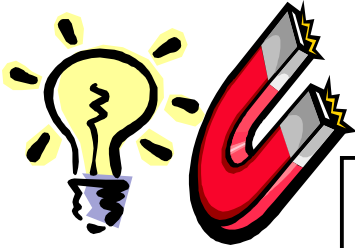


Science 10-Electricity & Magnetism

Activity 9

Activities 4D&E—The Magnetic Field Around a Current Carrying Wire and a Coil



10

Name _____	
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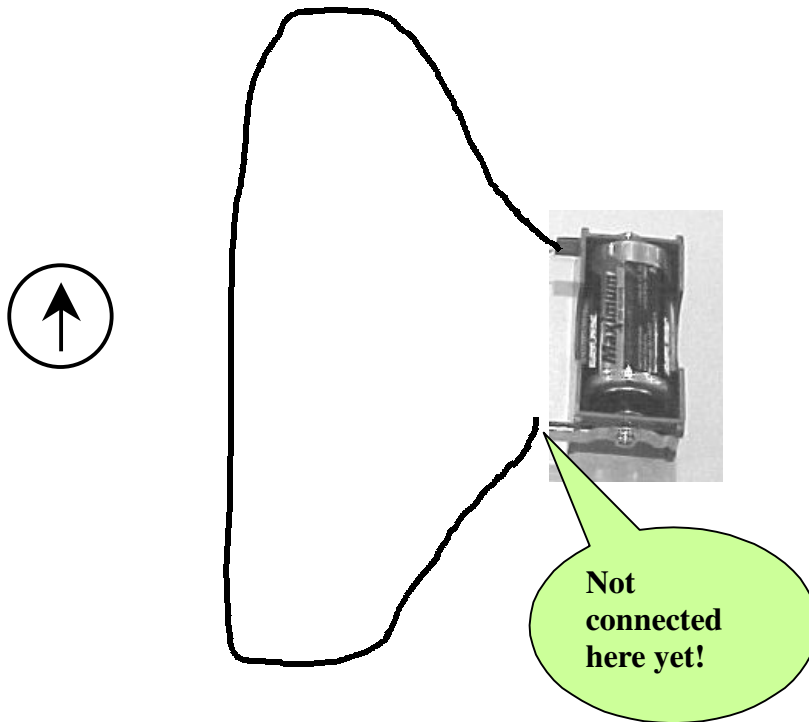
Purpose:

To determine the direction of the magnetic lines of force around a current carrying wire and around a coil of wire.

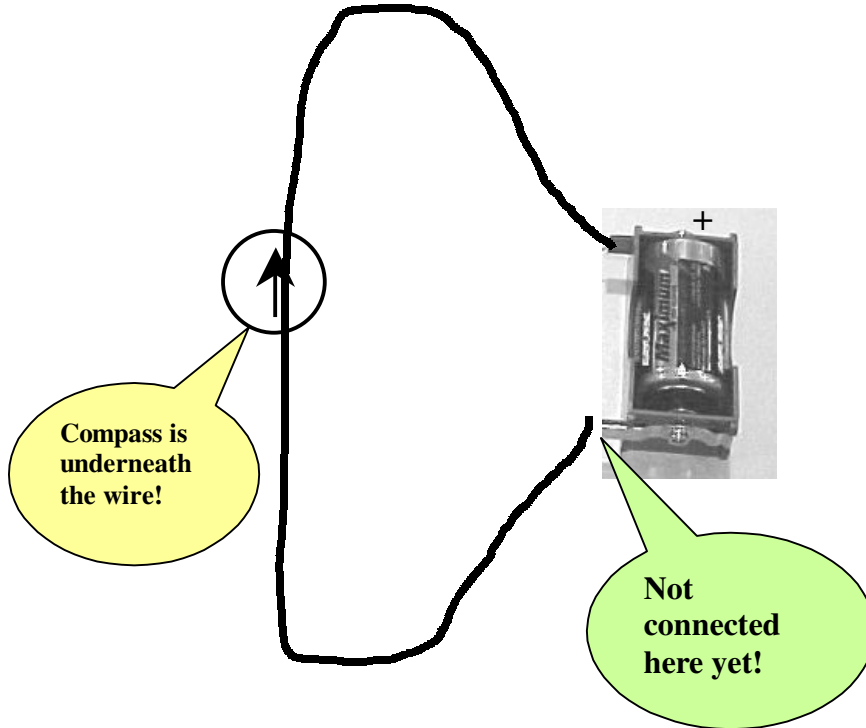
Procedure:

1. Obtain a battery (cell) in a holder, a fairly long piece of copper wire and a compass. The positive end of the battery should be facing in the same direction as the compass needle points.

