Answer on Question 55901, Physics, Electromagnetism

19. If the steady current in a wire is coming directly toward you, the magnetic field lines

a) point radially outward

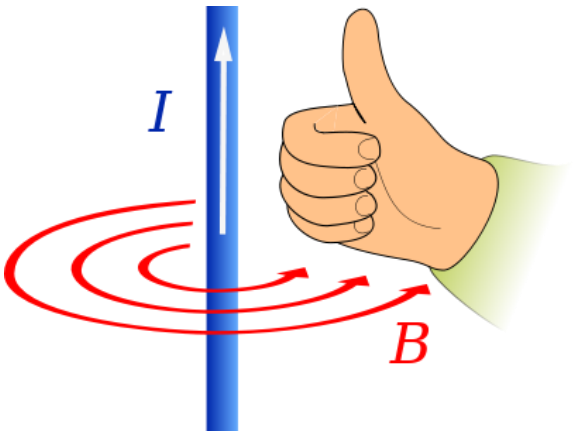
b) radially inward

c) circle the wire in the clockwise direction

d) circle the wire in the counterclockwise direction

Solution:

Let's use the Right Hand Thumb Rule.



Let's imagine the wire to be held in the right hand with the fingers curled around it. If the thumb points in the direction of the current, then the curled fingers show the direction of the magnetic field. In our case, as we can see in the picture above, the magnetic field lines circle the wire in the counterclockwise direction.

Answer:

d) circle the wire in the counterclockwise direction

20. One end of a simple rectangular wire-loop current balance is inserted into a solenoid. A force of $3.0 \cdot 10^{-3} N$ is found to act on this end when a current of $2.0 A$ is flowing in it. If the length of the conductor forming the end of the wire-loop is $0.10 m$. What is the magnetic flux density in the solenoid?

a) $0.043T$

b) $0.26T$

c) $0.43T$

d) $0.015T$

Solution:

The magnetic force act on a current-carrying conductor which is inserted into a solenoid because it oriented perpendicular to the magnetic field. We can obtain the magnitude of the magnetic force that act on the end of the current-carrying conductor from the equation $\boldsymbol{F}_B = I\boldsymbol{L} \times \boldsymbol{B}$, where $\boldsymbol{F}_B$ is the magnetic force, I is the current in the conductor, $\boldsymbol{L}$ is a vector that points in the direction of the current I and has a magnitude equal to the length L of the conductor, $\boldsymbol{B}$ is the magnetic field. Therefore, the magnitude of this force is:

$$F = ILB.$$

From this equation we can find the magnetic flux density in the solenoid:

$$B = \frac{F}{IL} = \frac{3.0 \cdot 10^{-3} N}{2.0A \cdot 0.10m} = 0.015T$$

Answer:

d) $0.015T$