Questions

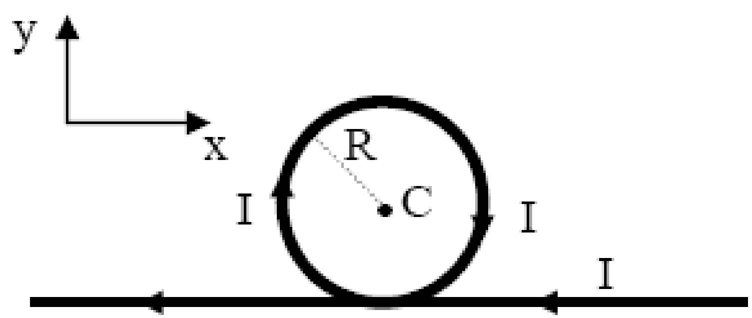
Chapter 29
Magnetic Fields Due to Currents

29-1 Calculating the Magnetic Field Due to a Current
29-2 Force Between Two Parallel Currents
29-3 Ampere's Law
29-4 Solenoids and Toroids

29-1 Calculating the Magnetic Field Due to a Current
final-062

A very long wire carries a current I = 0.5 A directed along the negative x-axis. Part of the wire is bent into a circular section of radius R = 2.5 cm as shown in the figure. What is magnetic field at point C?

A) 5.44 μT, out of the page
B) 16.6 μT, into the page
C) 10.2 μT, into the page
D) 5.44 μT, into the page
E) 16.6 μT, out the page



Answer B

29-1 Calculating the Magnetic Field Due to a Current

final-061

The radius R of a long current-carrying wire is 4.2 cm. If the magnetic field at r_1= 3.0 cm is equal to four times the magnetic field at r_2 , $r_2 > R$, calculate the distance r_2.

A) 23.5 cm
B) 12.2 cm
C) 6.2 cm
D) 8.0 cm
E) 43.1 cm

Answer A

29-1 Calculating the Magnetic Field Due to a Current
final-042

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 I_1=20A, I_2= -6A, I_3= 12A, I_4= -7A, and I_5= 18A (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)10 micro-T.
C)74 micro-T.
D)29 micro-T.
E)zero.

Answer C

29-1 Calculating the Magnetic Field Due to a Current
final-042

Figure 10 shows two concentric, circular wire loops, of radii r_1=15 cm and r_2= 30 cm, are located in the xy plane. The inner loop carries a current of 8.0 A in the clockwise direction, and the outer loop carries a current of 10.0 A in the counter clockwise direction. Find the net magnetic field at the center.

A)33.5 x10^{-6} T, directed into the page.
B)12.6 x10^{-6} T, directed out of the page.
C)12.6 x10^{-6} T, directed into the page.
D)33.5 x10^{-6} T, directed out of the page.
E)zero.

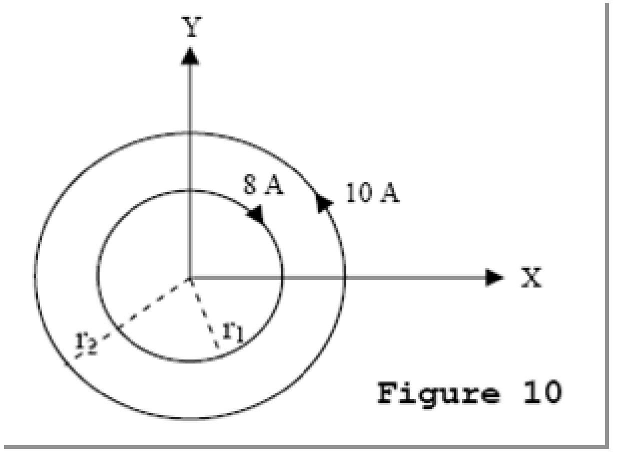


Figure 10

Answer C

29-1 Calculating the Magnetic Field Due to a Current
final-042

How strong is the magnetic field at a distance of 10.0 cm from a long straight wire, of radius 3.0 cm carrying a current of 5.0 A?

A)1.0 $x10^{-5}$ T.
B)3.4 $x10^{-5}$ T.
C)7.1 $x10^{-5}$ T.
D)2.1 $x10^{-7}$ T.
E)9.0 $x10^{-5}$ T.

Answer A

29-1 Calculating the Magnetic Field Due to a Current
final-042

Two long parallel wires, a distance d apart, carry currents of I and $5I$ in the same direction. Locate the point r, from I, at which their magnetic fields cancel each other.

A)r= d/6.
B)r= d/2.
C)r= 2d.
D)r= 3d/2.
E)r= d/4.

