30-03
0.50-38%

Question 903

Five long, straight, insulated wires are closely bound together to form a small cable of diameter 1.0 cm. Currents carried by the wires are I1=20A, I2=-6A, I3=12A, I4=-7A, and I5= 8A (negative currents are opposite in direction to the positive). Find the magnitude of the magnetic field at a distance 10 cm from the cable.

(a) 32 micro-T.
(b) zero.
(c) 29 micro-T.
(d) 10 micro-T.
(e) 74 micro-T.

30-4 Solenoids and Toroids

30-04

Question 904

What current in a solenoid 15-cm long wound with 100 turns would produce a magnetic field equal to that of the earth, which is 5.1*10**-5 T?

(a) 13*10**-3 A.
(b) 61*10**-3 A.
(c) 22*10**-3 A.
(d) 82*10**-3 A.
(e) 76*10**-3 A.

30-04

Question 905

A solenoid is formed by tightly winding a single layer of wire. The wire is 1.0 mm in diameter. What is the magnitude of the magnetic field inside the solenoid when there is a current of 0.081 A in the windings?

(a) 102 micro-T.
(b) 51 micro-T.
(c) 81 micro-T.
(d) 212 micro-T.
(e) 10 micro-T.

30-04

Question 906

A 500 turns solenoid is 30 cm long, has a radius of 0.5 cm and carries a current of 2.0 A. The magnitude of the magnetic field at the center of the solenoid is:

(a) 8.2*10**(-3) T
(b) 9.9*10**(-8) T
(c) 1.3*10**(-3) T
(d) 5.6*10**(-8) T
(e) 4.2*10**(-3) T

30-04

Question 907

A solenoid is 3.0 m long and has a circumference of 9.4*10**(-2) m. It carries a current of 12.0 A. The magnetic field inside the solenoid is 25.0*10**(-3) T. The length of the wire forming the solenoid is:

(a) 410 m.
(b) 245 m.
(c) 900 m.
(d) 467 m.
(e) 233 m.

30-04
Question 908 0.45-36%
A current of 2.5 A passes in a solenoid of length L = 50 cm. It produces a magnetic field of 2.3*10**(-3) T at its center. The number of turns in the solenoid is:
(a) 372.
(b) 645.
(c) 366.
(d) 781.
(e) 554.

30-04
Question 909 0.23-55%
Which of the following statements is CORRECT ?
(a) It is impossible for a constant magnetic field to change the speed of a charged particle.
(b) The magnetic field at the center of a current carrying conducting tube is non-zero.
(c) A magnetic field exerts a force on an electron at rest.
(d) The magnetic field inside an ideal solenoid depends on the radius of the solenoid.
(e) An emf can be induced by a constant magnetic field in a fixed conducting loop.

30-04
Question 910 0.48-41%
Consider two solenoids, A and B, having the same current. Solenoid B has twice the radius and six times the number of turns per unit length as solenoid A. The ratio of the magnetic field in the interior of solenoid B to that in the interior of solenoid A is:
(a) 6.
(b) 4.
(c) 3.
(d) 1.
(e) 2 .

30-04
Question 911 0.17-82%
A long solenoid has 1000 turns/m and carries current I. An electron moves within the solenoid in a circle of radius 2.30 cm perpendicular to the solenoid axis. The speed of the electron is 1.35*10**7 m/s. What is the current in the solenoid?
(a) 2.66 A
(b) 5.32 A
(c) 3.99 A
(d) 7.98 A
(e) 1.33 A

30-04
Question 912 0.47-43%
A solenoid has length L=2.0 m and diameter d=4.0 cm, and it carries a current I=6.0 A. It consists of seven closed packed layers, each with 90 turns along length L. What is B at its center?
(a) 2.4*10**(-3) Tesla.
(b) 8.0*10**(-7) Tesla.
(c) 5.0*10**(-3) Tesla.
(d) 3.5*10**(-3) Tesla.
(e) 8.0*10**(-4) Tesla.

30-04
0.28-79%

Question 913

A proton is moving along the axis of a solenoid carrying a current. Which of the following statement is CORRECT about the magnetic force acting on the proton?

(a) The force acts radially outwards.
(b) No force acts.
(c) The force acts in the direction of motion.
(d) The force acts radially inwards.
(e) The force acts in the opposite direction of motion.

30	All Sections

30

Question 914

Which one of the following statements is True?

