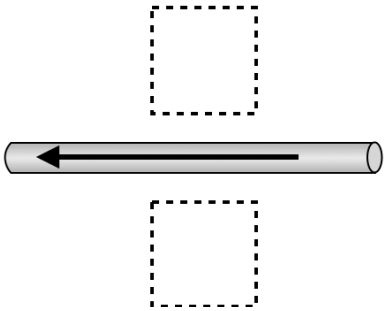
Electromagnetism Mastery Assignment

1. A current travels in the wire shown below.
    a. What are the directions of the magnetic field created the current in the two squares outlined by a dotted line?
    b. If the wire has a current of 3 A, then what is the magnitude of the magnetic field 1.00 cm away from the wire?



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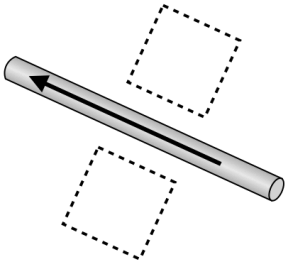
2. A wire is shown below, the arrow represents the flow of electrons. What are the directions of the magnetic field created by the flow of electrons in the two squares outlined by a dotted line?



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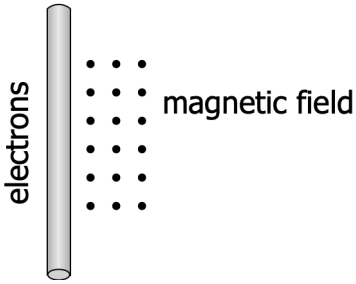
3. A magnetic field is created by a flow of electrons through a wire as shown below.
    a. What direction are the electrons moving to create this magnetic field?
    b. If the magnetic field has a magnitude of 100 μT 3.00 cm away from the wire, then what is the magnitude of the current in the wire?



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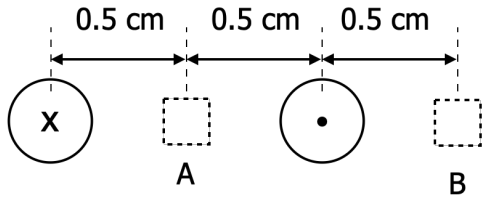
Below are two wires coming out of the page/screen. The current in the wire on the right –> is 3A.



4. At which location does the magnetic fields created by the two wires cancel? How do you know?
5. What must the current be in the wire on the left <– to cancel the magnetic field at this location?

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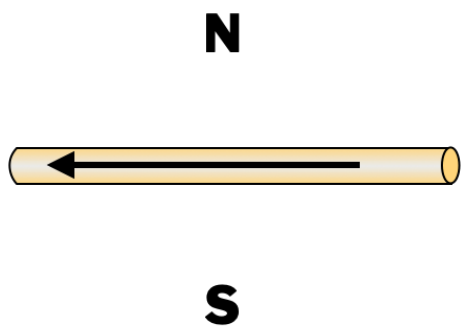
6. A wire has a current that is moving as shown below. The wire is place perpendicular a magnetic field whose poles are shown. Which direction will the wire move due to the Lorentz force?



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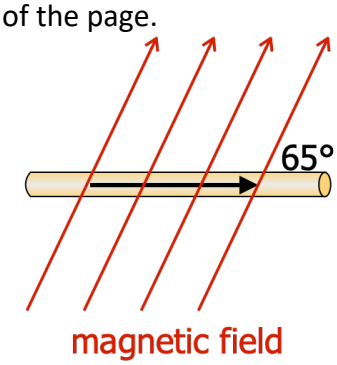
7. What is the <u>magnitude and direction</u> of the force experienced by the wire if the current through it is 2 A and 0.10 m of the wire is in the magnetic field of 2 T and the wire is made of copper and is 0.010 m in diameter? The force comes out of the page.