Answer A

final-041

Two long wires are parallel to the z-axis as shown in figure 2. Find the resultant magnetic field at the origin, given that the wires carry equal current I and moves in the same direction. [Take I= 1.0 A and a= 0.5 m]

A)8.0 x10^{-7} Tesla, In the positive x-direction.
B)8.0 x10^{-4} Tesla, In the negative x-direction.
C)3.2 x10^{-3} Tesla, In the positive z-direction.
D)3.2 x10^{-4} Tesla, In the positive z-direction.
E)Zero.

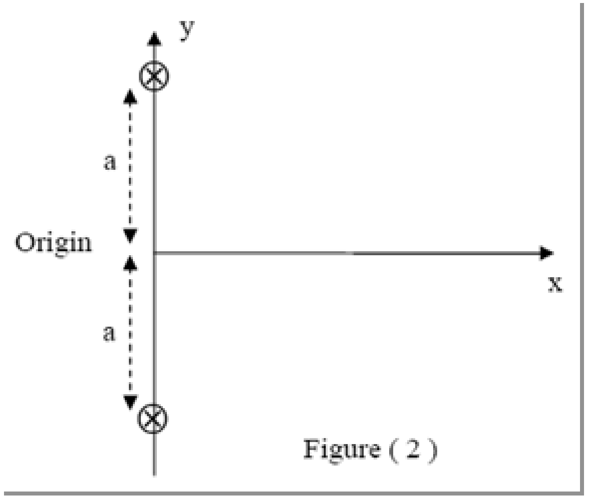


Figure (2)

Answer E

29-1 Calculating the Magnetic Field Due to a Current
final-041

Part of a long, flexible, current-carrying wire is made into a circular loop, while the rest of it lies in a straight line as shown in figure 3. What is the magnetic field strength at point C, the center of the loop? [Take I = 1.0 A and a=0.5 m]

A)Zero.
B)1.7 x10^{-6} T, into the page.
C)3.4 x10^{-6} T, into the page.
D)3.4 x10^{-6} T, out of the page.
E)1.7 x10^{-6} T, out of the page.

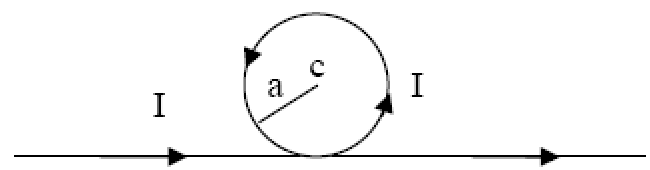


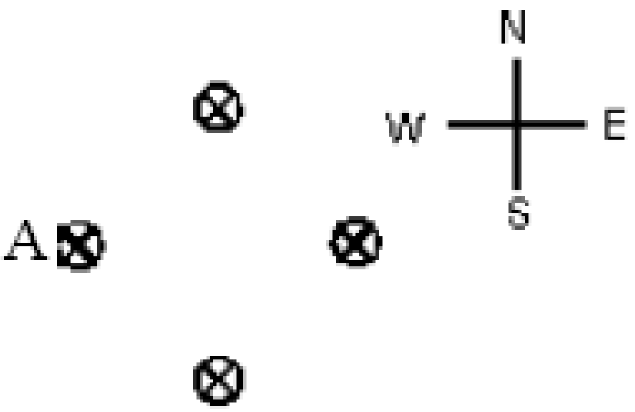
Figure (3)

Answer E

29-2 Force Between Two Parallel Currents
final-062

Four long straight wires carry equal currents into the page as shown in the figure. The direction of the net magnetic force exerted on wire A by the other three wires is:

A) South
B) North
C) East
D) West
E) zero



Answer
C

29-2 Force Between Two Parallel Currents

final-061

Two long straight wires are parallel and carry current in opposite directions. The currents are 8.0 and 12 A and the wires are separated by 0.40 cm. The magnetic field in tesla at a point midway between the wires is:

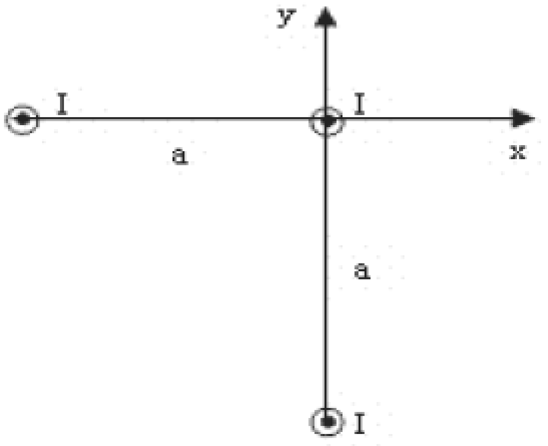
A) 40×10^{-4}
B) 20×10^{-4}
C) 80×10^{-4}
D) 12×10^{-4}
E) 0

Answer B

29-2 Force Between Two Parallel Currents
final-061

Suppose that the identical currents I in the following figure are all out of the page. The magnitude of the force per unit length on the wire at the origin is: [take I = 10.0 A, and a = 10^{-4} m.]

