WebAssign
CH18-HW03-FALL2010 (Homework)

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PHYS 272-FALL 2012, Fall 2012
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Current Score : 21.5 / 21.5 **Due :** Friday, October 5 2012 11:59 PM EDT

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1. 2/2 points | Previous Answers MI3 18.7.X.047

A straight wire of length 0.62 m carries a conventional current of 0.5 amperes. What is the magnitude of the magnetic field made by the current at a location 2.9 cm from the wire? Use both the exact formula and the approximate formula to calculate the field.

(a) result using exact formula

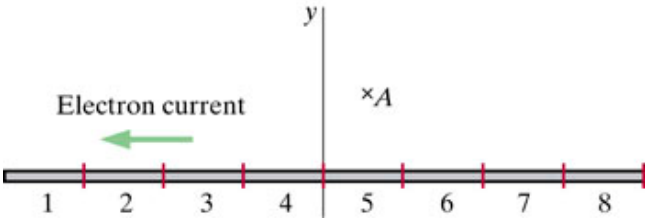
B = 3.433e-6 ✓ T

(b) result using approximate formula

B = 3.448e-6 ✓ T

- *Read the eBook*
- Section 18.7

2. 12.5/12.5 points | Previous Answers MI3 18.6.X.051



A wire through which a current is flowing lies along the x-axis as shown. Connecting wires which are not shown in the diagram connect the ends of the wire to batteries (which are also not shown). Electron current flows through the wire in the -x direction, as indicated in the diagram. To calculate the magnetic field at location *A* due to the current in the wire, we divide the wire into pieces, approximate each piece as a point charge moving in the direction of conventional current, and calculate the magnetic field at the observation location due only to this piece; then add the contributions of all pieces to get the net magnetic field.

The wire is 1.7 m long, and is divided into 8 pieces. The observation location *A* is located at < 0.106, 0.233, 0 >m. The conventional current running through the wire is 6.5 amperes. In this exercise you will calculate the magnetic field at the observation location due only to segment 1 of the wire.

What is the direction of conventional current in this wire? +x ✓

How long is segment 1? 1.7/8 ✓ m

What is the magnitude of the vector $\Delta\vec{l}$ for segment 1? $|\Delta\vec{l}|$ = 1.7/8 ✓ m

What is the vector $\Delta\vec{l}$ for segment 1?

$\Delta\vec{l}$ = < 1.7/8 ✓ , 0 ✓ , 0 ✓ > m

What is the location of the center of segment 1?

source location = < -0.74375 ✓ , 0 ✓ , 0 ✓ > m

What is the vector $\vec{r}$ from source to observation location, for segment 1?

$\vec{r}$ = < 0.84975 ✓ , 0.233 ✓ , 0 ✓ >m

What is the unit vector $\hat{r}$?

$\hat{r}$ = < 0.9644 ✓ , 0.2644 ✓ , 0 ✓ >

What is $\Delta\vec{l}\times\hat{r}$?

$\Delta\vec{l}\times\hat{r}$? = < 0 ✓ , 0 ✓ , 5.6185e-2 ✓ >

Calculate the magnetic field $\Delta\vec{B}$ at the observation location due only to the currrent in seqment 1 of the wire.

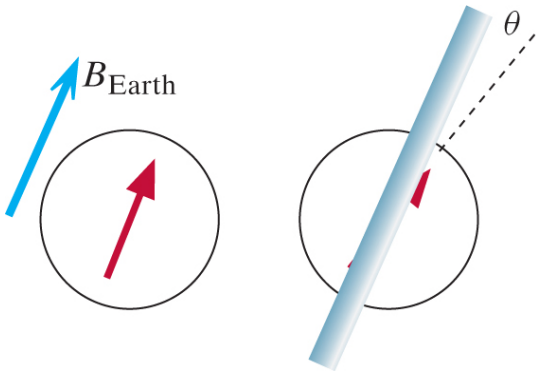
$\Delta\vec{B}$ = < 0 ✓ , 0 ✓ , 4.704e-8 ✓ > tesla

- *Read the eBook*
- Section 18.6

3. 2/2 points | Previous Answers MI3 18.7.P.057

Deflecting a compass needle

When you bring a current-carrying wire down onto the top of a compass, aligned with the original direction of the needle and 3 mm above the needle, the needle deflects by θ = 15 degrees (see the figure).



(a) Which of the following statements are correct? Select all that apply.

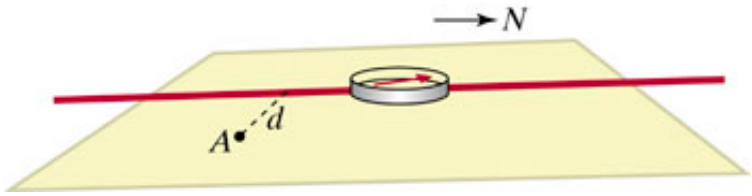
- [x] Electron current in the wire is flowing upward (North).
- [x] The magnetic field under the wire, due to the current, points to the East.
- [ ] The magnetic field under the wire, due to the current, points North.
- [ ] Conventional current in the wire flows upward (North).
- [x] Conventional current in the wire is flowing downward (South).
- [ ] The magnetic field under the wire, due to the current, points to the West.

(b) Calculate the amount of conventional current flowing in the wire. The measurement was made at a location where the horizontal component of the Earth's magnetic field is $B_{\text{Earth}} \approx 2 \times 10^{-5}$ tesla.

8.0385e-2 A

- *Read the eBook*
- Section 18.7

4. 5/5 points | Previous Answers MI3 18.7.P.062



A long current-carrying wire, oriented North-South, lies on a table (it is connected to batteries which are not shown). A compass lies ***on top of the wire***, with the compass needle about 3 mm above the wire. With the current running, the compass deflects 13 degrees to the West. At this location, the horizontal component of the Earth's magnetic field is about 2e-5 tesla.

What is the magnitude of the magnetic field at location *A*, on the table top, a distance 2.8 cm to the East of the wire, due only to the current in the wire?

$|\vec{B}|$ = 4.95e-7 ✓ tesla

What is the direction of the magnetic field at location *A*, due only to the current in the wire? Toward the ceiling ✓

- *Read the eBook*
- Section 18.7