WebAssign
CH23-HW03-FALL2010 (Homework)

Yinglai Wang
PHYS 272-FALL 2012, Fall 2012
Instructor: Virendra Saxena

Current Score : 13 / 16 **Due :** Friday, November 30 2012 11:59 PM EST

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1. 1/1 points | Previous Answers MI3 23.2.X.008

A thick copper wire connected to a voltmeter surrounds a region of time-varying magnetic flux, and the voltmeter reads 8 volts. If instead of a single wire we use a coil of thick copper wire containing 17 turns, what does the voltmeter read?

136 ✓ V

- *Read the eBook*
- Section 23.2

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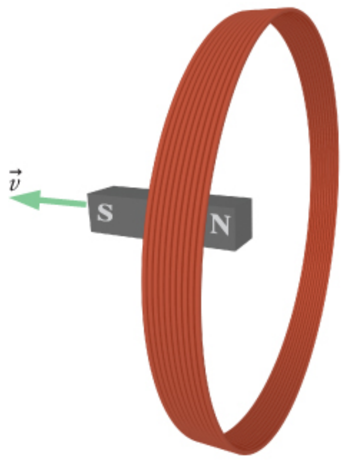
2. 3/3 points | Previous Answers MI3 23.2.X.021

The north pole of a bar magnet points toward a thin circular coil of wire containing 36 turns (see the figure). The magnet is moved away from the coil, so that the flux through one turn inside the coil decreases by 0.4 tesla·m^2 in 0.3 seconds. What is the average emf in the coil during this time interval? Viewed from the right side (opposite the bar magnet), does the current run clockwise or counterclockwise?

48 ✓ volts

- (selected) counterclockwise
- clockwise

✓

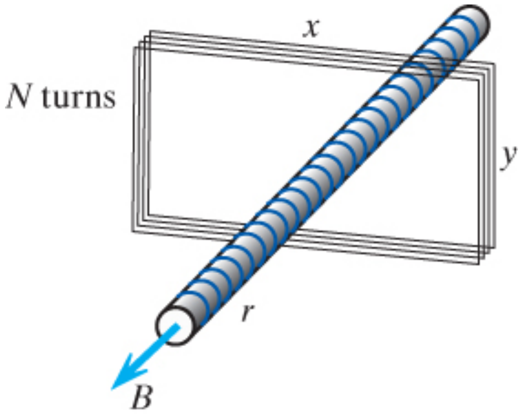


- *Read the eBook*
- Section 23.2

3. 1/4 points | Previous Answers MI3 23.2.P.038

A rectangular loop

A very long, tightly-wound solenoid has a circular cross section of radius r = 3.5 cm (only a portion of the very long solenoid is shown in the figure). The magnetic field outside the solenoid is negligible. Throughout the inside of the solenoid the magnetic field B is uniform, out of the page as shown, but varying with time t: $B = [0.07 + 0.03t^2]$ tesla. Surrounding the circular solenoid is a loop of N = 5 turns of wire in the shape of a rectangle 8 cm high by 19 cm wide. The total resistance of the 5-turn loop is 0.1 ohm.



(a) At t = 3.5 seconds, what is the direction of the current in the 5-turn loop?

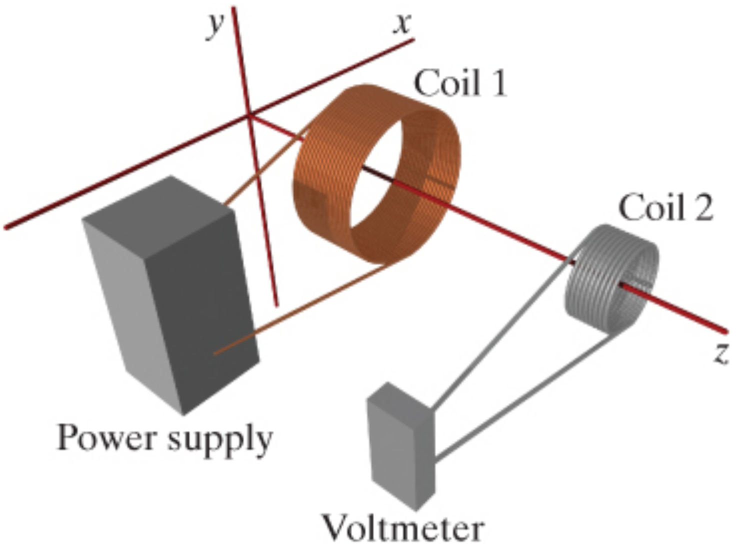
- counter-clockwise
- there is no current in the loop
- clockwise

(b) At t = 3.5 seconds, what is the magnitude of the current in the 5-turn loop? (Hint: remember that the magnetic field is negligible in the region outside the solenoid.)

5.25 A

- *Read the eBook*
- Section 23.2

4. 8/8 points | Previous Answers MI3 23.2.P.036



There are a lot of numbers in this problem. Just about the only way to get it right is to work out each step symbolically first, and then plug numbers into the final symbolic result.

Two coils of wire are aligned with their axes along the z-axis, as shown in the diagram. Coil 1 is connected to a power supply and conventional current flows counter-clockwise through coil 1, as seen from the location of coil 2. Coil 2 is connected to a voltmeter. The distance between the centers of the coils is 0.19 m.

Coil 1 has N_1 = 530 turns of wire, and its radius is R_1 = 0.08 m. The current through coil 1 is changing with time. At t=0 s, the current through coil 1 is I_0 = 18 A. At t=0.4 s, the current through coil 1 is $I_{0.4}$ = 6 A.

Coil 2 has N_2 = 220 turns of wire, and its radius is R_2 = 0.03 m.

Inside coil 2, what is the direction of $-d\vec{E}/dt$ during this interval? +z

What is the direction of the electric field inside the wire of coil 2, at a location on the top of coil 2?

-x

At time t=0, what is the magnetic flux through *one turn* of coil 2? Remember that all turns of coil 1 contribute to the magnetic field. Note also that the coils are not very far apart (compared to their radii), so you can't use an approximate formula here.

At t=0 $\Phi_{1\ \mathrm{turn}}$ = 1.238e-5 T m^2

At t=0.4 s, what is the magnetic flux through *one turn* of coil 2?

At t=0.4 s $\Phi_{1\ \mathrm{turn}}$ = 4.127e-6 T m^2

What is the emf in *one turn* of coil 2 during this time interval?

$|\mathrm{emf}_{1\ \mathrm{turn}}|$ = 2.06e-5 V

The voltmeter is connected across all turns of coil 2. What is the reading on the voltmeter during this time interval?

voltmeter reading is 4.54e-3 V

During this interval, what is the magnitude of the non-Coulomb electric field inside the wire of coil 2? Remember that the emf measured by the voltmeter involves the entire length of the wire making up coil 2.

E_{NC} = 1.09e-4 V/m

At t=0.5 seconds, the current in coil 1 becomes constant, at 5 A. Which of the following statements are true?

- [ ] The voltmeter reading is about the same as it was at t=0.4 seconds.
- [ ] The electric field inside the wire of coil 2 now points in the opposite direction.
- [x] The voltmeter now reads 0 V.
- [x] The electric field inside the wire of coil 2 is now 0 V/m.

- *Read the eBook*
- Section 23.2