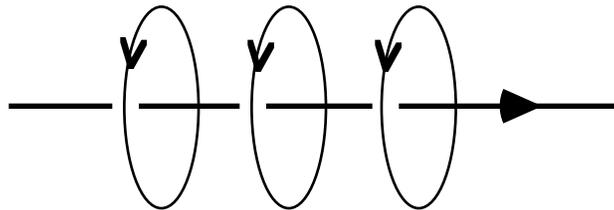


## Magnetism : Notes/W.S.-30

In 1819 the Danish scientist Hans Christian Oersted found that when a current flows through a copper wire, a magnetic field is created around the wire. This can be verified by using a compass.

This confirms that the phenomenon of magnetism is due to the movement of electrons.

The field gets smaller as we move farther away from the wire. Also, the field lines created are circular and have the direction shown. In the diagram below, a compass above the wire will point out of the page and compass below the wire will point into the page.



Right-Hand Rule

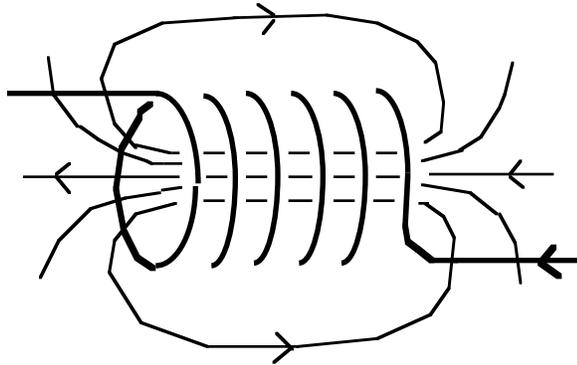


The direction of the field lines can be found by using the **right-hand rule**. The thumb points in the direction of the "conventional current", (opposite to the direction of electron flow) and the fingers will point in the direction of the field lines.

### The Solenoid

A solenoid is a coil of wire. If a current flows through it, a magnetic field is created inside and around the coil. The field is strongest inside. The field lines and their directions around the solenoid are similar to those around a bar magnet. The field direction can be found by using the right-hand rule.

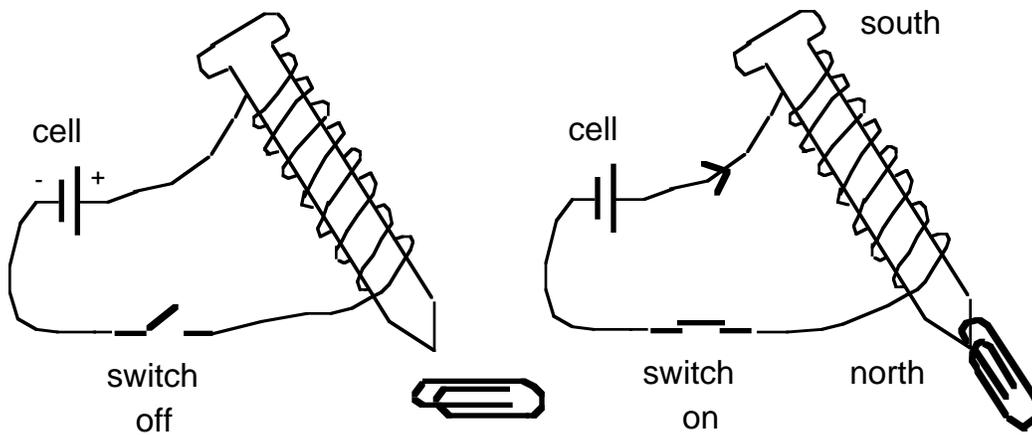
## Solenoid



## The Electromagnet

If we have a cylinder of soft iron such as a nail, with a coil of insulated wire around it, we have an electromagnet. If no current flows through the wire, the nail is not magnetic. If a current flows, the nail becomes magnetic.

