(98)

Name Stephen Mayfield

Multiple Choice

Read each question and choose the best answer by putting the corresponding letter in the blank to the left.

C 1. Which statement about electromagnets is true?

A. Electromagnets have generally weaker magnetic fields than permanent magnets.
B. Electromagnets are used when a continuous magnetic field is desired.
(C.) Electromagnets can be stronger than permanent magnets.
D. Electromagnets are usually large in size.

B 2. Faraday's law states that the induced potential difference is

A. inversely proportional to the change in flux.
(B.) inversely proportional to the time interval.
C. inversely proportional to the current.
D. equivalent to electrochemical potential.

A 3. Which of the following would *not* induce a current?

(A.) placing a wire in a uniform magnetic field
B. changing the magnetic flux
C. moving a current loop through a nonuniform magnetic field
D. bringing a current-carrying wire near a conductor

A 4. Lenz's law is an application of the conservation of

(A.) energy.
B. momentum.
C. perpetual motion.
D. current.

D 5. Which object is most susceptible to eddy currents?

A. a copper wire
B. a plastic-lacquered iron plate
C. a plastic sphere
(D.) a bar of gold

A B X 6. Eddy currents in motors, generators, and transformers

A. decrease the power by dividing the current's path.
(B.) cannot be induced by nonmetallic conductors. magnetic
C. can pass through air slits.
D. can pass through thin insulating strips.

C 7. The back emf in a motor

A. decreases as the speed of the armature increases.
B. is never zero.
(C.) reduces the armature current.
D. is *not* an induced emf.

A
8. (DS) Which of the following is *not* an advantage of AC power distribution?
   A. It easily connects various kinds of generators and utilities.
   B. It easily adjusts using transformers to accommodate different load sizes.
   C. It efficiently delivers power over long distances using high voltages and low currents.
   D. It uses compact and relatively simpler motors than DC.

D
9. The unit for inductance is the
   A. ohm.
   B. volt.
   C. ampere.
   D. henry.

D
10. The voltage on the secondary winding of a transformer is 50 V, and the voltage on the primary winding is 10 V. If the current on the primary winding is 15 A, estimate the current on the secondary winding. $\frac{50}{10} = \frac{15}{3}$
   A. 10 A
   B. 0.99 A
   C. 33.3 A
   D. 3 A

B
11. The current in the secondary winding as compared with that in the primary winding in a step-up transformer must be
   A. greater.
   B. smaller.
   C. equal.
   D. directly proportional to the secondary voltage.

C
12. What type of circuit segment impedes AC most?
   A. resistor-capacitor
   B. resistive
   C. resistor-inductor
   D. inductor-capacitor

True/False

Read the following statements. Identify each as true or false by putting *T* or *F* in the blank to the left.

T
13. The magnetic force is proportional to the number of coils in an electromagnet.

F
14. Two parallel wires carrying current in opposite directions exert a magnetic attraction on one another.

F
15. A closed circuit of wire not connected to any potential difference source moving through a nonuniform magnetic field perpendicular to the magnetic field lines will *not* sustain a current.

F 16. Three-phase AC generators usually produce a single sinusoidal electrical potential difference.

F 17. A DC generator has an output of a constant magnitude of potential difference.

T 18. Both AC and DC respond the same way to a resistive circuit.

F 19. Voltage leads the current across a resistor in any circuit.

T 20. Accelerating charges produce electromagnetic radiation.

T 21. All wavelengths of electromagnetic radiation travel at the speed of light in a vacuum.

Short Answer

After reading each sentence, write a response in the blank provided.

22. If you are looking down the end of a current-carrying wire with the current coming straight toward you, the direction of the surrounding magnetic field is counter clockwise.

23. The Biot-Savart law illustrates the similarity of magnetic force to gravitational and electric forces.

24. A series of wire coils that is used as a magnet is called a(n) electromagnet. solenoid

25. The SI unit for magnetic flux is the Webers.

26. The equivalent AC potential difference that produces the same power as a DC potential difference is called the effective potential difference.

27. The part of the generator that enables it to produce a direct current is the split ring comutator.

28. How are inductors different from resistors? inductors only effect current when it is changing, such as starting, stopping, or AC

29. The current in the secondary windings is smaller than the current in the primary windings in a step-up transformer.

30. Impedance opposes current in an AC circuit.

31. How are light waves propagated? nonuniformly changing electric field induces magnetic field, which strengthens electric field and so on, becomes wave that is self-propagating

32. What two properties of a medium determine the speed of light? electric permitivity and magnetic permeability

Application Problems

Complete the problems below. Be sure to show your work, consider significant figures, and put your answer with the correct units in the blank provided.

$1.5 \cdot 10^{-1}$ V 33. A conductor coil has 100 turns. When the coil is moved perpendicularly to a magnetic flux for 0.030 s, each loop experiences a change in flux of 4.5×10^{-5} Wb. What is the induced emf in the entire coil? $\frac{\Delta \Phi n}{\Delta t} / \frac{4.5 \cdot 10^{-5} \cdot 100}{.03} = .15$ V

16H 34. An inductor with eight loops produces a magnetic flux of $\phi = 3.50$ Wb per loop when a current $I = 1.75$ A flows through the inductor. What is its inductance?

$X = \frac{n\Phi}{I} / \frac{8 \cdot 3.5}{1.75} = 16H$

9.095Ω 35. What is the capacitive reactance of a 7.0 μF capacitor in a 25 kHz AC circuit?

$\frac{1}{2\pi fC} / \frac{1}{2 \cdot \pi \cdot 25{,}000 \cdot 7 \cdot 10^{-6}} / \frac{1}{.35\pi} = .9095\ \Omega$

$1.616 \cdot 10^{-1}\ \Omega$ 36. In a series RLC circuit, the resistance is 15.0 Ω, the inductive reactance is 10.0 Ω, and the capacitive reactance is 4.0 Ω. Find the total impedance.

$\sqrt{R^2 + (L-C)^2} / \sqrt{225 + 36} = \sqrt{261} = 16.16$

Essay

Answer the following questions using complete sentences.

37. (DS) Briefly summarize the history of U.S. electrical distribution system. Edison originally designed things to run on DC current and started putting power plants all over cities to distribute DC electricity all over the city. But then Tesla discovered that AC current could be sent over longer distances, at lower currents, requiring less wires. This allowed for less power plants to be made, and wiring was cheaper

38. Explain why power companies use transformers. power companies use transformers because sending electricity at high current would cause too much heating of the wires. So they use step-up transformers to lower the current and raise the voltage. But using electricity at such high voltage in a house would be bad so at the house is a step-down transformer to increase the current and decrease the voltage.