CHAPTER REVIEW

Concept Items

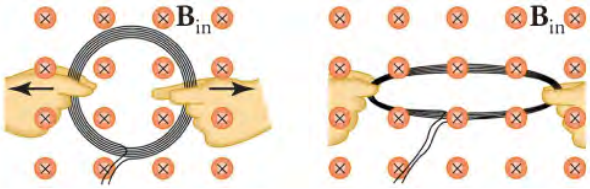
20.2 Motors, Generators, and Transformers

5. What is a voltage transformer?
   a. A transformer is a device that transforms current to voltage.
   b. A transformer is a device that transforms voltages from one value to another.
   c. A transformer is a device that transforms resistance of wire to voltage.

6. Why is electric power transmitted at high voltage?
   a. To increase the current for the transmission
   b. To reduce energy loss during transmission
   c. To increase resistance during transmission
   d. To reduce resistance during transmission

20.3 Electromagnetic Induction

7. Yes or no—Is an emf induced in the coil shown when it is stretched? If so, state why and give the direction of the induced current.



   a. No, because induced current does not depend upon the area of the coil.
   b. Yes, because area of the coil increases; the direction of the induced current is counterclockwise.
   c. Yes, because area of the coil increases; the direction of the induced current is clockwise.
   d. Yes, because the area of the coil does not change; the direction of the induced current is clockwise.

8. What is Lenz's law?
   a. If induced current flows, its direction is such that it adds to the changes which induced it.
   b. If induced current flows, its direction is such that it opposes the changes which induced it.
   c. If induced current flows, its direction is always clockwise to the changes which induced it.
   d. If induced current flows, its direction is always counterclockwise to the changes which induced it.

9. Explain how magnetic flux can be zero when the magnetic field is not zero.
   a. If angle between magnetic field and area vector is 0°, then its sine is also zero, which means that there is zero flux.
   b. If angle between magnetic field and area vector is 45°, then its sine is also zero, which means that there is zero flux.
   c. If angle between magnetic field and area vector is 60°, then its cosine is also zero, which means that there is zero flux.
   d. If the angle between magnetic field and area vector is 90°, then its cosine is also zero, which means that there is zero flux.

Critical Thinking Items

20.2 Motors, Generators, and Transformers

14. Explain why power is transmitted over long distances at high voltages.

a. $P_{lost} = I_{transmitted}\, V_{transmitted}$, so to maximize current, the voltage must be maximized

b. $P_{transmitted} = I_{transmitted}\, V_{transmitted}$, so to maximize current, the voltage must be maximized

c. $P_{lost} = I_{transmitted}\, V_{transmitted}$, so to minimize current, the voltage must be maximized

d. $P_{transmitted} = I_{transmitted}\, V_{transmitted}$, so to minimize current, the voltage must be maximized

20.3 Electromagnetic Induction

15. To obtain power from the current in the wire of your vacuum cleaner, you place a loop of wire near it to obtain an induced emf. How do you place and orient the loop?

a. A loop of wire should be placed nearest to the vacuum cleaner wire to maximize the magnetic flux through the loop.

b. A loop of wire should be placed farthest to the vacuum cleaner wire to maximize the magnetic flux through the loop.

c. A loop of wire should be placed perpendicular to the vacuum cleaner wire to maximize the magnetic flux through the loop.

d. A loop of wire should be placed at angle greater than 90° to the vacuum cleaner wire to maximize the magnetic flux through the loop.

16. A magneto is a device that creates a spark across a gap by creating a large voltage across the gap. To do this, the device spins a magnet very quickly in front of a wire coil, with the ends of the wires forming the gap. Explain how this creates a sufficiently large voltage to produce a spark.

a. The electric field in the coil increases rapidly due to spinning of magnet which creates an emf in the coil that is proportional to the rate of change of the magnetic flux.

b. The magnetic field in the coil changes rapidly due to spinning of magnet which creates an emf in the coil that is proportional to the rate of change of the magnetic flux.

17. If you drop a copper tube over a bar magnet with its north pole up, is a current induced in the copper tube? If so, in what direction? Consider when the copper tube is approaching the bar magnet.

a. Yes, the induced current will be produced in the clockwise direction when viewed from above.

b. No, the induced current will not be produced.

Problems

20.3 Electromagnetic Induction

19. What is the current in a wire loop of resistance 10 Ω through which the magnetic flux changes from zero to 10 Wb in 1.0 s?

a. −100 A

b. −2.0 A

c. −1.0 A

d. +1.0 A

20. An emf is induced by rotating a 1,000 turn, 20.0 cm diameter coil in Earth's 5.00×10^{-5} T magnetic field. What average emf is induced, given the plane of the coil is originally perpendicular to Earth's field and is rotated to be parallel to the field in 10.0 ms?

a. -1.6×10^{-4} V

b. $+1.6 \times 10^{-4}$ V

c. $+1.6 \times 10^{-1}$ V

d. -1.6×10^{-1} V

TEST PREP

Multiple Choice

20.2 Motors, Generators, and Transformers

27. An electrical generator _____.
- a. is a generator powered by electricity
- b. must be turned by hand
- c. converts other sources of power into electrical power
- d. uses magnetism to create electrons

28. A step-up transformer increases the
- a. voltage from power lines for use in homes
- b. current from the power lines for use in homes
- c. current from the electrical generator for transmission along power lines
- d. voltage from the electrical power plant for transmission along power lines

30. Why are the coils of a transformer wrapped around a loop of ferrous material?
- a. The magnetic field from the source coil is trapped and also increased in strength.
- b. The magnetic field from the source coil is dispersed and also increased in strength.
- c. The magnetic field from the source coil is trapped and also decreased in strength.
- d. Magnetic field from the source coil is dispersed and also decreased in strength.

