Magnetism Basics

3rd November

Four examples of magnetic materials are:

IRON, COBALT, NICKEL and STEEL

Magnetic field: a region (an area in space) where a magnetic object experiences a NON-CONTACT force.

Permanent magnet: a piece of material which produces its own magnetic field, and stays magnetic for a long time.

Most magnets have MAGNETIC POLES, called NORTH and SOUTH.

Placing two like poles of different magnets together (a North pole of one, and a North pole of another), they will repel.

Two unlike poles will always attract (N to S).

If a magnetic material is placed close to a permanent magnet it can become temporarily magnetic. This is called an INDUCED MAGNET. These induced magnets are ALWAYS ATTRACTED to permanent magnets.

Drawing Magnetic Fields

6th Nov

When we draw diagrams of magnetic fields we use LINES to represent where the field is.

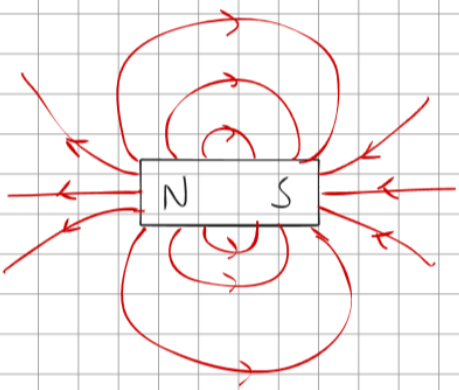
The lines must have ARROWS on them, to show the direction of the field.

The arrow on a field line should show the direction a compass would point if it were placed on that line (the direction of the force on a North pole).

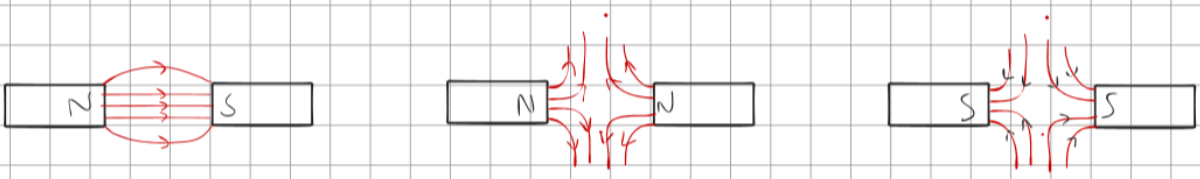
The lines should be CONTINUOUS (no breaks).

The SPACING of the lines shows the STRENGTH. Closer field lines show a stronger field.

Bar magnet



Between bar magnets



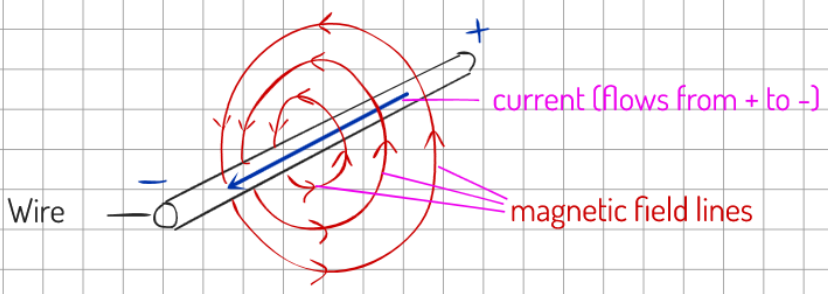
Field around a wire

7th November

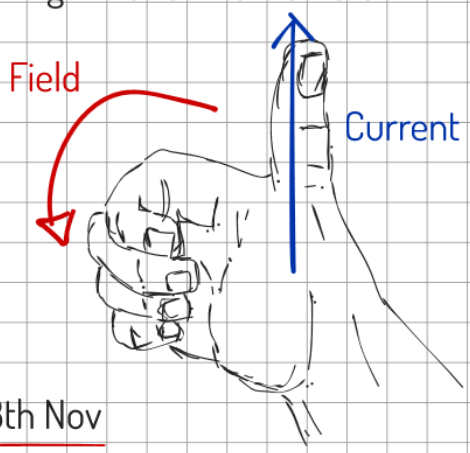
A current flowing through a wire creates a magnetic field around it.