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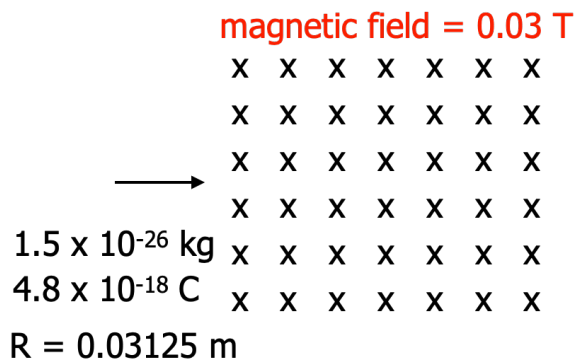
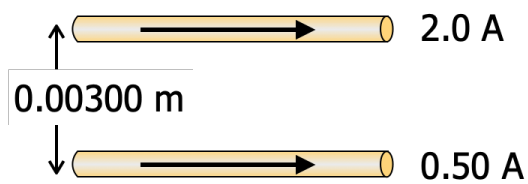
8. Until around 2005 nearly all televisions and computer screens contained and electron gun that would shoot electrons to the back side of the glass in the television screen. The device that would shoot the electrons is called an "electron gun." The electron gun would apply a force of 7.2×10^{-13} N to an electron to change it direction to the hit the various sections of eh televisions screen. The electron would travel perpendicular to a magnetic field of 1.5 T.
    a. How fast would the electron travel in these circumstances?
    b. What percent of the speed of light is this speed? (You may need to look up some additional values on the Internet.)

9. A particle enters a perpendicular magnetic field as shown below. Given the values in the picture,
    a. Draw the particle's path.
    b. Calculate the particle's speed.



10. Two wires are parallel to each other. They carry the currents shown below.
    a. Are these two wires attracted or repelled form each other? How do you know?
    b. What is the magnitude of the force per unit length between them?



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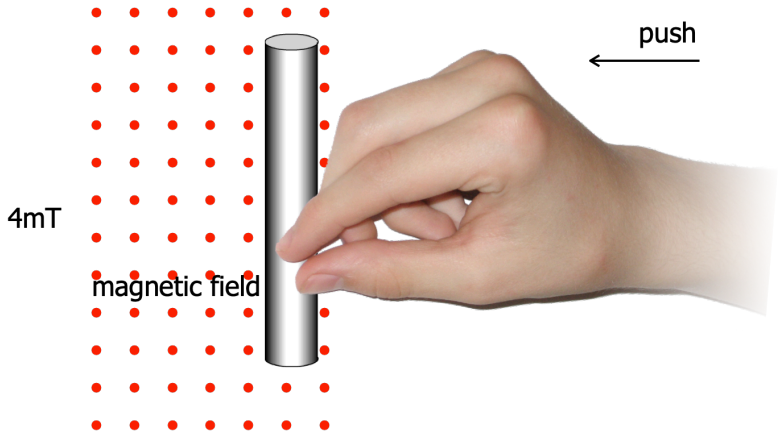
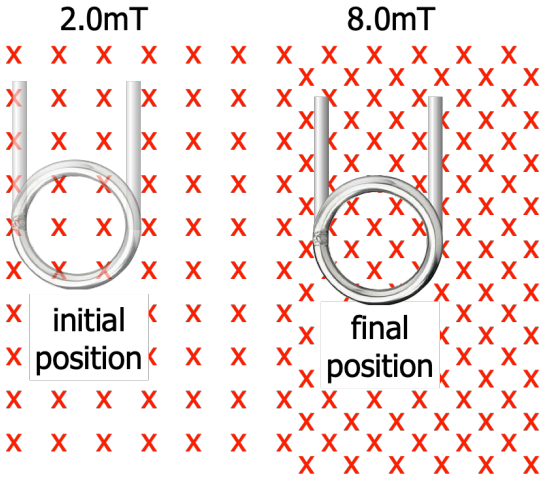
11. A 10 cm long metal rod is pushed across the screen/page at 20 m/s as shown below.
    a. Which end has an accumulation of positive charges?
    b. What is the direction and magnitude of the electric field established between the ends of the rod?
    c. What is the potential difference between the rod's ends?
    d. What is the potential difference when the rod stops moving?



12. A coil consisting of 5 loops is moved from the left to the right in 0.100 seconds. The leads are the ends of the wire pointing in the vertical direction. The loops have a diameter of 3.00 cm.
    a. What is the direction of the current during this change in position?
    b. How much voltage is generated across the wire leads?
    c. If the resistance of the whole coil is 0.047 Ohms, then what is the magnitude of the current through the coils?
    d. What is the potential difference across the leads 10 seconds after reaching the "final position?"



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13. A coil of wire is moved through a magnetic field in such a way that the magnetic flux versus time graph looks like the one to the right. This graph is created as a conducting loop of metal passes across a varying magnetic field.
    a. If the current in the conducting loop is traveling clockwise at 0.55 seconds, then where on the graph is the current traveling counterclockwise?
    b. Where on the graph is there no current being induced?
    c. Rank the magnitudes of the generated emf for segments A - E from greatest to smallest.
    d. What is the emf current along segment "C?"
    e. If the coil used in making this has 50 loops of wire, then how much voltage is generated along segment "D?"