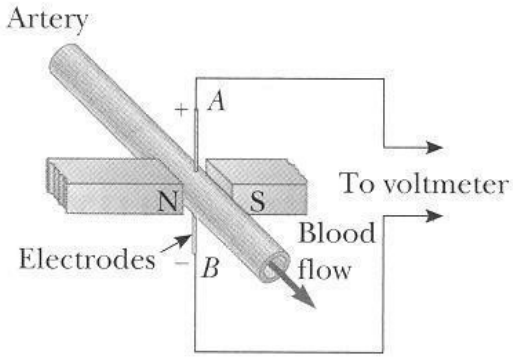
27. A heart surgeon monitors the flow rate of blood through an artery using an electromagnetic flowmeter. Electrodes A and B make contact with the outer surface of the blood vessel, which has interior diameter 3.00 mm. For a magnetic field magnitude of 0.040 T, an emf of 160 μV appears between the electrodes. Calculate the speed of the blood.

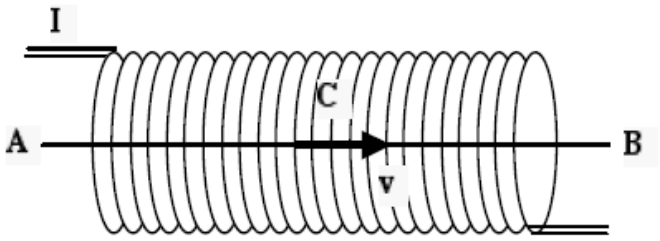


a. 16.2 m/s
b. 8.2 m/s
c. 5.6 m/s
d. 4.2 m/s
e. 1.3 m/s

28. In the figure below, assume i_1 = 2 A and i_2 = 6 A. What is the relationship between the magnitude F_1 of the force exerted on wire 1 and the magnitude F_2 of the force exerted on wire 2?

a. $F_1 = 6F_2$
b. $F_1 = 3F_2$
c. $F_1 = F_2$
d. $F_1 = F_2/3$
e. $F_1 = F_2/6$

29. A solenoid carries a current I. An electron is injected with a velocity v along the axis AB of the solenoid. When the electron is at C, it experiences a force that is



a. zero
b. not zero and parallel to the direction from A to B
c. not zero and parallel to the direction from B to A
d. not zero and perpendicular to the page

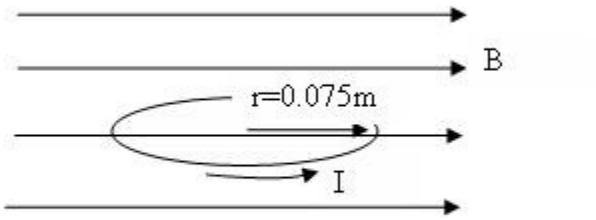
30. A charged particle is moving in a circle in an uniform B-field. If you halve the strength of the B-field and keep all other quantities the same, then the radius of the circle

a. stays the same
b. is half the size
c. is a quarter the size
d. increases by a factor of four
e. doubles

31. A hollow, cylindrical copper tube carries a 1 A current along its length. The radius of the tube is 1cm. What is the magnitude of the B-field at the center of the tube?

a. $2 * 10^{-5}$ T
b. $4 * 10^{-5}$ T
c. $1 * 10^{-5}$ T
d. 0 T
e. $6.3 * 10^{-5}$ T

32. A circular loop of wire is 0.075 m in radius and lies in the horizontal plane (part of the loop is obscured in the diagram). It carries a current of 2.00 A in a counter-clockwise direction when viewed from above. The loop is in a uniform external B-field of strength 1.20 T that is directed to the right. What is the magnitude of the torque that this loop of wire experiences.

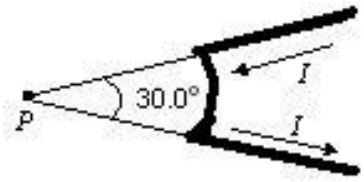


a. 0.0 Nm
b. 0.021 Nm
c. 0.12 Nm
d. 0.57 Nm
e. 0.042 Nm

33. A solenoid produces a B-field when it has current in its coils. If a diamagnetic material is placed inside this solenoid, then the total B-field

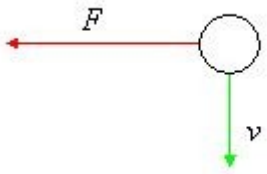
a. increases in strength
b. decreases in strength
c. is unchanged
d. depends on what type of diamagnetic material is placed in the solenoid

34. A current path (thick lines) shaped as shown below produces a magnetic field at *P*, the center of the arc. The thin lines carry no current but indicate how the geometry of the wires extrapolates to point P. If the arc subtends an angle of 30.0^{o} and the radius of the arc is 0.600 m, what is the magnitude of the B-field produced at *P* if the current is 3.00 A?



