Worksheet: Magnetically Induced emf

Question Video

Q1: A current is induced in a circular loop of radius 1.5 cm between two poles of a horseshoe electromagnet when the current in the electromagnet is varied. The magnetic field in the area of the loop is perpendicular to the loop and has a uniform magnitude. If the rate of change of magnetic field is 10 T/s, find the magnitude of the induced current if the resistance of the loop is 25 Ω.

A 4.7×10^{-4} A

B 2.5×10^{-4} A

C 3.6×10^{-4} A

D 4.1×10^{-4} A

E 2.8×10^{-4} A

Q2: A single-turn circular loop of wire of radius 50 mm lies in a plane perpendicular to a spatially uniform magnetic field. During a 0.10-s time interval, the magnitude of the field increases uniformly from 200 to 300 mT. Determine the emf induced in the loop.

A 7.8×10^{-3} V

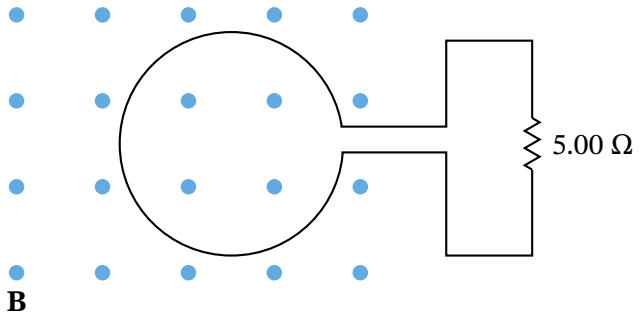
B 7.5×10^{-3} V

C 8.3×10^{-3} V

D 8.6×10^{-3} V

E 7.0×10^{-3} V

Q3: The magnetic flux through the loop shown in the accompanying figure varies with time according to $\phi_m = 2.00e^{-3t}\sin(120\pi t)$, where ϕ_m is in milliwebers.



- What is the magnitude of the current through the resistor at $t = 0.00$ s?

A 120 A

B 108 A

C 162 A

D 150 A

E 137 A

- What is the magnitude of the current through the resistor at $t = 2.17 \times 10^{-2}$ s?

A 219 A

B 205 A

C 270 A

D 232 A

E 256 A

What is the magnitude of the current through the resistor at $t = 3.00$ s?

A 0.0890 A

B 0.111 A

C 0.0500 A

D 0.0930 A

E 0.0667 A

Q4: A long solenoid with 10 turns per centimeter is placed inside a copper ring such that both objects have the same central axis. The radius of the ring is 10.0 cm, and the radius of the solenoid is 5.0 cm.

What is the emf induced in the ring when the current I through the solenoid is 5.0 A and changing at a rate of 100 A/s?

A 5.8×10^{-4} V

B 7.2×10^{-4} V

C 9.9×10^{-4} V

D 4.1×10^{-4} V

E 8.7×10^{-4} V

- What is the emf induced in the ring when $I = 2.0$ A and $\frac{\mathrm{d}I}{\mathrm{d}t} = 100$ A/s?

A 6.1×10^{-4} V

B 7.7×10^{-4} V

C 9.9×10^{-4} V

D 5.0×10^{-4} V

E 8.3×10^{-4} V

- What is the electric field magnitude inside the ring in both of these cases?

A 2.5×10^{-3} V/m

B 3.3×10^{-3} V/m

C 1.6×10^{-3} V/m

D 2.0×10^{-3} V/m

E 3.9×10^{-3} V/m

Suppose the ring is moved so that its central axis and the central axis of the solenoid are still parallel but no longer coincide. (You should assume that the solenoid is still inside the ring.) Now what is the emf induced in the ring?

A 7.3×10^{-4} V

B 8.6×10^{-4} V

C 9.9×10^{-4} V

D 7.0×10^{-4} V

E 9.1×10^{-4} V

Q5: A square loop with sides of length 2 cm is placed at a distance of 1 cm from a long wire that is carrying a current. The current in the wire varies with time at a constant rate of 3 A/s.

Determine the rate of change of the magnetic field.

A 10×10^{-6} T/s

B 4×10^{-6} T/s

C 2×10^{-6} T/s

D 8×10^{-6} T/s

E 4×10^{-6} T/s

If the loop has a resistance of 3 Ω, what is the current induced in the loop?

A 10 nA

B 4 nA

C 2 nA

D 8 nA

E 6 nA