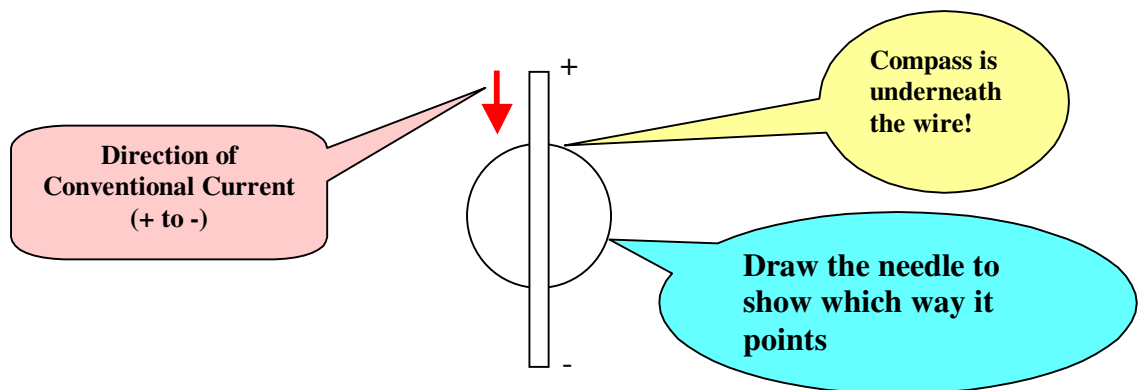
Do not connect the wire to the negative end of the battery yet!



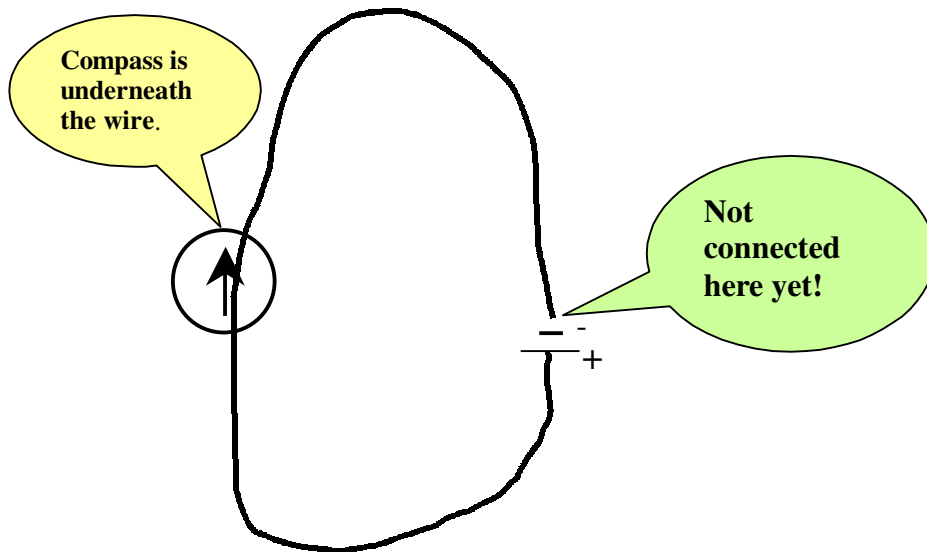
2. Move the compass in such a way that it is underneath the wire and the needle is pointing parallel to the direction of the wire. Since compasses point North, you may have to rearrange the battery and the wire in order to do this. Don't connect the wire to the negative end of the battery yet.



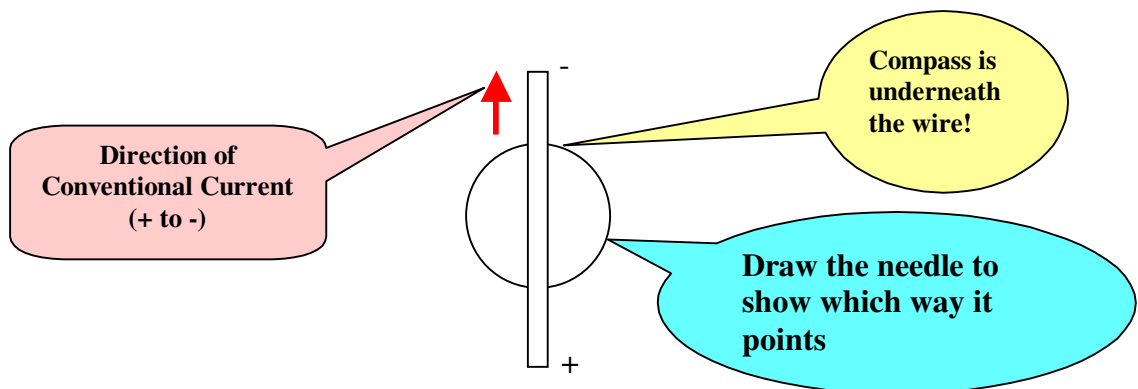
3. Briefly connect the wire to the negative end of the battery and watch what happens to the needle on the compass. Draw the needle in the next diagram exactly how it appears when the circuit is closed. (Wire is connected). As soon as you draw the needle to show which direction it points, disconnect the battery.



