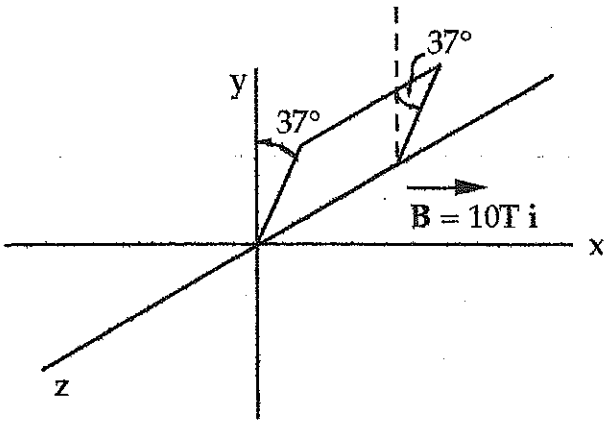
A.P. "C" Ch 26 Induction Practice

1. A 3.0-cm by 5.0-cm rectangular coil has 100 turns. Its axis makes an angle of 55° with a uniform magnetic field of 0.35 T. What is the magnetic flux through this coil?

   a. 3.0×10^{-4} Wb b. 4.3×10^{-4} Wb c. 3.0×10^{-2} Wb d. 4.3×10^{-2} Wb e. 5.3×10^{-2} Wb

2.



A rectangular surface of area 1.0 m^2 is hinged along the z axis and makes an angle of 37° with the yz plane. If the local magnetic field is 10 T **i**, the magnetic flux through this surface is

a. 6.0 T · m^2 b. 8.0 T · m^2 c. 10 T · m^2 d. 13 T · m^2 e. 17 T · m^2

3. The magnetic flux through a certain coil is given by

$$\phi m = (1/50\pi) \cos 100\pi t$$

where the units are SI. The coil has 100 turns. The magnitude of the induced emf when t = 1/200 s is

a. 100 V b. 200 V c. zero d. $2/\pi$ V e. $1/50\pi$ V

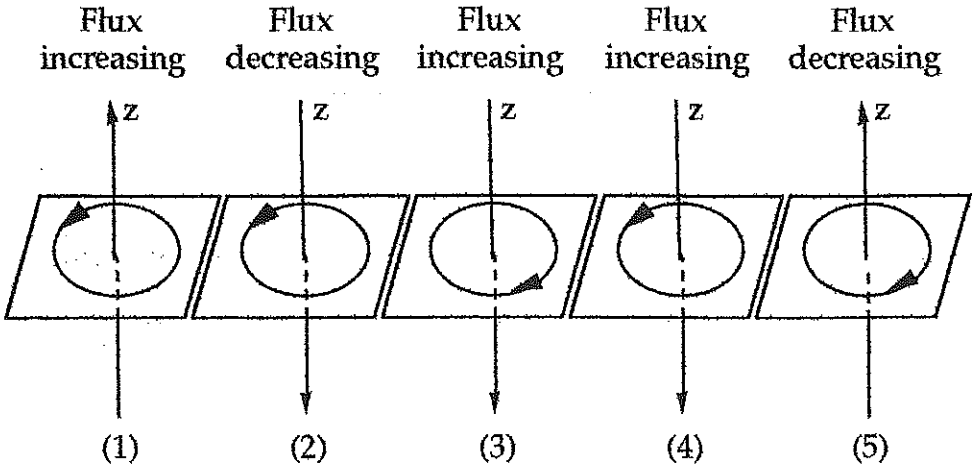
4. The instantaneous induced emf in a coil of wire located in a magnetic field

   a. depends on the time rate of change of flux through the coil.
   b. depends on the instantaneous value of flux through the coil.
   c. is independent of the area of the coil.
   d. is independent of the number of turns of the coil.
   e. is determined by the resistance in series with the coil.

5. A conducting loop around a bar magnet begins to move away from the magnet. Which of the following statements is true?

   a. The magnet and the loop repel one another.
   b. The magnet and the loop attract one another.
   c. The magnet is attracted, but the loop is repelled.
   d. The magnet is repelled, but the loop is attracted.
   e. The magnet and loop neither attract nor repel one another.

6.