(a) The magnetic field due to a long straight wire increases with increasing distance from the wire.
(b) The magnetic field is smallest where the field lines are closest.
(c) The torque on a magnetic dipole is zero when it is in a uniform magnetic field.
(d) If the current in each of two parallel current-carrying wires is doubled, the force between them will be doubled.
(e) A uniform magnetic field can be found at the center of a solenoid.

Chapter 31 Induction and Inductance

31-3 faraday's Law of Induction

31-03
0.39-41%

Question 915
Consider a circular loop of radius R = 20 cm lying in the x-y plane. There is throughout the region a uniform magnetic field given by

B = (5.0i + 4.0j + 3.0k) T.

Calculate the magnetic flux though the loop.
(a) 0.15 T*m**2
(b) 0.38 T*m**2
(c) 0.62 T*m**2
(d) 0.21 T*m**2
(e) 0.92 T*m**2

31-03

Question 916
A uniform magnetic field B = (2.0 i + 4.0 j + 5.0 k) T intersects a circular surface of radius 2 cm lying in the yz plane. What is the magnetic flux through this surface?
(a) zero
(b) 8.4*10**(-3) T*m**2
(c) 6.3*10**(-3) T*m**2
(d) 5.0*10**(-3) T*m**2
(e) 2.5*10**(-3) T*m**2

31-03
0.29-31%

Question 917
Consider a cube of side L= 10 cm positioned as shown in Figure 6. Throughout the region, There is a magnetic field B= (4.0*i + 5.0*j - 6.0*k) T. Calculate the magnetic flux through the shaded face of the cube.

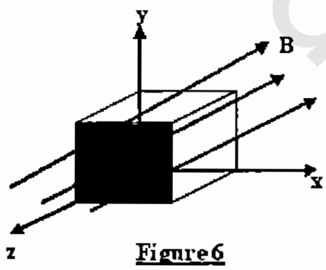

Figure6

(a) -0.04 T*m**2
(b) -0.06 T*m**2
(c) 0.05 T*m**2
(d) 0.04 T*m**2
(e) 0.06 T*m**2

31-03

Question 918
A constant magnetic flux of 4.0*10**(-5) Wb is maintained through a coil for 0.5 s. What emf is induced in the coil by this flux during that period?
(a) -2.0*10**(-5) V.
(b) 2.0*10**(-5) V.
(c) 4.0*10**(-5) V.
(d) Zero.
(e) -4.0*10**(-5) V.

31-03

Question 919

Faraday's law states that an induced emf is proportional to:
(a) the rate of change of magnetic flux.
(b) the rate of change of electric flux.
(c) the rate of change of gravitational field.
(d) the rate of change of magnetic field.
(e) the rate of change of electric field.

31-03

Question 920

Consider a circular loop of wire within which the magnetic flux, Phi, is given as a function of time, t, as

Phi = a*t**2 + b,

where a and b are constants. If the induced emf is measured as 48 V at t=3 s, what is the value of a?
(a) - 8.0 V/s.
(b) - 6.0 V/s.
(c) - 2.1 V/s.
(d) - 4.0 V/s.
(e) - 3.2 V/s.

31-03
0.45-36%

Question 921

A 2.0 Tesla uniform magnetic field makes an angle of 60 degrees with the xy-plane. The magnetic flux through an area of 3 m**2 portion of the xy-plane is:
(a) 5.2 Wb.
(b) 2.0 Wb.
(c) 6.0 Wb.
(d) 12 Wb.
(e) 3.0 Wb.

31-03
0.49-57%

Question 922

A 2.0-T uniform magnetic field (in the x-y plane) makes an angle of 30 degrees with the y-axis The magnetic flux through a 4.0-m**2 portion of the xz plane is:
(a) 6.9 Wb
(b) 12 Wb
(c) 3.0 Wb
(d) 4.0 Wb
(e) 8.0 Wb

31-03
0.55-39%

Question 923

Figure 12 shows a conducting loop consisting of a half circle of radius 0.20 m and three straight sections. The loop lies in a uniform magnetic field that is directed as shown in the figure and is given by:

B = (4.5*t**2) - (10*t) ,

with B in tesla and t in seconds. What is the magnitude of the induced emf at t = 10 s ?

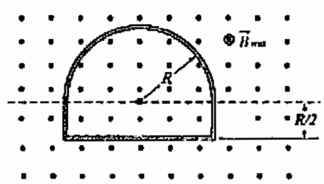

Figure 12

(a) 5.0 V
(b) 10 V
(c) 8.2 V
(d) 6.3 V
(e) 4.1 V

31-03
Question 924 0.53-55%
A 400-turn coil of total resistance 6.0 ohm has a cross sectional area of 30 cm**2. How rapidly should a magnetic field parallel to the coil axis change in order to induce a current of 0.3 A in the coil?
(a) 0.67 T/s.
(b) 1.5 T/s.
(c) 0.25 T/s.
(d) 0.04 T/s.
(e) 2.8 T/s.