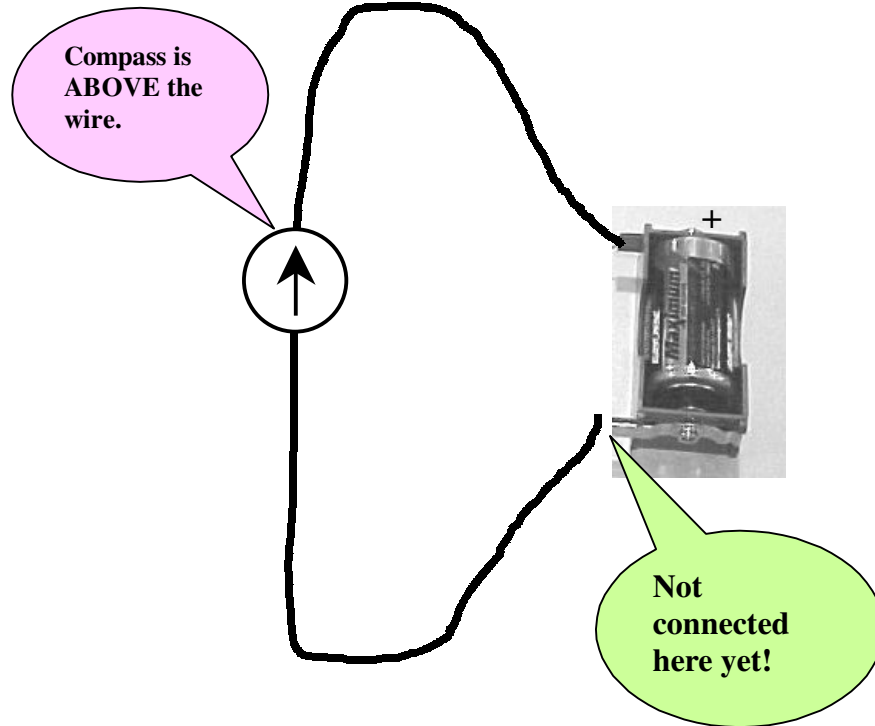
4. **Flip the battery** so that the positive and negative ends are switched. Move the compass in such a way that it is underneath the wire and the needle is pointing parallel to the direction of the wire. Don't connect the wire to the negative end of the battery yet.



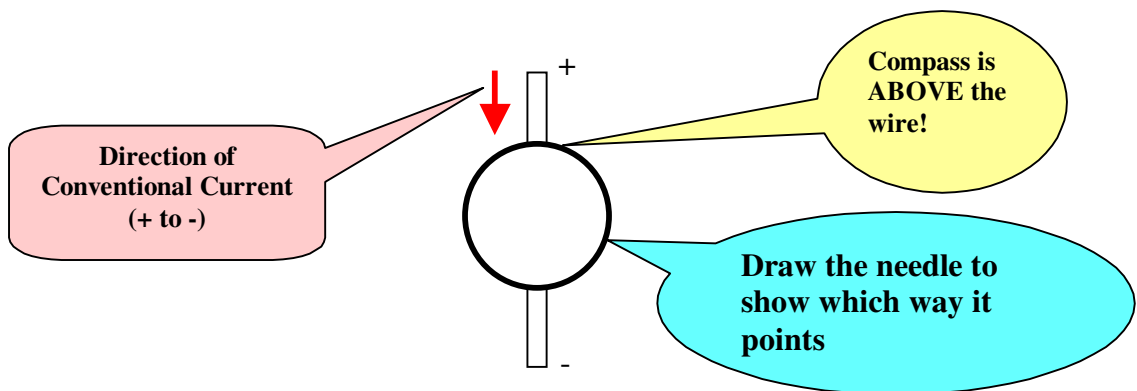
5. Briefly connect the wire to the negative end of the battery and watch what happens to the needle on the compass. Draw the needle in the next diagram exactly how it appears when the circuit is closed. (Wire is connected).
As soon as you draw the needle to show which direction it points, disconnect the battery.



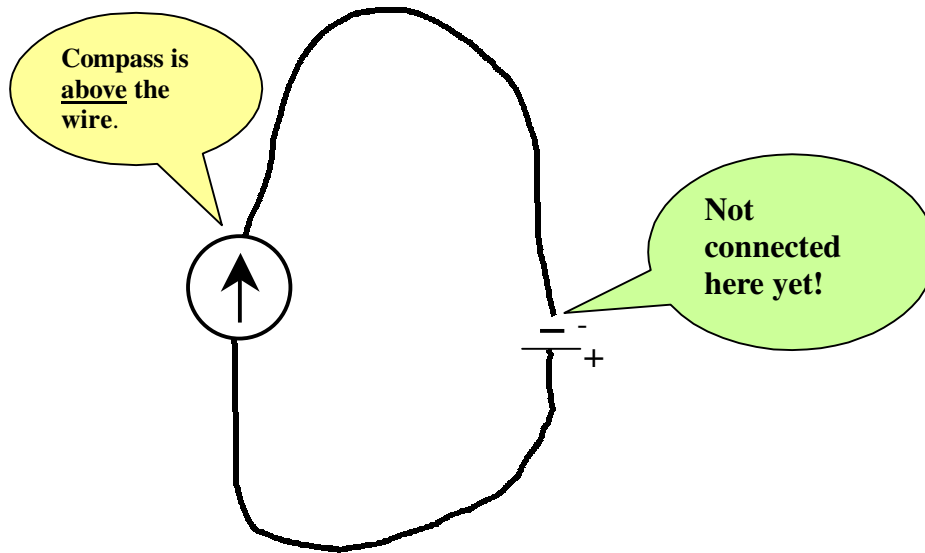
6. Disconnect the battery and flip it so it is back in the position you originally started with. This time, place the compass **above** the wire.