A) 0.13 N/m.
B) 0.18 N/m.
C) 0.55 N/m.
D) 0.28 N/m.
E) 0.30 N/m

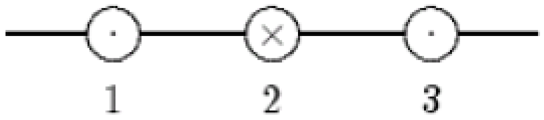


Answer
D

29-2 Force Between Two Parallel Currents
final-061

The diagram shows three equally spaced wires that are perpendicular to the page. The currents are all equal, two being out of the page and one being into the page. Rank the wires according to the magnitudes of the magnetic forces on them, from least to greatest.

A) 2, then 1 and 3 tie
B) 1, 2, 3
C) 2 and 3 tie, then 1
D) 1 and 3 tie, then 2
E) 3, 2, 1



Answer
D

29-2 Force Between Two Parallel Currents
final-042

Three long parallel wires are arranged as shown in figure 8. Wires 1 and 3 each carries a current of 5.0 A in the directions shown. If the net magnetic force on wire 3 is zero, what is the magnitude and direction of the current in wire 2?

A)2.5 A, downwards.
B)2.5 A, upwards.
C)5.5 A, downwards.
D)5.5 A, upwards.
E)30 A, downwards.

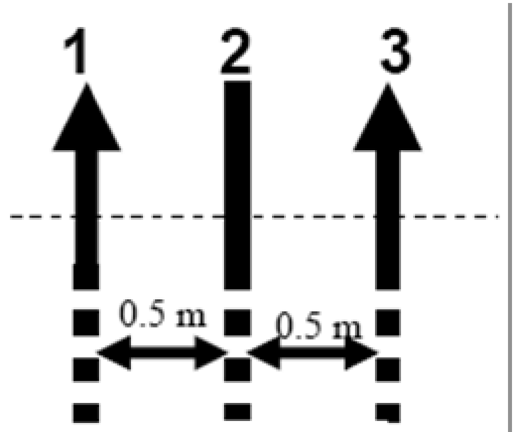


Figure 8

Answer A

29-2 Force Between Two Parallel Currents
final-041

Two infinite parallel wires are separated by 2.5 cm and carry current 10 A and 12 A in the same direction. What is the force per unit length on each wire?

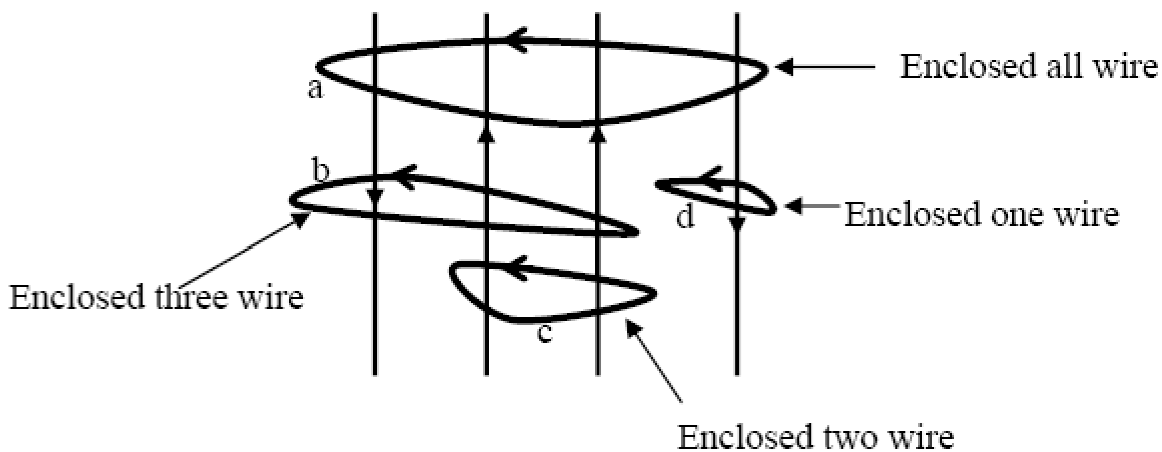
A)2.0 x10^{-3} N/m, attraction.
B)1.0 x10^{-3} N/m, repulsive.
C)0.5 x10^{-3} N/m, attraction.
D)0.5 x10^{-3} N/m, repulsive.
E)1.0 x10^{-3} N/m, attraction .

Answer E

29-3 Ampere's Law
final-062

The figure shows four wires carrying equal currents and four Amperian loops. Rank the loops according to the magnitude of $\oint \vec{B}\cdot d\vec{s}$ along each, greatest first.

