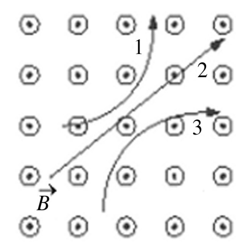
Review Exam-3 UP2

1. A horizontal wire carries a current straight toward you. From your point of view, the magnetic field at a point directly below the wire points
   a. directly away from you.
   b. to the left.
   c. to the right.
   d. directly toward you.
   e. vertically upward.

2. An electron moving in the direction of the $+x$-axis enters a magnetic field. If the electron experiences a magnetic deflection in the $-y$ direction, the direction of the magnetic field in this region points in the direction of the
   a. $+z$-axis.
   b. $-z$-axis.
   c. $-x$-axis.
   d. $+y$-axis.
   e. $-y$-axis.

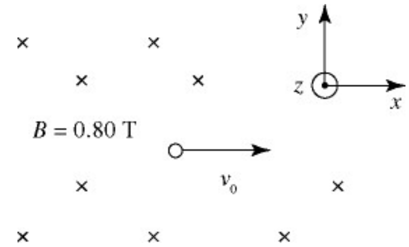
3. Three particles travel through a region of space where the magnetic field is out of the page, as shown in the figure. The electric charge of each of the three particles is, respectively,



   a. 1 is neutral, 2 is negative, and 3 is positive.
   b. 1 is neutral, 2 is positive, and 3 is negative.
   c. 1 is positive, 2 is neutral, and 3 is negative.
   d. 1 is positive, 2 is negative, and 3 is neutral.
   e. 1 is negative, 2 is neutral, and 3 is positive.

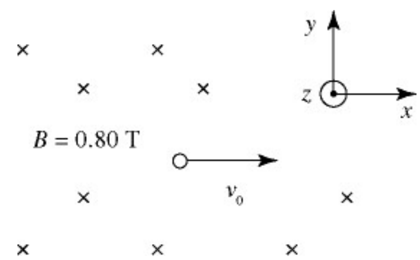
4. An electron traveling toward the north with speed 4.0×10^5 m/s enters a region where the Earth's magnetic field has the magnitude 5.0×10^{-5} T and is directed downward at 45° below horizontal. What is the magnitude of the force that the Earth's magnetic field exerts on the electron? ($e = 1.60 \times 10^{-19}$ C)
   a. 2.3×10^{-18} N
   b. 3.2×10^{-18} N
   c. 2.3×10^{-19} N
   d. 3.2×10^{-19} N
   e. 2.3×10^{-20} N

5. A uniform magnetic field of magnitude 0.80 T in the negative z direction is present in a region of space, as shown in the figure. A uniform electric field is also present and is set at 76,000 V/m in the $+y$ direction. An electron is projected with an initial velocity $v_0 = 9.5 \times 10^4$ m/s in the $+x$ direction. The y component of the initial force on the electron is closest to which of the following quantities? ($e = 1.60 \times 10^{-19}$ C)



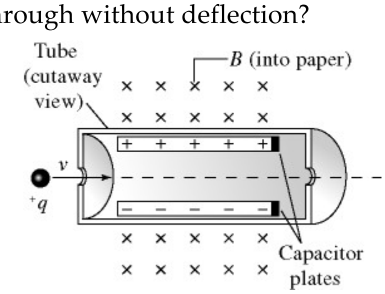
a. -2.4×10^{-14} N
b. $+2.4 \times 10^{-14}$ N
c. -1.0×10^{-14} N
d. $+1.0 \times 10^{-14}$ N
e. zero

6. A uniform magnetic field of magnitude 0.80 T in the negative z-direction is present in a region of space, as shown in the figure. A uniform electric field is also present. An electron that is projected with an initial velocity $v_0 = 9.1 \times 10^4$ m/s in the positive x-direction passes through the region without deflection. What is the electric field vector in the region?