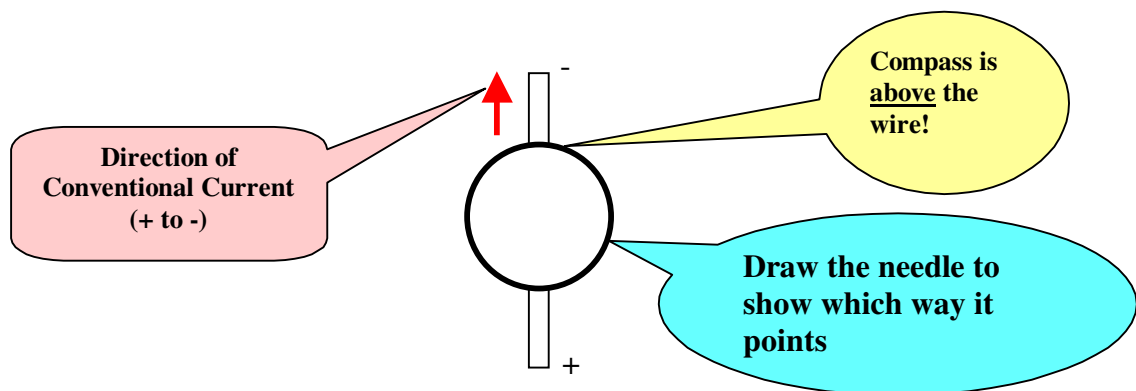
7. Briefly connect the wire to the negative end of the battery and watch what happens to the needle on the compass. Draw the needle in the next diagram exactly how it appears when the circuit is closed. (Wire is connected). As soon as you draw the needle to show which direction it points, disconnect the battery.



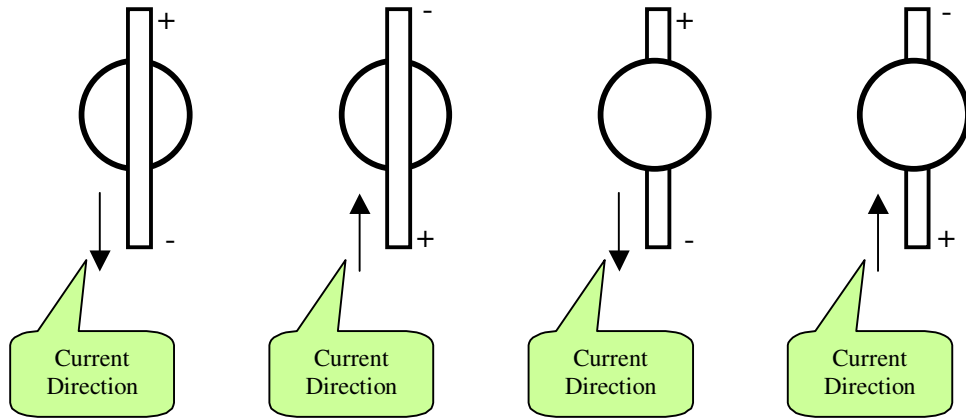
8. **Flip the battery** so that the positive and negative ends are switched. Move the compass in such a way that it is **above** the wire and the needle is pointing parallel to the direction of the wire. Don't connect the wire to the negative end of the battery yet.



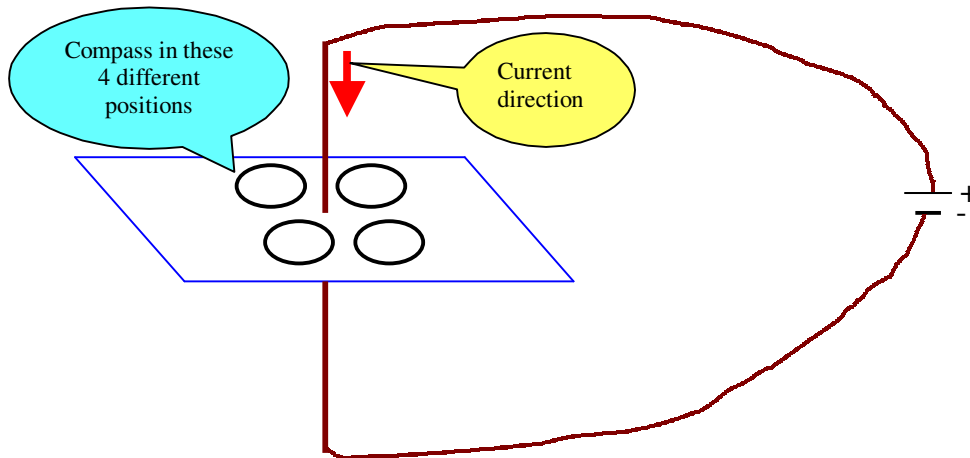
9. Briefly connect the wire to the negative end of the battery and watch what happens to the needle on the compass. Draw the needle in the next diagram exactly how it appears when the circuit is closed. (Wire is connected).
As soon as you draw the needle to show which direction it points, disconnect the battery.