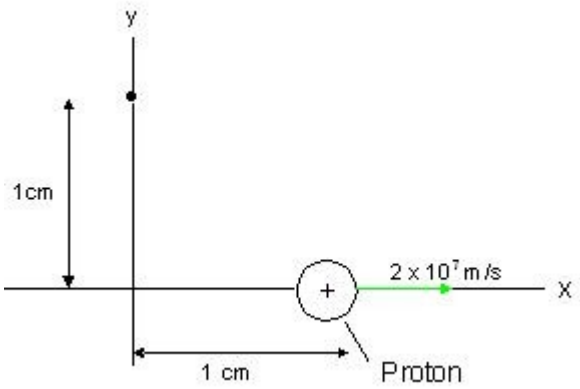
a. $8.3 * 10^{-8}$ T
b. $2.6 * 10^{-7}$ T
c. $3.1 * 10^{-6}$ T
d. $1.8 * 10^{-7}$ T
e. $7.1 * 10^{-7}$T

35. A proton moves down the page and perpendicular to a magnetic field. It experiences a magnetic force to the left. What is the direction of the B-field?



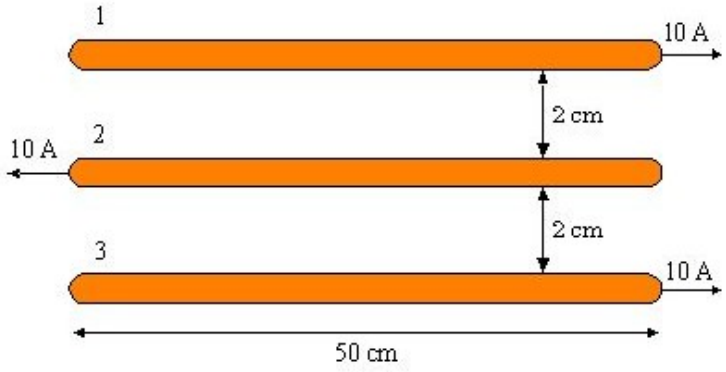
a. Up
b. Into the page
c. Right
d. Down
e. Out of the page

36. A proton moves to the right with a velocity of $2*10^7$ m/s. What are the magnetic field strength and direction at the dot on the y-axis in the figure below?



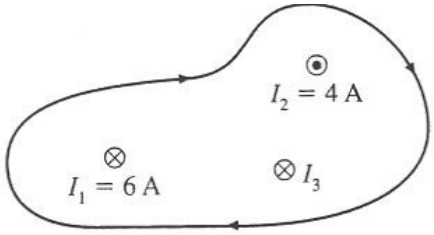
a. 0
b. $3.2 * 10^{-15}$ T, out of page
c. $3.2 * 10^{-15}$ T, into of page
d. $1.6 * 10^{-15}$ T, out of page
e. $1.6 * 10^{-15}$ T, into page

37. Three very long wires are each carrying 10 A of current in the directions shown. What is the net force (magnitude and direction) on a 50cm long section of the bottom wire?



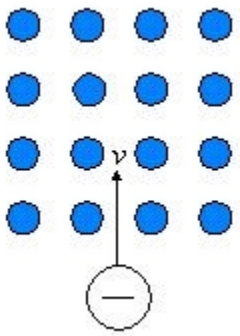
a. $2.5 * 10^{-4}$ N, towards the top of the page
b. $2.5 * 10^{-4}$ N, towards the bottom of the page
c. 0 N
d. $7.5 * 10^{-4}$ N, towards the top of the page
e. $7.5 * 10^{-4}$ N, towards the bottom of the page

38. The value of the line integral of the B-field is $5.0*10^{-6}$ Tm around the closed path in the figure. What is the approximate value of I_3?