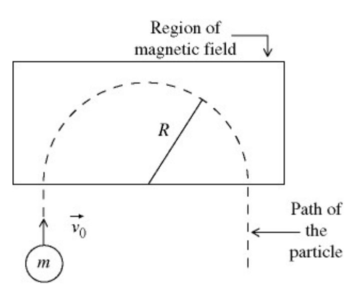
a. -73 kV/m $\hat{\boldsymbol{j}}$
b. $+73$ kV/m $\hat{\boldsymbol{i}}$
c. $+110$ kV/m $\hat{\boldsymbol{i}}$
d. $+110$ kV/m $\hat{\boldsymbol{j}}$
e. -110 kV/m $\hat{\boldsymbol{j}}$

7. The figure shows a velocity selector that can be used to measure the speed of a charged particle. A beam of particles is directed along the axis of the instrument. A parallel plate capacitor sets up an electric field E, which is oriented perpendicular to a uniform magnetic field B. If the plates are separated by
2.0 mm and the value of the magnetic field is 0.60 T, what voltage between the plates will allow particles of speed 5.0×10^5 m/s to pass straight through without deflection?

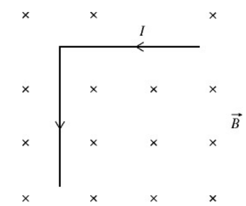


a. 600 V
b. 1900 V
c. 3800 V
d. 190 V
e. 94 V

8. As shown in the figure, a small particle of charge $q = -7.0 \times 10^{-6}$ C and mass $m = 3.1 \times 10^{-12}$ kg has velocity $v_0 = 9.4 \times 10^3$ m/s as it enters a region of uniform magnetic field. The particle is observed to travel in the semicircular path shown, with radius $R = 5.0$ cm. Calculate the magnitude and direction of the magnetic field in the region

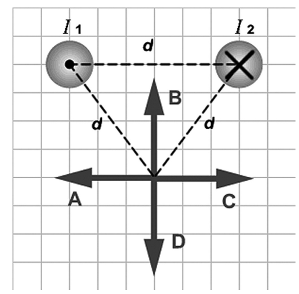


9. An L-shaped metal machine part is made of two equal-length segments that are perpendicular to each other and carry a 4.50-A current as shown in the figure. This part has a total mass of 3.80 kg and a total length of 3.00 m, and it is in an external 1.20-T magnetic field that is oriented perpendicular to the plane of the part, as shown. What is the magnitude of the NET magnetic force that the field exerts on the part?



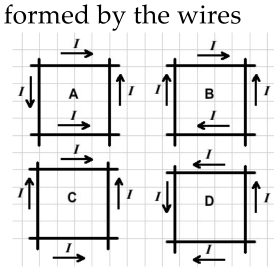
a. 8.10 N
b. 11.5 N
c. 16.2 N
d. 22.9 N
e. 32.4 N

10. The figure shows two long wires carrying equal currents I_1 and I_2 flowing in opposite directions. Which of the arrows labeled A through D correctly represents the direction of the magnetic field due to the wires at a point located at an equal distance d from each wire?



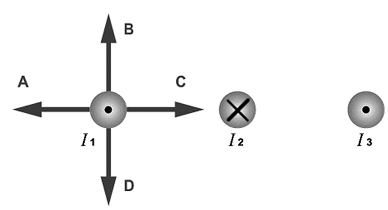
a. A
b. B
c. C
d. D
e. The magnetic field is zero at that point.

11. The figure shows four different sets of insulated wires that cross each other at right angles without actually making electrical contact. The magnitude of the current is the same in all the wires, and the directions of current flow are as indicated. For which (if any) configuration will the magnetic field at the center of the square formed by the wires be equal to zero?



a. A
b. B
c. C
d. D
e. The field is not equal to zero in any of these cases.

12. The figure shows three long, parallel current-carrying wires. The magnitudes of the currents are equal and their directions are indicated in the figure. Which of the arrows drawn near the wire carrying current 1 correctly indicates the direction of the magnetic force acting on that wire?