10. Summarize the results of procedures 1-9 by showing the direction of the compass arrow on each of the following diagrams:



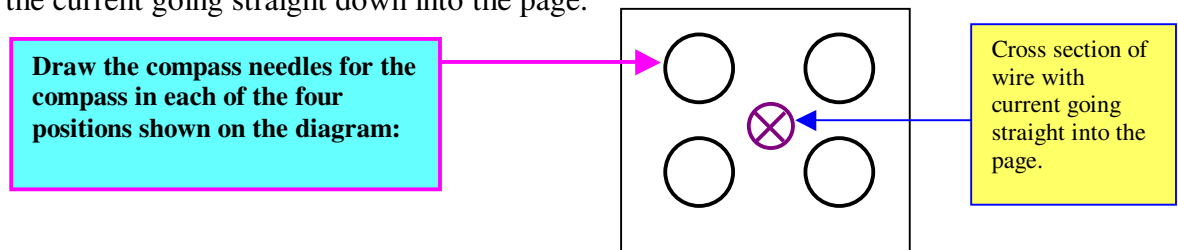
11. The teacher will now set up an apparatus like the one shown in the following diagram:



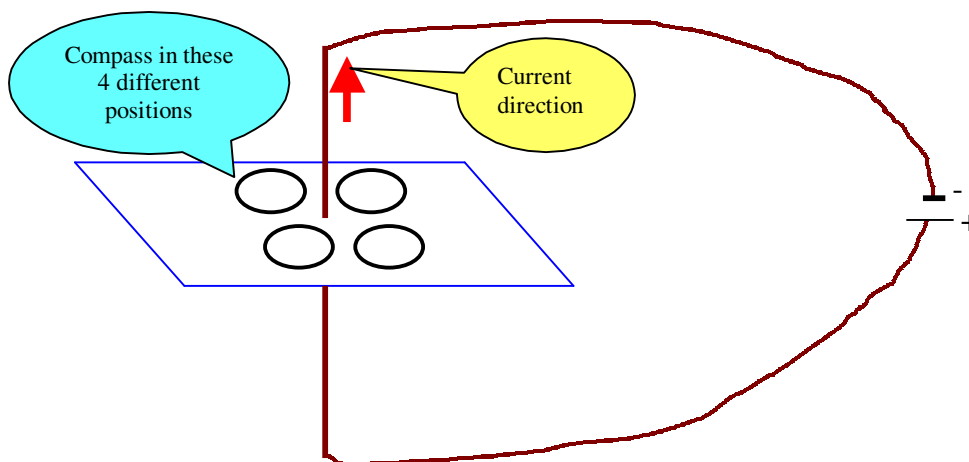
On the diagram above, **sketch** the needle on the compass when it is in the four different positions as shown.

12. The symbol for a cross section of wire with the current going **straight into** the page is: \otimes

See the following 2 dimensional diagram of the apparatus above as it would be looking straight down from the top. All you see is a cross section of the current carrying wire with the current going straight down into the page.



13. Now, the direction of the current will be switched by reversing the battery connection:

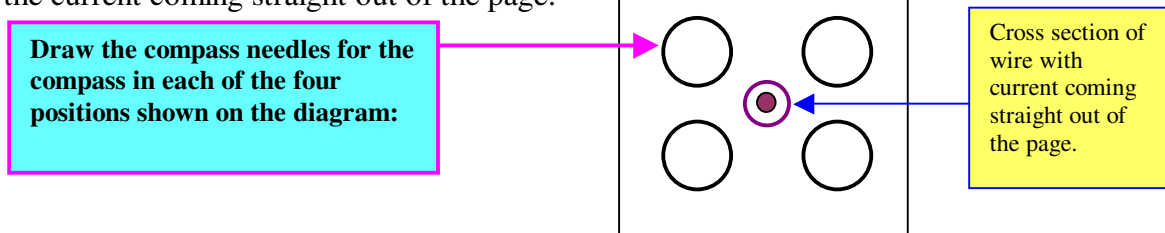


On the diagram above, **sketch** the needle on the compass when it is in the four different positions as shown.