31-03
Question 925 0.34-61%
A circular wire loop of area 0.5 m**2 is perpendicular to a magnetic field of 0.8 T. If the coil is removed completely from the field in 0.1 s, the average emf induced in the loop has a magnitude
(a) 5.0 V.
(b) 8.0 V.
(c) 4.0 V.
(d) 2.0 V.
(e) 1.0 V.

31-03
Question 926 0.40-40%
A circular area with a radius of 8.0 cm lies in the xy-plane. What is the magnitude of the magnetic flux through this circle due to a uniform magnetic field of 0.5 T at an angle of 30 degrees from the positive z-axis?.
(a) 8.7*10**(-3) Wb.
(b) zero.
(c) 4.3*10**(-3) Wb.
(d) 2.3*10**(-3) Wb.
(e) 1.1*10**(-3) Wb.

31-03
Question 927 0.45-66%
A circular wire loop, of an area 0.10 m**2, is initially oriented so that its plane is perpendicular to a 0.40 T magnetic field. When the loop is rotated so that its plane is parallel to the field, a 25 V average potential difference is induced across the loop. The time (in seconds) required to make this rotation of the loop is
(a) 4.5*10**(-3).
(b) 1.0*10**(-3).
(c) 1.6*10**(-3).
(d) 1.2*10**(-3).
(e) 3.3*10**(-3).

31-4 Lenz's Law

31-04
Question 928
A plane loop of wire consisting of a single turn of cross- sectional area 0.20 m**2 is perpendicular to a magnetic field that increases uniformly in magnitude from 0.25 T to 3.25 T in a time of 2.0 s. What is the resistance of the coil if the induced current has a value of 2.0 A?
(a) 0.15 Ohm.
(b) 0.35 Ohm.
(c) 0.07 Ohm.
(d) 0.11 Ohm.
(e) 0.70 Ohm.

31-04

Question 929

Linz's law states that "Induced currents always flow in a direction such that they oppose any change in magnetic flux through a conductor". If the above statement is not true, this would lead to a violation of

(a) the law of conservation of energy.
(b) Entropy.
(c) Ampere's law.
(d) Coulomb's law.
(e) the law of conservation of momentum.

31-04

Question 930

Each turn of a 100-turn coil, whose resistance is 60 Ohm, encloses an area of 80 cm**2. What should be the rate of change of a magnetic field parallel to its axes in order to induce a current of 1 mA in the coil?

(a) 0.235 T/s.
(b) Zero.
(c) 0.125 T/s.
(d) 0.075 T/s.
(e) 0.347 T/s.

31-04
0.54-49%

Question 931

A flat coil of wire consisting of 20 turns, each with an area of 50 cm**2, is positioned perpendicularly to a uniform magnetic field that increases its magnitude at a constant rate from 2.0 T to 6.0 T in 2.0 s. If the coil has a total resistance of 0.4 ohms, what is the magnitude of the induced current in the coil?

(a) 0.8 A
(b) 0.5 A
(c) 0.7 A
(d) 0.2 A
(e) 0.6 A

31-04

Question 932

A single turn plane loop of wire of cross sectional area 40 cm**2 is perpendicular to a magnetic field that increases uniformly in magnitude from 0.5 T to 5.5 T in 2.0 seconds. What is the resistance of the wire if the induced current has a value of 1.0 mA.

(a) 40 Ohms
(b) 50 Ohms
(c) 10 Ohms
(d) 20 Ohms
(e) 30 Ohms

31-04

Question 933 0.36-40%

The square circuit shown in Figure 8 is in a uniform magnetic field directed into the page and is decreasing at a rate of 1.5 T/s. Calculate the induced current in the circuit if the resistance of the wire 10 ohms.

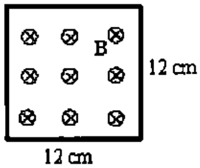

Figure 8

(a) 2.16 milli-A
(b) 2.16 micro-A
(c) 40.1 milli-A
(d) 40.1 micro-A
(e) 5.7 micro-A

31-04

Question 934

Each turn of a 100-turn coil, whose resistance is 60.0 Ohm, encloses an area of 80.0 cm**2. What should be the rate of change of a magnetic field parallel to its axis in order to induce a current of 1.00*10**(-3) A in the coil?

