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Halliday/Resnick/Walker
Fundamentals of Physics 8th edition

Classroom Response System Questions

Chapter 29 Magnetic Fields Due to Currents

Interactive Lecture Questions

29.2.1. The equation for the magnetic field of a straight, current carrying wire is given by $B = \dfrac{\mu_0 i}{2\pi R}$, but the magnetic field at the center of a single closed circular loop is given by $B = \dfrac{\mu_0 i}{2R}$. Although these equations look similar, there is an important difference between these two equations, other that the factor of π. What is it?

a) The μ_0 factor is different for the two situations.

b) The variable R represents two different lengths.

c) The i represents two different types of current.

29.2.2. Complete the following statement: The magnetic field around a current-carrying, circular loop is most like that of

a) the Earth.

b) a current-carrying, rectangular loop

c) a short bar magnet.

d) a long, straight, current-carrying wire.

e) two long, straight wires that carry currents in opposite directions.

29.3.1. Two parallel wires have currents that have the same direction, but differing magnitude. The current in wire A is i; and the current in wire B is $2i$. Which one of the following statements concerning this situation is true?

a) Wire A attracts wire B with half the force that wire B attracts wire A.

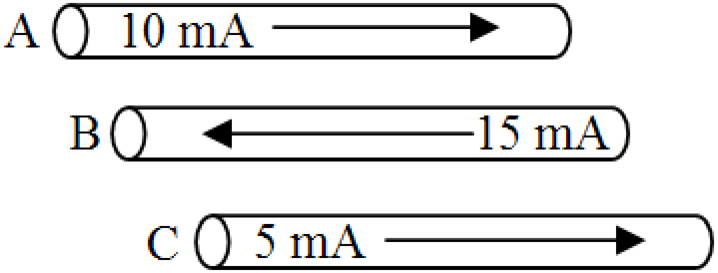
b) Wire A attracts wire B with twice the force that wire B attracts wire A.

c) Both wires attract each other with the same amount of force.

d) Wire A repels wire B with half the force that wire B attracts wire A.

e) Wire A repels wire B with twice the force that wire B attracts wire A.

29.3.4. Three very long, parallel wires (a small portion of each is shown in the drawing) are resting on a flat surface. The distance between wire B, which has a 15 mA current to the left, and its neighbors is 0.0015 m. Wire A carries a 10 mA current toward the right; and wire C carries a 5 mA current toward the right. Rank the wires in order of the magnitude of the net magnetic force on each, with the largest value first and the lowest value last.



a) A > B > C

b) B > A > C

c) C > B > A

d) A > C > B

e) B > C > A

29.4.1. A copper cylinder has an outer radius $2R$ and an inner radius of R and carries a current i. Which one of the following statements concerning the magnetic field in the hollow region of the cylinder is true?

a) The magnetic field within the hollow region may be represented as concentric circles with the direction of the field being the same as that outside the cylinder.

b) The magnetic field within the hollow region may be represented as concentric circles with the direction of the field being the opposite as that outside the cylinder.

c) The magnetic field within the hollow region is parallel to the axis of the cylinder and is directed in the same direction as the current.

d) The magnetic field within the hollow region is parallel to the axis of the cylinder and is directed in the opposite direction as the current.

e) The magnetic field within the hollow region is equal to zero tesla.

29.4.2. The drawing shows two long, thin wires that carry currents in the positive *z* direction. Both wires are parallel to the *z* axis. The 50-A wire is in the *x*-*z* plane and is 5 m from the *z* axis. The 40-A wire is in the *y*-*z* plane and is 4 m from the *z* axis. What is the magnitude of the magnetic field at the origin?