14. The symbol for a cross section of wire with the current coming **straight out of** the page is:



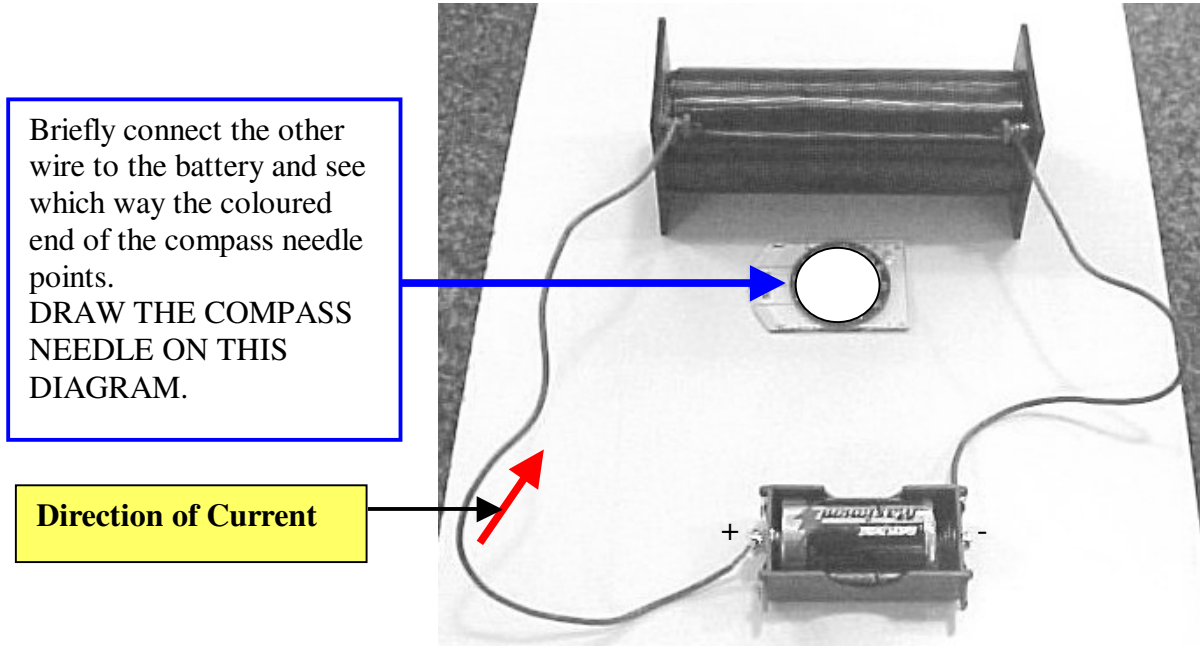
See the following 2 dimensional diagram of the apparatus above as it would be looking straight down from the top. All you see is a cross section of the current carrying wire with the current coming straight out of the page.



15. At this point, your teacher will go over the Right Hand Rule with you. Once it has been explained, write it down here. (See p. 74 in the Text if you need to.)

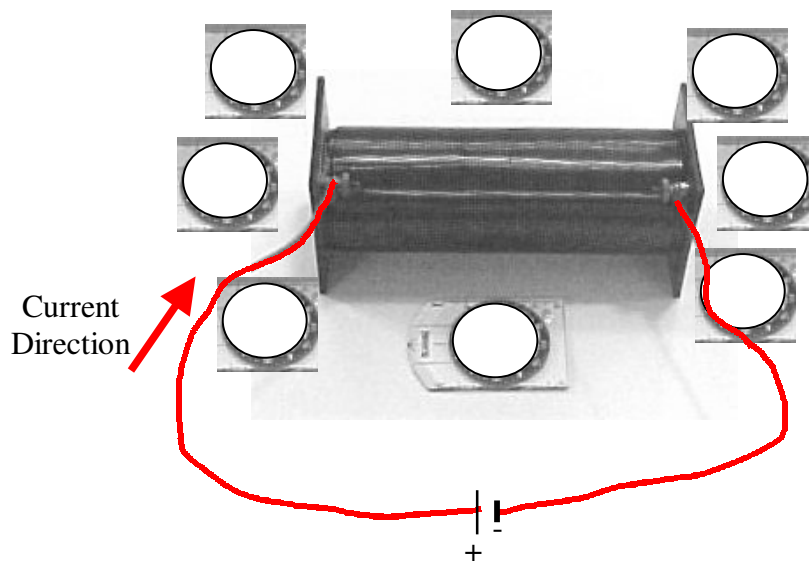
Right Hand Rule:

16. Now set up a battery in a holder and a coil of wire as shown in the following diagram. DON'T connect both wires to the battery yet. Just **one** of them. Make sure that the terminals on the coil are exactly the way they are in the diagram. (At the front, on top.). The positive terminal of the battery must be facing left!