(a) 0.235 T/s.
(b) 0.075 T/s.
(c) 7.51 T/s.
(d) 0.125 T/s.
(e) Zero.

31-04

Question 935

A magnet is taken towards a metallic ring in such a way that a constant current of 10**(-2) A is induced in it. The total resistance of the ring is 0.25 Ohm. In 10 seconds, the flux of the magnetic field through the ring changes by:

(a) 2.5*10**(-9) Wb.
(b) 2.5*10**(-3) Wb.
(c) 2.5*10**(-2) Wb.
(d) 2.5*10**(-1) Wb.
(e) 2.5*10**(-6) Wb.

31-04

Question 936 0.45-36%

A single turn plane loop of wire of cross sectional area 40 cm**2 is perpendicular to a magnetic field that increases uniformly in magnitude from 0.5 T to 5.5 T in 2.0 seconds. What is the resistance of the wire if the induced current has a value of 1.0*10**(-3) A?

(a) 30 Ohms.
(b) 20 Ohms.
(c) 50 Ohms.
(d) 40 Ohms.
(e) 10 Ohms.

31-04

Question 937

A rectangular loop of wire is placed midway between two long straight parallel conductors as shown in figure (11). The conductors carry currents i1 and i2 as indicated. If i1 is increasing and i2 is constant, then the induced current in the loop is:

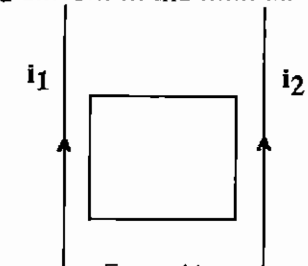

Figure 11

(a) counterclockwise.
(b) depends on i1 - i2.
(c) depends on i1 + i2.
(d) zero.
(e) clockwise.

31-04
0.43-59%

Question 938

A 200-turn coil has a cross sectional area of 0.20 m**2 and a resistance of 20 ohms. The coil is placed in a magnetic field perpendicular to the plane of the coil. The magnitude of the magnetic field decreases from 1.6 milli-T to zero in 0.020 seconds. What is the current induced in the coil ?

(a) 160 mA
(b) 3.20 mA
(c) 32.0 mA
(d) 16.0 mA
(e) 0.800 mA

31-04
0.48-59%

Question 939

A square loop of wire lies in the plane of the page. A decreasing magnetic field is directed into the page. The induced current in the loop:

(a) is zero.
(b) is clockwise in two of the loop sides and counterclockwise in the other two.
(c) is counterclockwise.
(d) depends upon whether or not B is decreasing at a constant rate
(e) is clockwise.

31-04
0.34-67%

Question 940

A long straight wire is in the plane of a rectangular conducting loop as shown in Figure 8. The straight wire carries an increasing current i in the direction shown. The current in the rectangular is:

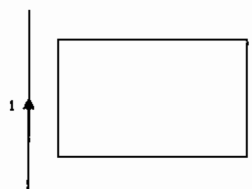

Figure 8

(a) counter clockwise.
(b) counter clockwise in the left side and clockwise in the right side.
(c) clockwise in the left side and counter clockwise in the right side.
(d) zero.
(e) clockwise.

31-04
0.36-62%

Question 941

The circuit shown in figure 9 is in a uniform magnetic field that is into the page and is decreasing in the magnitude at the rate of 150 T/s. The current in the circuit is:

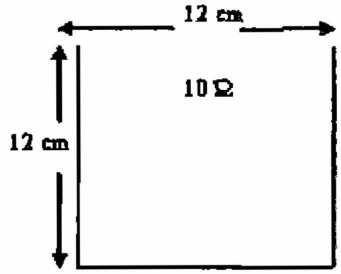

Figure 9

(a) 0.18 A.
(b) 0.22 A.
(c) 0.15 A.
(d) 0.62 A.
(e) 0.40 A.

31-04
0.53-45%

Question 942

A long straight wire carrying a constant current I is in the plane of a circular conducting loop as shown in figure (9). If the wire is moved away from the loop toward point A, the current induced in the loop is

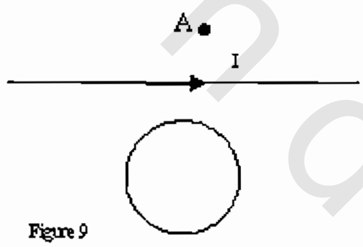

Figure 9

(a) zero.
(b) into the page.
(c) out of the page.
(d) counterclockwise.
(e) clockwise.