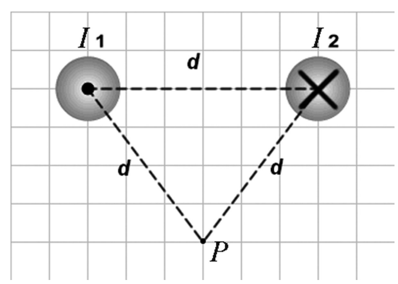
a. A
b. B
c. C
d. D
e. The magnetic force on current 1 is equal to zero.

13. Consider a solenoid of length L, N windings, and radius b (L is much longer than b). A current I is flowing through the wire. If the radius of the solenoid were doubled (becoming $2b$), and all other quantities remained the same, the magnetic field inside the solenoid would
    a. remain the same.
    b. become twice as strong.
    c. become one half as strong.

14. A very long thin wire produces a magnetic field of 0.0050×10^{-4} T at a distance of 3.0 mm from the central axis of the wire. What is the magnitude of the current in the wire? ($\mu_0 = 4\pi \times 10^{-7}$ T • m/A)
    a. 7.5 mA
    b. 1.7 mA
    c. 3300 mA
    d. 24,000 mA

15. The magnetic field at a distance of 2 cm from a current carrying wire is 4 μT. What is the magnetic field at a distance of 4 cm from the wire?
    a. 1/2 μT
    b. 1 μT
    c. 2 μT
    d. 4 μT
    e. 8 μT

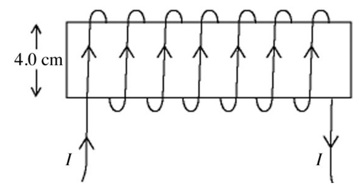
16. The figure shows two long, parallel current-carrying wires. The wires carry equal currents $I_1 = I_2 = 20$ A in the directions indicated and are located a distance $d = 0.5$ m apart. Calculate the magnitude and direction of the magnetic field at the point P that is located an equal distance d from each wire. ($\mu_0 = 4\pi \times 10^{-7}$ T • m/A)



    a. 8 μT downward
    b. 8 μT upward
    c. 4 μT downward
    d. 4 μT upward
    e. 4 μT to the right

17. A solenoid having N turns and carrying a current of 2.000 A has a length of 34.00 cm. If the magnitude of the magnetic field generated at the center of the solenoid is 9.000 mT, what is the value of N?
($\mu_0 = 4\pi \times 10^{-7}$ T • m/A)
    a. 860.0
    b. 1591
    c. 2318
    d. 3183
    e. 1218

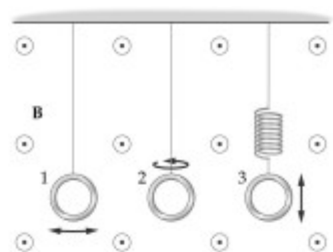
18. A solenoid is wound with 970 turns on a form 4.0 cm in diameter and 50 cm long. The windings carry a current I in the sense that is shown in the figure. The current produces a magnetic field, of magnitude 4.3 mT, near the center of the solenoid. Find the current in the solenoid windings. ($\mu_0 = 4\pi \times 10^{-7}$ T • m/A)



    a. 1.8 A
    b. 1.5 A
    c. 1.3 A
    d. 2.2 A
    e. 2.0 A

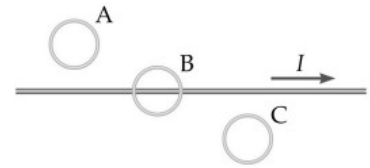
19. A 1000-turn toroidal solenoid has a central radius of 4.2 cm and is carrying a current of 1.7 A. What is the magnitude of the magnetic field inside the solenoid at the central radius? ($\mu_0 = 4\pi \times 10^{-7}$ T • m/A)
    a. 8.1 mT
    b. 51 mT
    c. 16 mT
    d. 81 mT
    e. zero