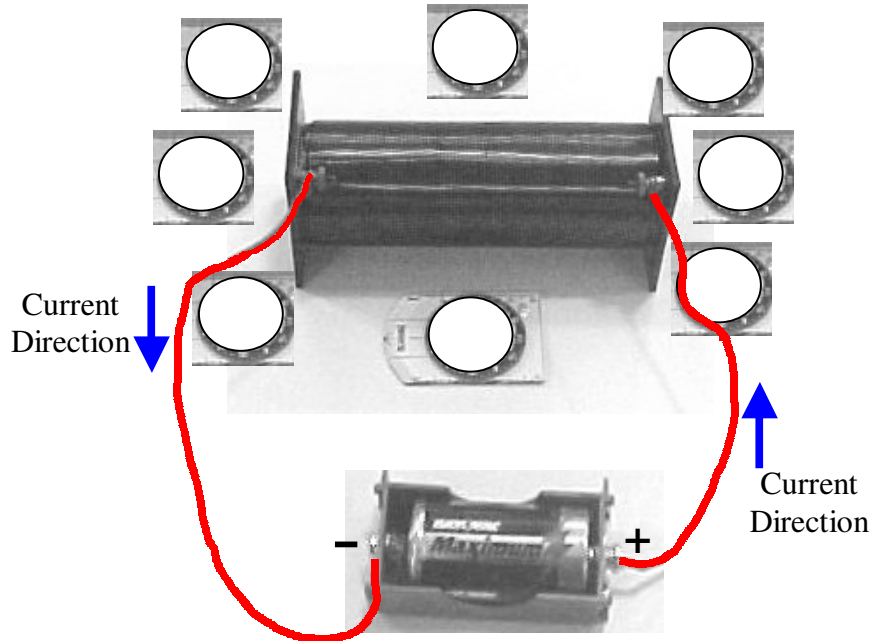


As soon as you see which way the needle points, disconnect the wire from the battery.

17. Leave the battery the way it is and move the compass to the positions shown in the following diagram. For **each position** of the compass, briefly connect the battery and **draw** the compass needle, showing the direction it is pointing.

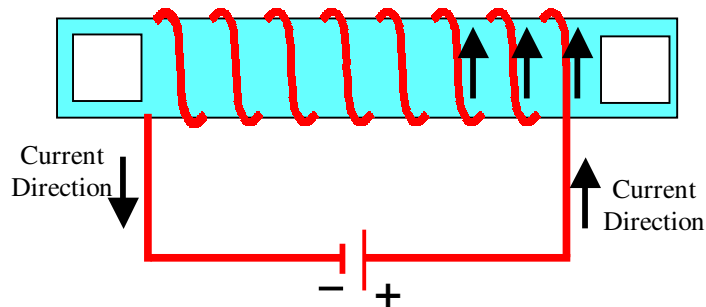


18. Now disconnect the battery and **reverse it** so that the + is on the right side and move the compass to the positions shown in the following diagram. For **each position** of the compass, briefly connect the battery and **draw** the compass needle, showing the direction it is pointing.



When the current through a coil is reversed, the direction of the magnetic lines of force _____

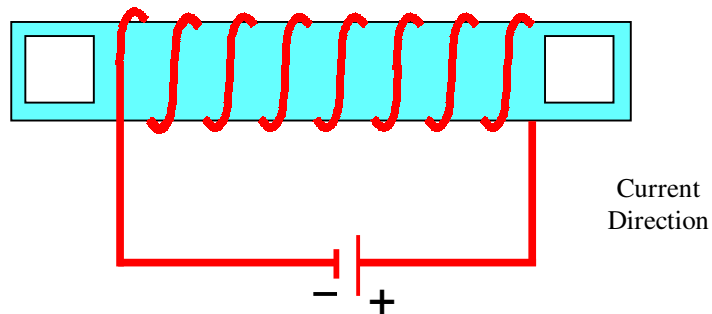
19. Your teacher will now explain the **right hand rule for coils**.



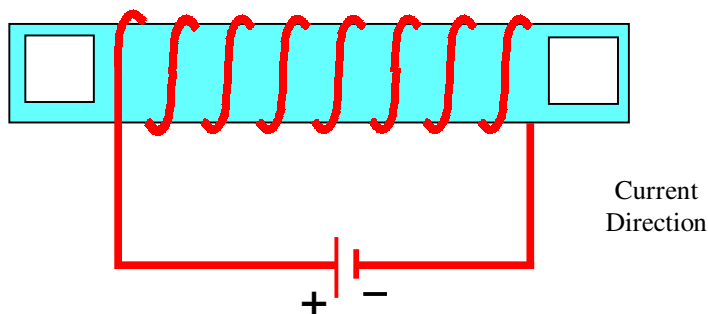
Right Hand Rule for Coils:

Questions:

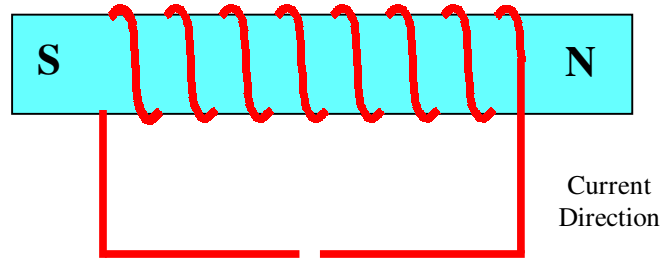
1. Given the following coil:
 - a. Show the direction of conventional current in the wire
 - b. Draw a few magnetic lines of force around the coil
 - c. Show the direction of the magnetic lines of force around the coil (use the right hand rule)
 - d. Label the North (N) and South (S) poles of the magnet