A loop rests in the xy plane. The z axis is normal to the plane and positive upward. The direction of the changing flux is indicated by the arrow on the z axis. The diagram that correctly shows the direction of the resultant induced current in the loop is

a. 1 b. 2 c. 3 d. 4 e. 5

7. Which law does the following statement express? "In all cases of electromagnetic induction, the induced voltages have a direction such that the currents they produce oppose the effect that produces them."

a. Maxwell's law b. Fleming's rule c. Lenz's law
d. Gauss's law e. Ampère's law

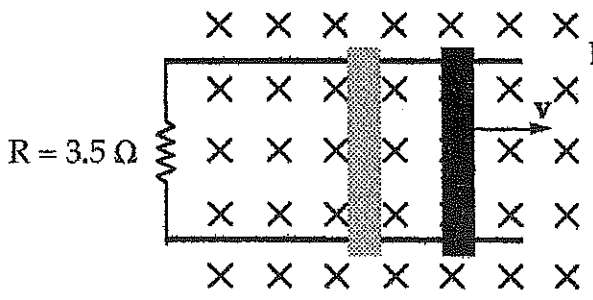
8. A 25-cm long conducting rod moves at a speed of 12 m/s in a plane perpendicular to a uniform magnetic field of magnitude 0.080 T. What is the induced potential difference between the ends of the rod?

a. 24 V b. 2.4 V c. 0.24 V d. 0.60 kV e. 6.0 V

9. A straight conductor 10 cm long is perpendicular to a uniform magnetic field of flux density 2.0 mT. When the conductor carries a current of 5.0 A, the force exerted on it by the field is

a. 0.25 kN b. 40 μN c. 1.0 mN d. zero e. 5.0 mN

10.



A wire rod rolls with a speed of 8.0 m/s on two metallic rails, 30 cm apart, that form a closed loop. The magnitude and direction of the current induced in the resistor R are

a. 0.82 A clockwise b. 0.82 A counterclockwise c. 1.2 A clockwise
d. 1.2 A counterclockwise e. 2.9 A counterclockwise

11. The plane of a wire loop with an area of 0.20 m^2 is perpendicular to a magnetic field of 50 mT. In 40 ms you rotate the loop 90° so that its plane is parallel to the magnetic field. The average emf induced in the loop is

a. 0.25 V b. 6.0 V c. 3.0 V d. 4.0 V e. 1.3 V

12. A motor sometimes burns out when its load is suddenly increased because the resulting sudden decrease in its rotational frequency causes

a. an increased back emf and an increased current flow.
b. a decreased back emf and a decreased current flow.
c. a decreased back emf and zero current flow.
d. an increased back emf and a decreased current flow.
e. a decreased back emf and an increased current flow.

13. A 200-turn coil rotates in a magnetic field of magnitude 0.25 T at a frequency of 60 Hz. The area of the coil is 5.0 cm^2. What is the maximum emf in the coil?

a. 1.5 V b. 4.5 V c. 9.0 V d. 9.4 V e. 24 V

14. A coil with a self inductance of 6.5 H carries a current that is changing at a rate of 50 A/s. What is the induced emf in the coil?

a. 0.13 V b. 7.7 V c. 32 V d. 65 V e. 0.32 kV

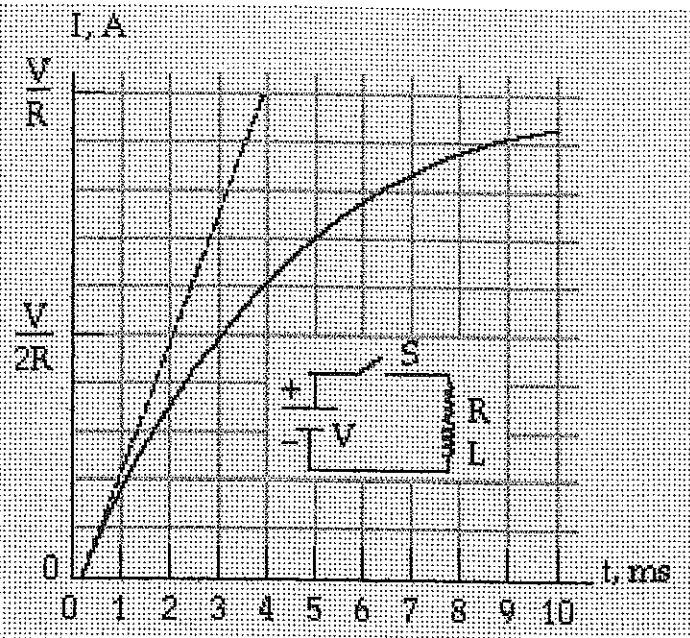
15. How many turns are needed in a solenoid of radius 10 cm and length 20 cm for its self inductance to be 6.0 H?

a. 30 b. 74 c. 500 d. 550 e. 5500

16. What is the time constant of an LR circuit with a resistance R = 25 Ω and an inductance L = 5.4 mH?

a. 7.4 s b. 4.6 s c. 0.14 s d. 0.22 ms e. 1.5 ms

17.