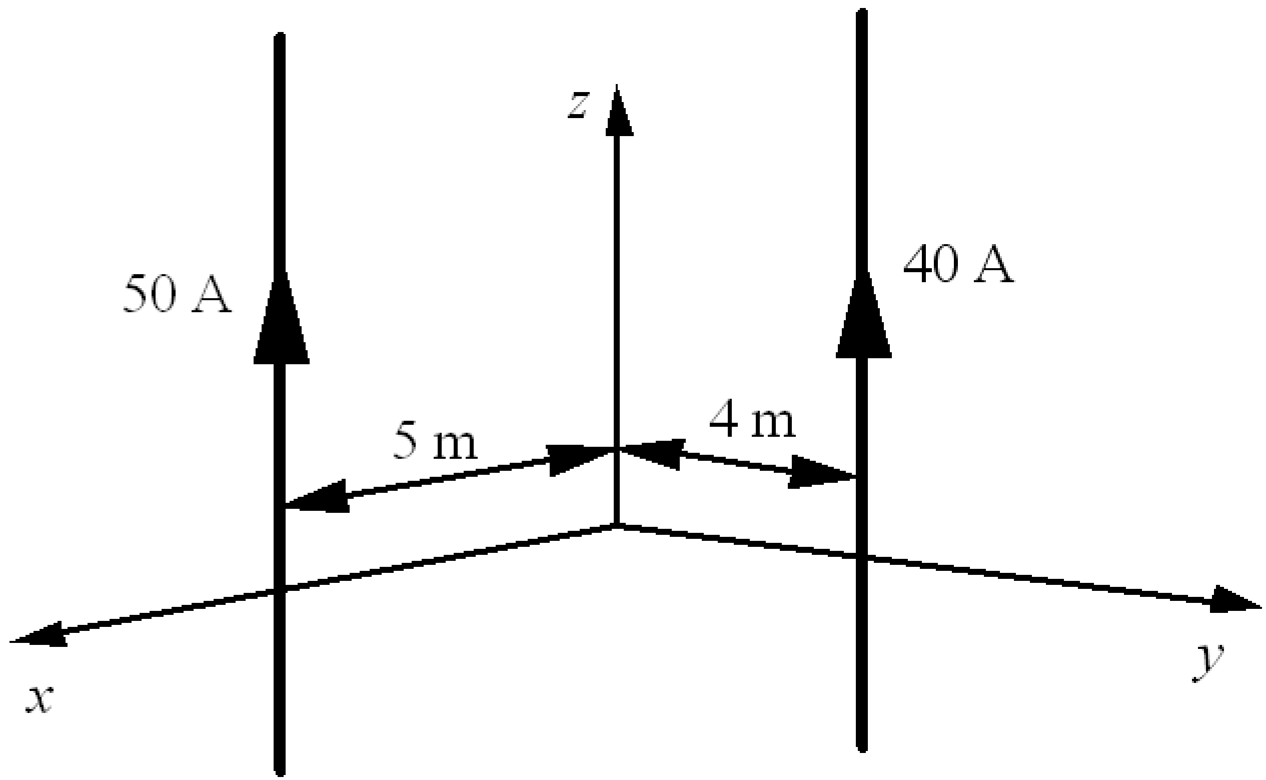
a) zero tesla

b) 1×10^{-6} T

c) 3×10^{-6} T

d) 5×10^{-6} T

e) 7×10^{-6} T



29.4.3. The drawing shows two long, straight wires that are parallel to each other and carry a current of magnitude i toward you. The wires are separated by a distance d; and the centers of the wires are a distance d from the y axis. Which one of the following expressions correctly gives the magnitude of the total magnetic field at the origin of the x, y coordinate system?