20. The three loops of wire shown in the figure are all subject to the same uniform magnetic field $\vec{B}$ that does not vary with time. Loop 1 oscillates back and forth as the bob in a pendulum, loop 2 rotates about a vertical axis, and loop 3 oscillates up and down at the end of a spring. Which loop, or loops, will have an emf induced in them?
    a. A) loop 1 only
    b. B) loop 2 only
    c. C) loop 3 only
    d. D) loops 1 and 2
    e. E) loops 2 and 3



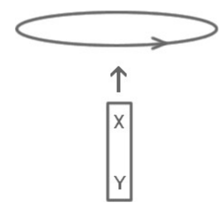
21. A circular loop of wire lies in the plane of the paper. An increasing magnetic field points out of the paper. What is the direction of the induced current in the loop?
    a. counter-clockwise then clockwise
    b. clockwise then counter-clockwise
    c. clockwise
    d. counter-clockwise
    e. There is no current induced in the loop.

22. The long straight wire in the figure carries a current I that is decreasing with time at a constant rate. The circular loops A, B, and C all lie in a plane containing the wire. The induced emf in each of the loops A, B, and C is such that



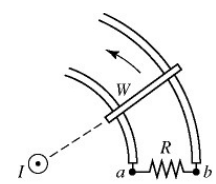
 a. no emf is induced in any of the loops.
 b. a counterclockwise emf is induced in all the loops.
 c. loop A has a clockwise emf, loop B has no induced emf, and loop C has a counterclockwise emf.
 d. loop A has a counter-clockwise emf, loop B has no induced emf, and loop C has a clockwise emf.
 e. loop A has a counter-clockwise emf, loops B and C have clockwise emfs.

23. The figure shows a bar magnet moving vertically upward toward a horizontal coil. The poles of the bar magnets are labeled X and Y. As the bar magnet approaches the coil it induces an electric current in the direction indicated on the figure (counter-clockwise as viewed from above). What are the correct polarities of the magnet?



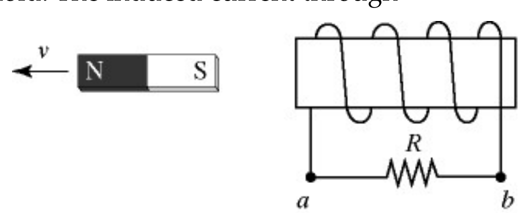
 a. X is a south pole, Y is a north pole.
 b. X is a north pole, Y is a south pole.
 c. Both X and Y are north poles.
 d. Both X and Y are south poles.
 e. The polarities of the magnet cannot be determined from the information given.

24. In the figure, a straight wire carries a steady current I perpendicular to the plane of the page. A bar is in contact with a pair of circular rails, and rotates about the straight wire. The direction of the induced current through the resistor R is



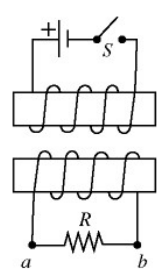
 a. from a to b.
 b. from b to a.
 c. There is no induced current through the resistor.

25. In the figure, a bar magnet moves away from the solenoid. The induced current through the resistor R is



 a. from a to b.
 b. from b to a.
 c. There is no induced current through the resistor.

26. In the figure, two solenoids are side by side. The switch S, initially open, is closed. The induced current through the resistor R is

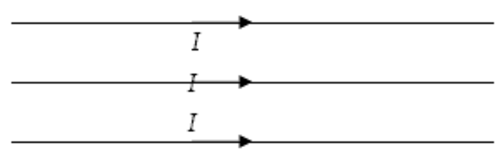


 a. from a to b.
 b. from b to a.
 c. There is no induced current through the resistor.