The growth of current in the inductive circuit in the inset diagram is represented by the curve in the graph. The broken line is tangent to the curve at the origin. The time constant of the circuit is approximately

a. 3.0 ms b. 2/R ms c. 0.40 ms d. 4.0 ms e. 2.0 ms

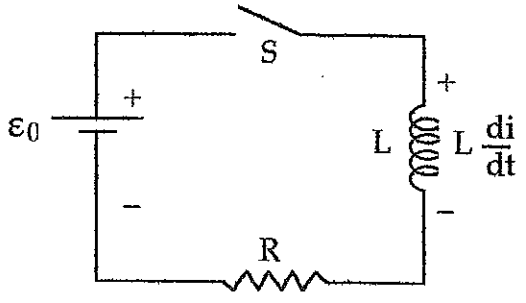
18. A coil of self inductance 7.5 mH and resistance of 30 Ω is placed across the terminals of a 12-V battery of negligible internal resistance. The current in this circuit after 50 μs is approximately

a. 73 mA b. 47 mA c. 28 mA d. 51 mA e. 19 mA

19. The current in an LR circuit is zero at time t = 0 and increases to 75 percent of its final value in 4.5 s. The time constant of this circuit is approximately

a. 6.0 s b. 12 s c. 8.7 s d. 3.3 s e. 9.8 s

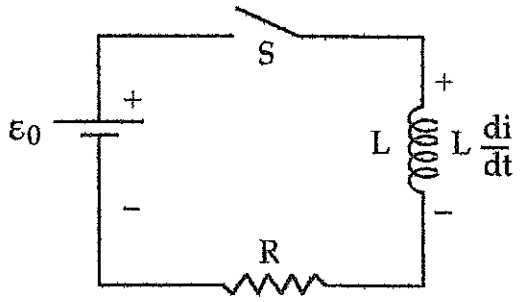
20.



In this circuit, $\varepsilon_0 = 12$ V, R = 6.0 Ω, and L = 0.48 H. The switch is closed at time t = 0. At time t = 0.25 s, the rate at which the battery is supplying power is approximately

a. 23 W b. 1.9 W c. 51 W d. 37 W e. 11 W

21.



In this circuit, $\varepsilon_0 = 12$ V, $R = 6.0\ \Omega$, and $L = 0.48$ H. The switch is closed at time $t = 0$. At time $t = 0.25$ s, the rate of Joule heating is approximately

a. 17 W b. 22 W c. 51 W d. 37 W e. 11 W

22. How much does the energy stored in an inductor change if the current through the inductor is doubled?

a. It is the same. b. It is doubled. c. It is quadrupled.
d. It is halved. e. It is quartered.

23. A device used chiefly for storing energy in a magnetic field is

a. an inductor. b. a resistor. c. a capacitor.
d. a galvanometer. e. a dielectric.

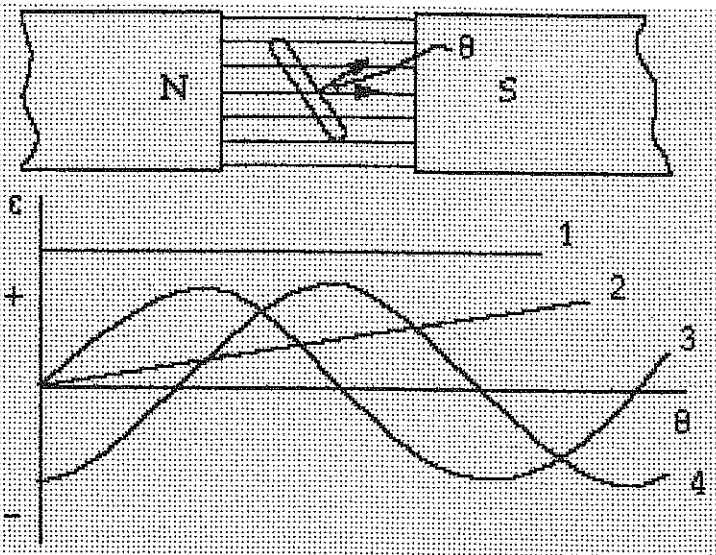
24. Two identical bar magnets are dropped from equal heights. Magnet A is dropped over bare earth and magnet B over a metal plate. Which magnet strikes first?

a. magnet A
b. magnet B
c. both strike at the same time
d. whichever has its N pole toward the ground
e. whichever has its S pole toward the ground

25. A flat, rectangular coil measuring 0.10 m by 0.20 m and containing 50 turns of wire is rotating at a constant speed of 100π rad/s in a magnetic field of 0.20 T. The maximum emf induced in this coil is approximately

a. 1.0 V b. 10 V c. 63 V d. 44 V e. 0.13 V

26.



A simple generator consists of a single rectangular loop of wire rotating between two magnetic pole faces as shown. Which curve in the graph correctly represents the emf ε as a function of the angle between the normal to the plane of the coil and the direction of the magnetic field?

a. 1 b. 2 c. 3 d. 4 e. none of these