A) c, b and d tie, then a
B) a, b and a tie, then c
C) c, a, b, d
D) c, d, a, b
E) a, b, c, d

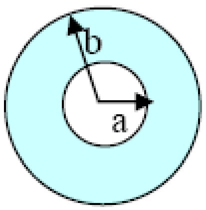


Answer A

29-3 Ampere's Law
final-062

The following figure shows a hollow cylindrical conductor of inner radius a = 3.0 mm and outer radius b = 5.0 mm carries a current of 2.0 A parallel to its axis. The current is uniformly distributed over the cross section of the conductor. Find the magnitude of the magnetic field at a point that is 2.0 mm from the axis of the conductor.

A) 15 nT
B) 32 nT
C) zero
D) 45 nT
E) 50 nT



Answer
C

29-3 Ampere's Law
final-061

An infinitely long wire has a charge density λ per unit length. The wire moves along its axis with a velocity V. The ratio of the magnetic field to the eclectic field at a point *r from the wire is:*

A) independent of *r*
B) directly proportional to λ
C) proportional to *r*
D) inversly proportional to *r*
E) inversly proportional to r^2

Answer A

29-3 Ampere's Law
final-041

Figure 4 shows four circular loops concentric with a wire whose current is directed out of the page. The current is uniform across the cross section of the wire. Rank the loops according to the magnitude of the enclosed current, greatest first [loops a and b inside the wires, c and d are outside]

A)a > c > b > d.
B)d > c > b > a.
C)a > c > b > d.
D)d = c > b > a .
E)a = b > c > d.

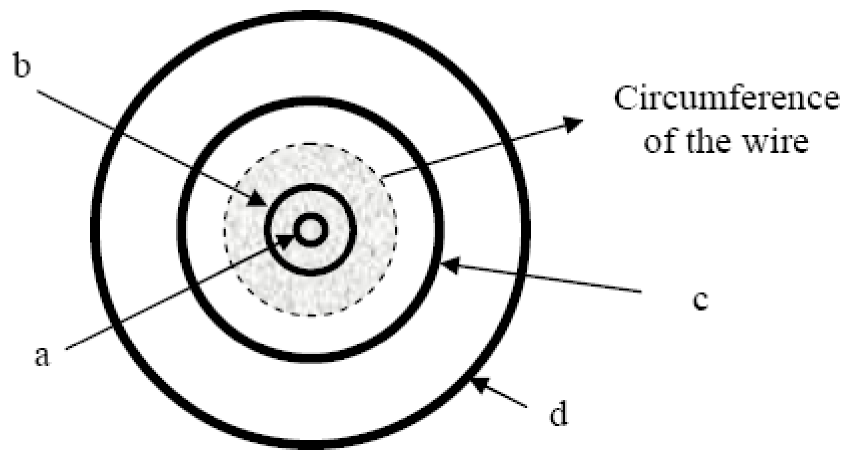


Figure (4)

Answer D

29-4 Solenoids and Toroids
final-062

An ideal solenoid that is 100 cm long has a diameter of 5.0 cm and a winding of 1000 turns and carries a current of 5.0 A. Calculate the magnetic field inside the solenoid.

A) 1.8 mT
B) 3.2 mT
C) 0.9 mT
D) 0.3 mT
E) 6.3 mT

Answer E

29-4 Solenoids and Toroids
final-061

A 600-turn solenoid is 40 cm long, has a radius of 0.6 cm and carries a current of 3.0 A. The magnitude of the magnetic field at the center of the solenoid is:

A) 5.65 mT
B) 2.25 mT
C) 56.2 μT
D) 56.2 mT
E) 2.25 μT

Answer A

29-4 Solenoids and Toroids
final-042

An electron is moving along the axis of a solenoid carrying a current. Which of the following is a correct statement about the magnetic force acting on the electron?

A)The force acts in the direction of motion.
B)The force acts radially inward.
C)The force acts radially outward.
D)No force acts .
E)The force acts opposite to the direction of motion.

Answer D

29-4 Solenoids and Toroids
final-042

A copper wire is of total length 1.0 m. You want to make N-turn circular current loop, using the entire wire, that generates a 1.0 mT magnetic field at the center of the coil when the current is 1.0 A. What will be the diameter of your coil?

A)0.02 m.
B)0.12 m.
C)0.22 m.
D)0.50 m.
E)0.01 m.

Answer A

29-4 Solenoids and Toroids
final-041

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 in the direction of motion.
B)The force acts radially inwards.
C)The force acts radially outwards.
D)No force acts .
E)The force acts in the opposite direction of motion.

Answer D

29-4 Solenoids and Toroids
final-041

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)8.0 x10^{-7} Tesla.
B)2.4 x10^{-3} Tesla .
C)3.5 x10^{-3} Tesla.
D)5.0 x10^{-3} Tesla.
E)8.0 x10^{-4} Tesla.

Answer B