20.3 Electromagnetic Induction

31. What does *emf* stand for?
- a. electromotive force
- b. electro motion force
- c. electromagnetic factor
- d. electronic magnetic factor

32. Which formula gives magnetic flux?
- a. $\frac{\mu_0 I}{2\pi r}$
- b. $qvB \sin \theta$
- c. $-N\frac{\Delta\Phi}{\Delta t}$
- d. $BA \cos \theta$

33. What is the relationship between the number of coils in a solenoid and the emf induced in it by a change in the magnetic flux through the solenoid?
- a. The induced emf is inversely proportional to the number of coils in a solenoid.
- b. The induced emf is directly proportional to the number of coils in a solenoid.
- c. The induced emf is inversely proportional to the square of the number of coils in a solenoid.
- d. The induced emf is proportional to square of the number of coils in a solenoid.

34. True or false—If you drop a bar magnet through a copper tube, it induces an electric current in the tube.
- a. false
- b. true

Short Answer

20.2 Motors, Generators, and Transformers

41. A laminated-coil transformer has a wire coiled 12 times around one of its sides. How many coils should you wrap around the opposite side to get a voltage output that is one half of the input voltage? Explain.

a. six output coils because the ratio of output to input voltage is the same as the ratio of number of output coils to input coils
b. 12 output coils because the ratio of output to input voltage is the same as the ratio of number of output coils to input coils
c. 24 output coils because the ratio of output to input voltage is half the ratio of the number of output coils to input coils
d. 36 output coils because the ratio of output to input voltage is three times the ratio of the number of output coils to input coils

42. Explain why long-distance electrical power lines are designed to carry very high voltages.

a. $P_{transmitted} = I_{transmitted>}^{2} R_{wire}$ and $P_{lost} = I_{transmitted} V_{transmitted}$, so V must be low to make the current transmitted as high as possible.
b. $P_{transmitted} = I_{transmitted>}^{2} R_{wire}$ and $P_{lost} = I_{lost} V_{lost}$, so V must be low to make the current transmitted as high as possible.
c. $P_{transmitted} = I_{transmitted>}^{2} R_{wire}$ and $P_{lost} = I_{transmitted} V_{transmitted}$, so V must be high to make the current transmitted as low as possible
d. $P_{lost} = I_{transmitted}^{2} R_{wire}$ and $P_{transmitted} = I_{transmitted} V_{transmitted}$, so V must be high to make the current transmitted as low as possible.

44. In a hydroelectric dam, what is used to power the electrical generators that provide electric power? Explain.

a. The electric potential energy of stored water is used to produce emf with the help of a turbine.
b. The electric potential energy of stored water is used to produce resistance with the help of a turbine.
c. Gravitational potential energy of stored water is used to produce resistance with the help of a turbine.
d. Gravitational potential energy of stored water is used to produce emf with the help of a turbine.

20.3 Electromagnetic Induction

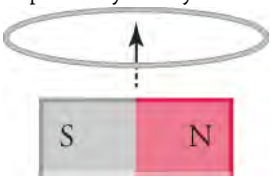
45. A uniform magnetic field is perpendicular to the plane of a wire loop. If the loop accelerates in the direction of the field, will a current be induced in the loop? Explain why or why not.

a. No, because magnetic flux through the loop remains constant.
b. No, because magnetic flux through the loop changes continuously.
c. Yes, because magnetic flux through the loop remains constant.
d. Yes, because magnetic flux through the loop changes continuously.

46. The plane of a square wire circuit with side 4.0 cm long is at an angle of 45° with respect to a uniform magnetic field of 0.25 T. The wires have a resistance per unit length of 0.2. If the field drops to zero in 2.5 s, what magnitude current is induced in the square circuit?

a. 35 μA
b. 87.5 μA
c. 3.5 mA
d. 35 A

47. Yes or no—If a bar magnet moves through a wire loop as shown in the figure, is a current induced in the loop? Explain why or why not.



a. No, because the net magnetic field passing through the loop is zero.
b. No, because the net magnetic field passing through the loop is nonzero.
c. Yes, because the net magnetic field passing through the loop is zero.
d. Yes, because the net magnetic field line passing through the loop is nonzero.

48. What is the magnetic flux through an equilateral triangle with side 60 cm long and whose plane makes a 30° angle with a uniform magnetic field of 0.33 T?

a. 0.045 Wb
b. 0.09 Wb
c. 0.405 Wb
d. 4.5 Wb