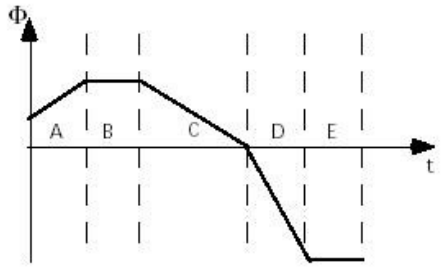
a. 2 A
b. 4 A
c. 6 A
d. 0 A
e. not possible to determine

39. The B-field shown in the diagram is out of the page. What is the *initial* direction of deflection for the negatively charged particle as it enters the magnetic field shown below?



a. into the page
b. out of the page
c. to the right
d. to the left
e. no magnetic force

40. A graph of the magnetic flux Φ through a coil as a function of time t is shown at the right. During which time interval does the induced voltage across the output of the coil have the largest magnitude?

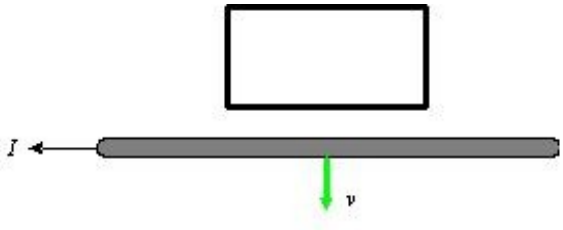


a. A
b. B
c. C
d. D
e. E

41. You push a permanent magnet, with its north pole away from you, toward a loop of conducting wire. The loop is in front of you. Just before the north pole enters the loop the current in the loop is (from your point of view):

a. zero
b. clockwise
c. counterclockwise
d. to your left
e. to your right

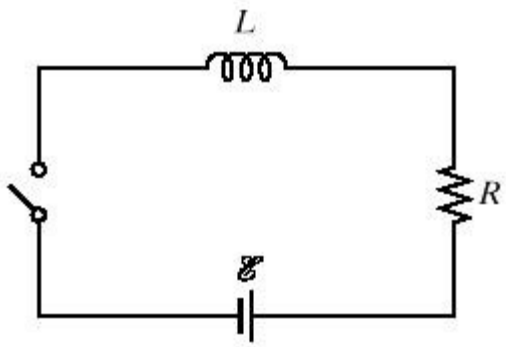
42. A current-carrying wire is pulled away from a conducting loop in the direction shown.



As the wire is moving, there is:

a. a clockwise current around the loop (as viewed in this diagram)
b. a counter-clockwise current around the loop (as viewed in this diagram)
c. no current

43. When the switch is closed, the current through the circuit exponentially approaches a value of I=ε/R. If we repeat this experiment with an inductor that has twice the number of turns per length (and use the same resistor and power supply), then the time it takes for the current to reach a value of I/2



a. increases
b. decreases
c. stays the same
d. insufficient information given

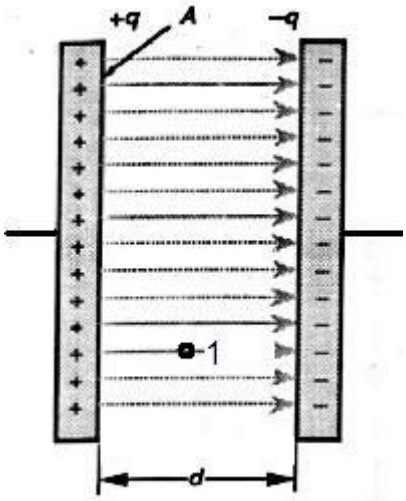
44. An inductor is made by tightly wrapping a single layer of 0.30 mm diameter wire around a cylinder of 2.0mm radius. What length cylinder has an inductance of 10 μH ?

a. 0.057 m
b. 0.18 m
c. 0.26 m
d. 0.041 m
e. 0.72 m

45. A series circuit has a power supply, a switch, a resistor and an inductor. The switch jas been closed for a long-time and the current in the circuit is fully established. At a time t=0 the switch is opened. The current will be ___ of its full value after two time constants.

a. 63%
b. 86%
c. 14%
d. 37%
e. 0%

46. While a parallel plate capacitor is charging which direction does the induced magnetic field have at point 1?



a. to the right
b. to the left
c. out of the page
d. into the page
e. no induced B-field exists

47. The circuit element shown is an ideal inductor. The potential at a is lower than the potential at b. Which of the following statements about the inductor current *I* could be true?

a. *I* is from a to b and steady.
b. *I* is from a to b and increasing.
c. *I* is from a to b and decreasing.
d. *I* is from b to a and steady.