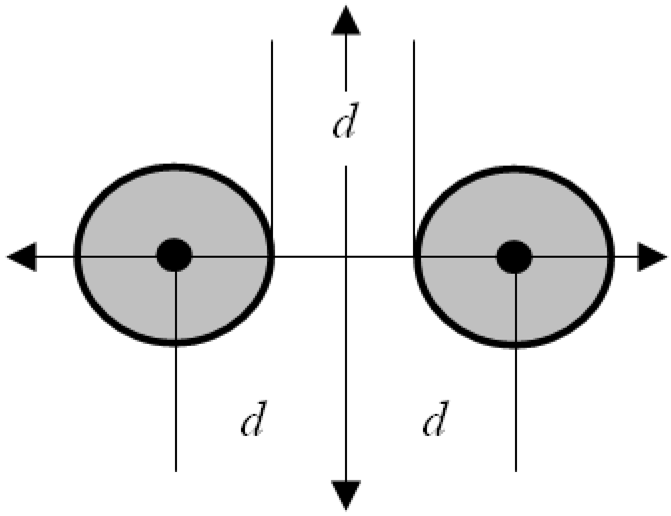
a) $\dfrac{\mu_0 i}{2d}$

b) $\dfrac{\mu_0 i}{\sqrt{2}d}$

c) $\dfrac{\mu_0 i}{2\pi d}$

d) $\dfrac{\mu_0 i}{\pi d}$

e) zero tesla



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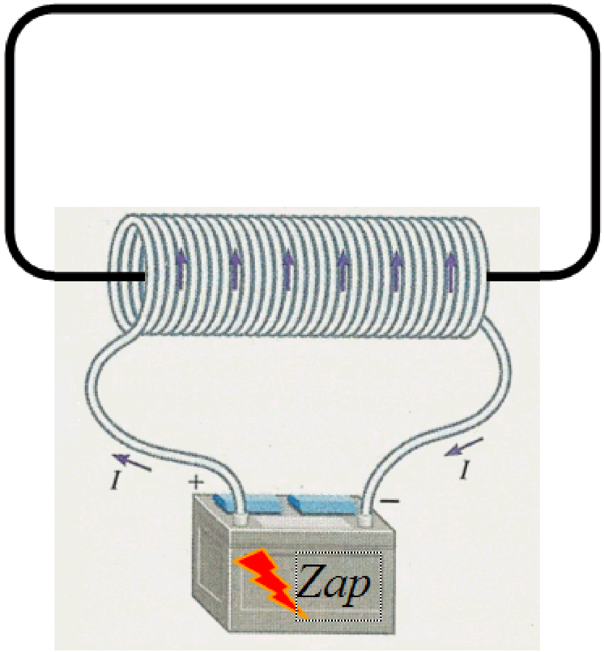
29.5.1. The drawing shows a rectangular wire loop that has one side passing through the center of a solenoid. Which one of the following statements describes the force, if any, that acts on the rectangular loop when a current is passing through the solenoid.



a) The magnetic force causes the loop to move upward.

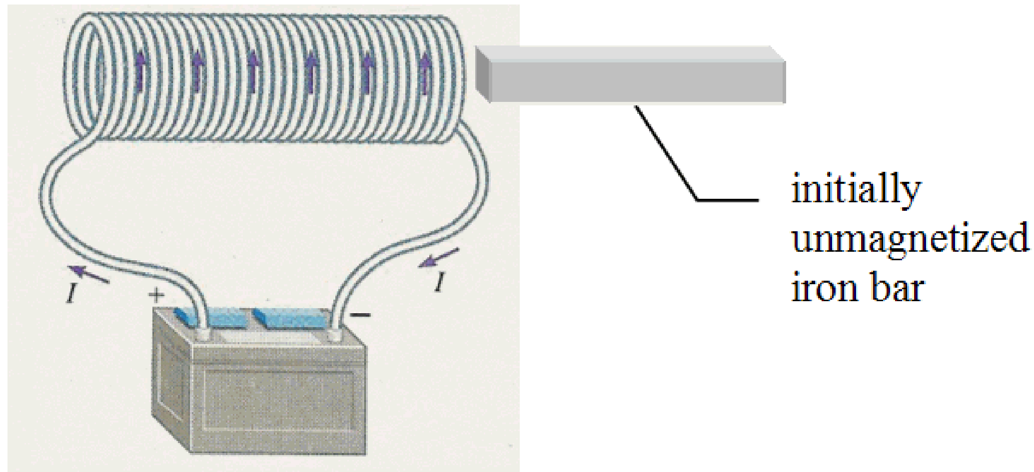
b) The magnetic force causes the loop to move downward.

c) The magnetic force causes the loop to move to the right.

d) The magnetic force causes the loop to move to the left.

e) The loop is not affected by the current passing through the solenoid or the magnetic field resulting from it.

29.5.2. An initially unmagnetized iron bar is placed next to a solenoid. Which one of the following statements describes the iron bar after the solenoid is connected to the battery?



a) A magnetic force accelerates the bar to the right.

b) Since the bar is unmagnetized, there will not be any affect on the bar.

c) The magnetic field of the solenoid will cause a current to flow in a loop that extends from one end of the bar to the other and that continues until the battery is disconnected from the solenoid.

d) The magnetic field of the solenoid induces magnetism in the bar with the bar’s north pole nearest to the solenoid.

e) The magnetic field of the solenoid induces magnetism in the bar with the bar’s south pole nearest to the solenoid.

29.5.4. A solenoid of length 0.250 m and radius 0.0200 m is comprised of 120 turns of wire. Determine the magnitude of the magnetic field at the center of the solenoid when it carries a current of 15.0 A.

a) 9.05×10^{-3} T

b) 7.50×10^{-3} T

c) 4.52×10^{-3} T

d) 2.26×10^{-3} T

e) zero tesla

29.5.5. A solenoid carries current I as shown in the figure. If the observer could "see" the magnetic field inside the solenoid, how would it appear?