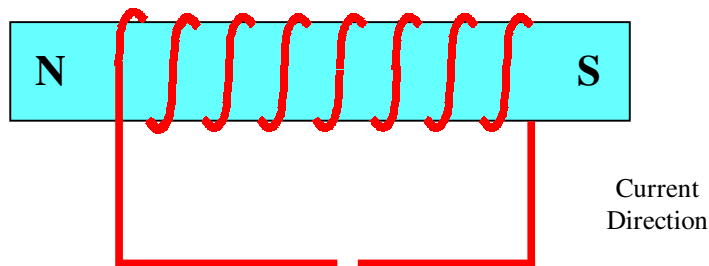
2. Given the following coil:
 - e. Show the direction of conventional current in the wire
 - f. Draw a few magnetic lines of force around the coil
 - g. Show the direction of the magnetic lines of force around the coil (use the right hand rule)
 - h. Label the North (N) and South (S) poles of the magnet



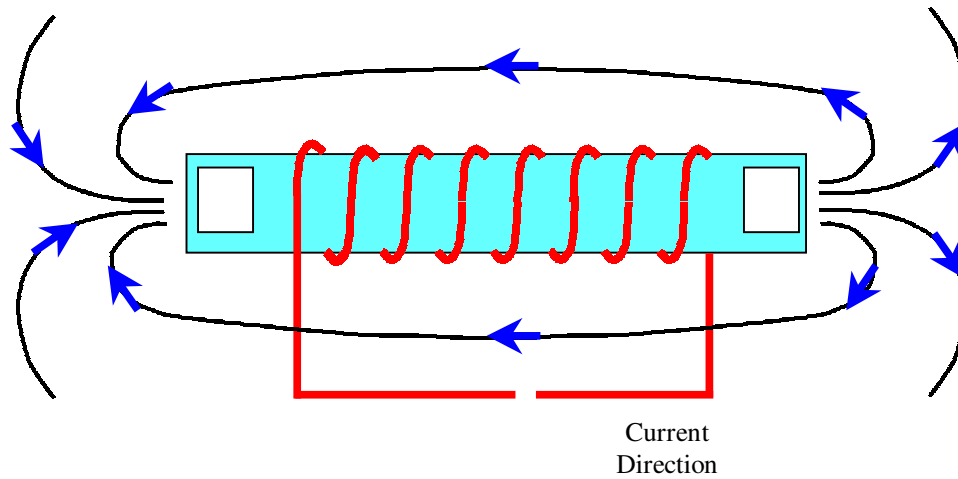
3. Given the following coil with the N and S poles shown:
 - a. Draw a few magnetic lines of force around the coil.
 - b. Show the direction of the magnetic lines of force.
 - c. Show the direction of the conventional current in the circuit
 - d. Draw in the symbol for the cell (battery) aligned the correct way



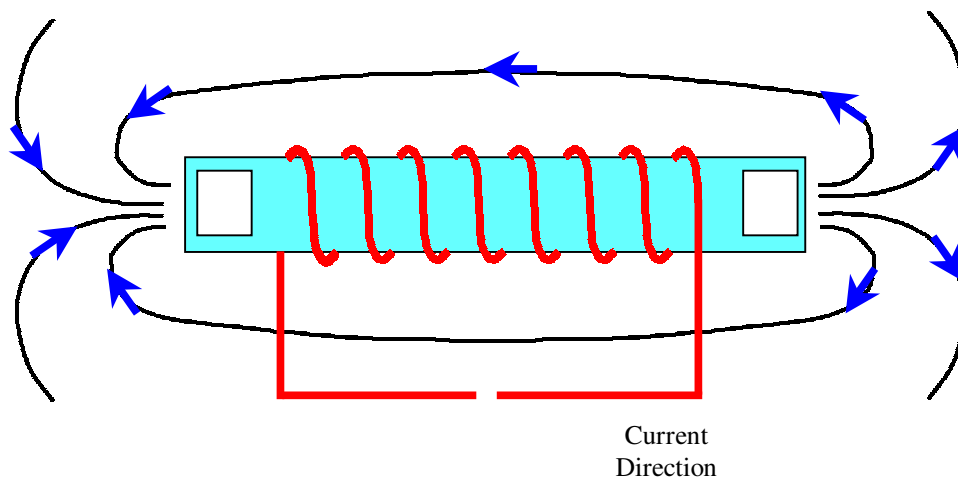
4. Given the following coil with the N and S poles shown:
 - a. Draw a few magnetic lines of force around the coil.
 - b. Show the direction of the magnetic lines of force.
 - c. Show the direction of the conventional current in the circuit
 - d. Draw in the symbol for the cell (battery) aligned the correct way



5. Given the following coil with the **direction of the magnetic lines of force shown**:
- label the N and S poles of the magnet
 - show the current direction in the wire
 - draw in the symbol for the battery in the correct way



6. Given the following coil with the **direction of the magnetic lines of force shown**:
- label the N and S poles of the magnet
 - show the current direction in the wire
 - draw in the symbol for the battery in the correct way



7. Given the following diagram, show the direction that the compass needles are pointing in each case. Use the right hand rule.