27. A 2.0-m long conducting wire is formed into a square and placed in the horizontal *xy*-plane. A uniform magnetic field is oriented 30.0° above the horizontal with a strength of 9.0 T. What is the magnetic flux through the square?
    a. $1.1\ T \cdot m^2$
    b. $1.9\ T \cdot m^2$
    c. $2.3\ T \cdot m^2$
    d. $18\ T \cdot m^2$

28. The coil in a 60-Hz ac generator has 125 turns, each having an area of $3.0 \times 10^{-2}\ m^2$ and is rotated in a uniform 0.12-T magnetic field. What is the peak output voltage of this generator?
    a. 170 V
    b. 120 V
    c. 200 V
    d. 110 V
    e. 220 V

29. Three coplanar, parallel, straight wires carry equal currents I to the right as shown below. Each pair of wires is a distance a apart. The direction of the magnetic force on the middle wire

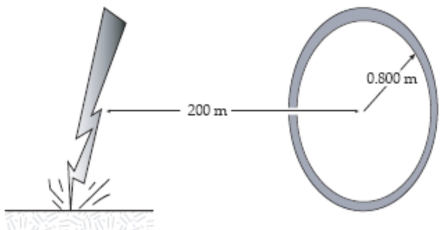


    a. is up out of the plane of the wires.
    b. is down into the plane of the wires.
    c. is in the plane of the wires, directed upwards.
    d. is in the plane of the wires, directed downwards
    e. cannot be defined, because there is no magnetic force on the middle wire

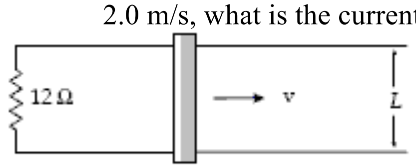
30. At what rate would the current in a 100-mH inductor have to change to induce an emf of 1000 V in the inductor?
    a. 100 A/s
    b. 1 A/s
    c. 1000 A/s
    d. 10,000 A/s
    e. 10 A/s

31. An insulated wire of diameter 1.0 mm and negligible resistance is wrapped tightly around a cylindrical core of radius 5.0 cm and length 30 cm to build a solenoid. What is the energy stored in this solenoid when a current $I = 0.20$ A flows through it? ($\mu_0 = 4\pi \times 10^{-7}\ T \cdot m/A$)
    a. 1.2×10^{-4} J
    b. 9.6×10^{-4} J
    c. 4.8×10^{-4} J
    d. 2.4×10^{-4} J
    e. 5.9×10^{-5} J

32. A bolt of lightning strikes the ground 200 m from a 100-turn coil oriented vertically and with the plane of the coil pointing toward the lightning strike. The radius of the coil is 0.800 m and the current in the lightning bolt falls from 6.02×10^6 A to zero in 10.5 μs. What is the voltage induced in the coil over this time period?

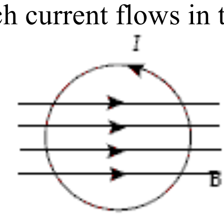


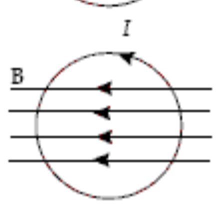
33. A rod (length = 10 cm) moves on two horizontal frictionless conducting rails, as shown. The magnetic field in the region is directed perpendicularly to the plane of the rails and is uniform and constant. If a constant force of 0.60 N moves the bar at a constant velocity of 2.0 m/s, what is the current through the 12-Ω load resistor?

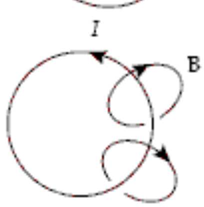


a. 0.32 A
b. 0.34 A
c. 0.37 A
d. 0.39 A
e. 0.43 A

34. Which diagram correctly shows the magnetic field lines created by a circular current loop in which current flows in the direction shown?

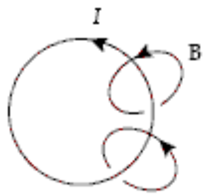
a. 

b. 

c. 

ANS

d.



e.