## Electromagnet

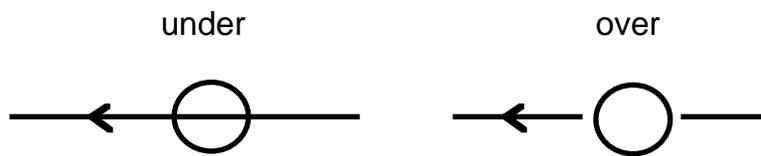


Problems:

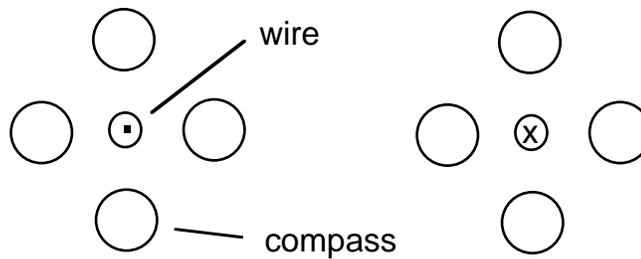
- 1) What did Oersted discover?
- 2) In the diagram below, a current flows through the wire. The "conventional current" direction is given.



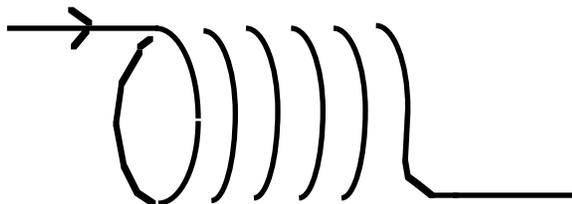
- a) Draw the magnetic field lines around the wire. Show the field direction.
- b) Which way are the electrons moving?
- 3) Give the compass direction.



- 4) Give the compass directions. The wires are seen from the end. The dot means conventional current flows toward you. The x means conventional current flows into the page.



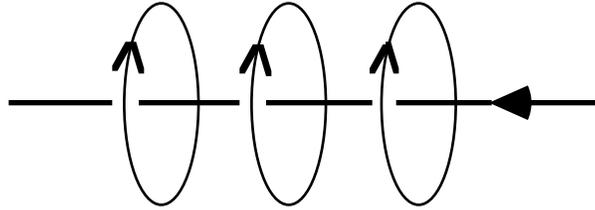
- 5) A solenoid is shown below.



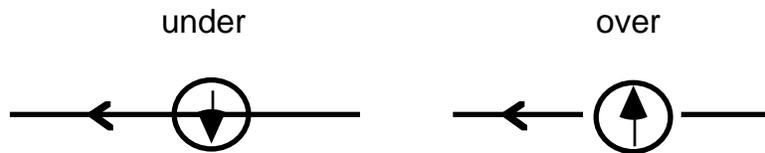
- a) Draw the field lines. Show the direction of the field.
- b) Where is the field strongest?

Answers:

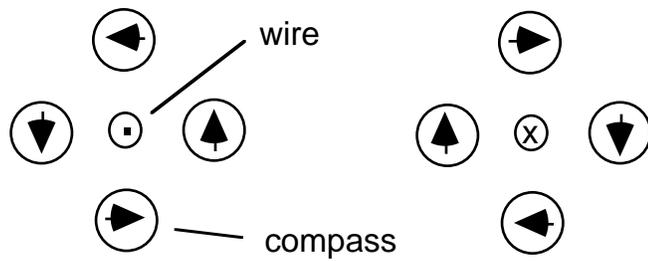
1) Oersted discovered that a current carrying wire will have a magnetic field around it. 2)a)



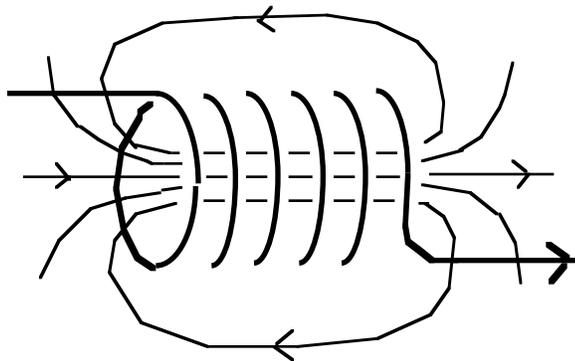
b) Electrons move to the right. 3)



4)



5)a)



b) The field is strongest inside the solenoid.