31-04
0.59-45%

Question 943

The area of a 333-turn conducting coil is 78.5*10**(-4) m**2 and its resistance is 10.4 ohms. The coil lies in the xy plane and is placed in a magnetic field that points in the z direction. At what rate should the magnetic field change to induce a current of 2.50 mA in the coil?

(a) 3.31 T/s
(b) 0.757 T/s
(c) 0.228 T/s
(d) 0.00995 T/s
(e) 1.52 T/s

31-04
Question 944
0.67-54%

A long, straight wire is in the same plane as a square metallic loop (see figure 9). The wire carries a steady current I in the direction shown in the figure. Now, the loop is moved upward parallel to the wire. Which of the following statements is CORRECT?

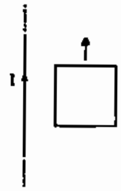

FIGURE 9

(a) The magnetic flux through the loop will decrease.
(b) No current will be induced in the loop.
(c) A clockwise current will be induced in the loop.
(d) The magnetic flux through the loop will increase.
(e) A counter-clockwise current will be induced in the loop.

31-04
Question 945
0.48-47%

A 2.0 m long copper wire, with resistance 5.0 Ohm, is formed into a square loop and placed perpendicular to a uniform magnetic field that is increasing at the constant rate of 10.0 mT/s, at what rate is thermal energy generated in the loop?

(a) 2.1*10**(-4) W.
(b) 4.5*10**(-6) W.
(c) 1.3*10**(-6) W.
(d) 3.2*10**(-3) W.
(e) 0.1*10**(-6) W.

31-04
Question 946
0.43-30%

A small circular loop of area 0.50 cm**2 is placed in the plane of, and concentric with, a large circular loop of radius 2.0 m. The current in the large loop is changed uniformly from +100 A to 100 A in a time of 0.50 s. Find the emf induced in the small loop in this time interval (Assume the field is uniform through the smaller loop).

(a) 7.5*10**(-6) V.
(b) 3.1*10**(-8) V.
(c) 9.2*10**(-9) V.
(d) 5.0*10**(-8) V.
(e) 6.3*10**(-9) V.

31-04
Question 947
0.39-61%

A long straight wire is in the plane of a circular conducting loop as shown in figure 9. The straight wire carries a constant current I in the direction shown. The circular loop starts moving to the left. The induced current in the circular loop is:

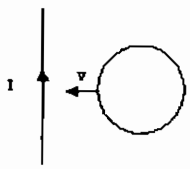

Figure 9

(a) zero.
(b) counter clockwise.
(c) 4*I.
(d) clockwise.
(e) 2*I.

31-5 Induction and Energy Transfers

31-05

Question 948

In the arrangement shown in Figure (7), a conducting bar moves to the right. Assume R=10-Ohm, L=0.5 m, and that a uniform 3.5 T magnetic field is directed into the page. Neglect the mass of the bar, find the power dissipated in the resistor such that the bar moves to the right with a constant speed of 4.0 m/s?

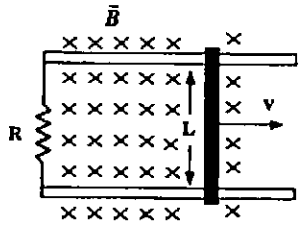

Figure # 7

(a) 1.3 W.
(b) 4.9 W.
(c) 8.6 W.
(d) 2.4 W.
(e) 7.6 W.

31-05

Question 949 0.51-51%

A conducting rod of length 1.2 m is moving with a speed of 10 m/s as shown in Figure 9. If the magnetic field is 0.55 T into the page. Calculate the potential difference between the ends of the rod.

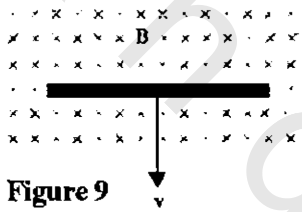

Figure 9

(a) 5.5 V
(b) ZERO
(c) 2.2 V
(d) 8.8 V
(e) 6.6 V

31-05

Question 950

Figure 7 shows a conducting bar moving with a constant speed of 5.0 m/s to the right. Assume that R = 5.0 Ohms, L = 0.20 m, and that a uniform magnetic field of 3.5 T is directed into the page. Calculate the magnitude of the applied force pulling the bar.(Neglect the mass of the bar.)

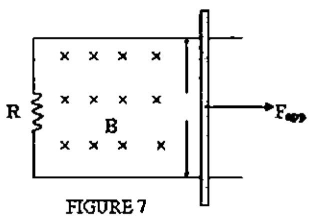

FIGURE 7

(a) 0.25 N
(b) 0.92 N
(c) 1.5 N
(d) 0.73 N
(e) 0.49 N