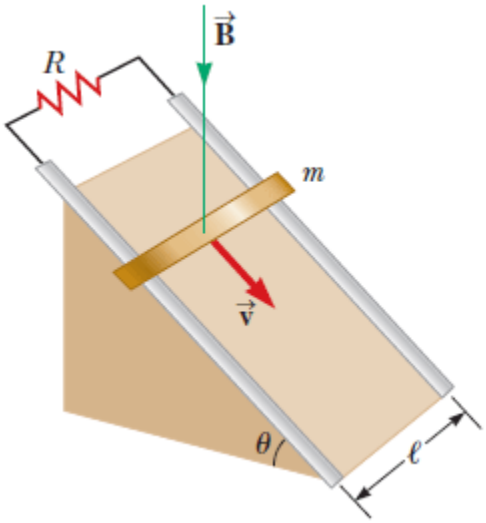
6. –/1 pointsSerPSE9 31.P.031.

The figure below shows a bar of mass m = 0.260 kg that can slide without friction on a pair of rails separated by a distance ℓ = 1.20 m and located on an inclined plane that makes an angle θ = 33.0° with respect to the ground. The resistance of the resistor is R = 3.30 Ω and a uniform magnetic field of magnitude B = 0.500 T is directed downward, perpendicular to the ground, over the entire region through which the bar moves. With what constant speed v does the bar slide along the rails?

[ ] m/s



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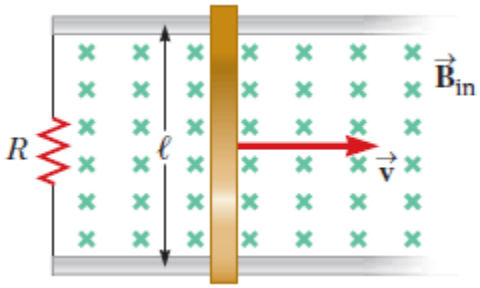
7. –/4 pointsSerPSE9 31.P.034.

A conducting bar of length ℓ moves to the right on two frictionless rails as shown in the figure below. A uniform magnetic field directed into the page has a magnitude of 0.330 T. Assume R = 9.20 Ω and ℓ = 0.320 m.



(a) At what constant speed should the bar move to produce an 8.70-mA current in the resistor?

[ ] m/s

(b) What is the direction of the induced current?

- clockwise
- counterclockwise
- into the page
- out of the page

(c) At what rate is energy delivered to the resistor?

[ ] mW

(d) Explain the origin of the energy being delivered to the resistor.

This answer has not been graded yet.

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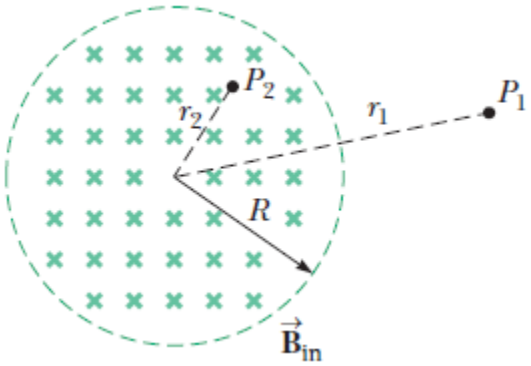
8. –/2 pointsSerPSE9 31.P.040.MI.

A magnetic field directed into the page changes with time according to $B = 0.053\ 0t^2 + 1.40$, where B is in teslas and t is in seconds. The field has a circular cross section of radius $R = 2.50$ cm (see figure below).



(a) When $t = 4.90$ s and $r_2 = 0.020\ 0$ m, what is the magnitude of the electric field at point P_2?

[ ] N/C

(b) When $t = 4.90$ s and $r_2 = 0.020\ 0$ m, what is the direction of the electric field at point P_2?

- perpendicular to r_2 and clockwise
- out of the page
- into the page
- perpendicular to r_2 and counterclockwise

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9. –/5 pointsSerPSE9 31.P.049.

The rotating loop in an AC generator is a square 15.0 cm on a side. It is rotated at 65.0 Hz in a uniform field of 0.800 T. Calculate the following quantities as functions of time t, where t is in seconds.

(a) the flux through the loop

$\text{mT}\cdot\text{m}^2$

(b) the emf induced in the loop

V

(c) the current induced in the loop for a loop resistance of 2.00 Ω

A

(d) the power delivered to the loop

W

(e) the torque that must be exerted to rotate the loop

mN·m

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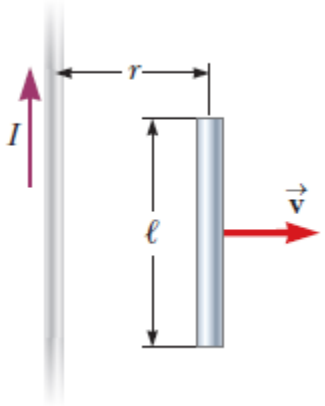
10. –/1 pointsSerPSE9 31.P.068.

A conducting rod moves with a constant velocity in a direction perpendicular to a long, straight wire carrying a current I as shown in the figure below. Show that the magnitude of the emf generated between the ends of the rod is

$$|\mathcal{E}| = \frac{\mu_0 v I \ell}{2\pi r}.$$

In this case, note that the emf decreases with increasing r as you might expect.

This answer has not been graded yet.



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