When the current is turned off, the magnetic field disappears.

Magnetic field lines around a straight piece of wire are circular.
The direction we draw arrows on the field lines depends on the direction of the current in the wire.
The strength of the field depends on the size of the current.



Right Hand Thumb Rule

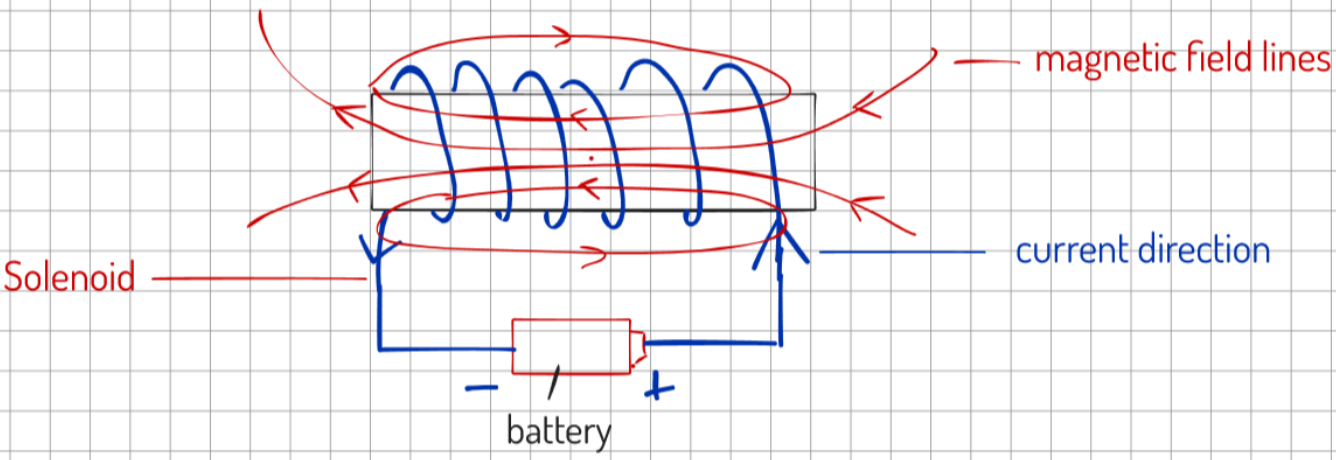


Electromagnets

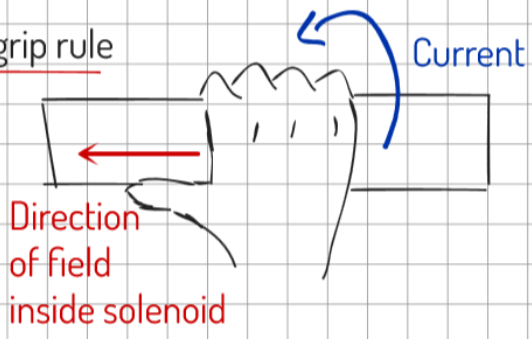
8th Nov

A coil of wire is called a SOLENOID. When current flows around a solenoid, the magnetic field around each loop (or turn) of wire in the coil combines with the fields of the loops (or turns) of wires next to them.

This makes the field stronger.



Right hand grip rule



Making Electromagnets

13th Nov

Number of turns	Length of paperclip chain (number of clips)
10	2
20	2
30	3
40	3
50	3
60	4
70	3

When we add an iron core to a solenoid we generally refer to this as an ELECTROMAGNET. When current flows through the solenoid it creates a magnetic field around the solenoid.

The iron core then becomes an INDUCED MAGNET. The magnetic field of the iron core and the field of the solenoid combine. This increases the overall strength of the magnetic field.

We can increase the strength of an electromagnet by:

- Adding an iron core
- Increasing the current
- Increasing the number of turns
- Moving the turns closer together

Uses of Electromagnets

15th Nov

Similarities between permanent and electromagnets:

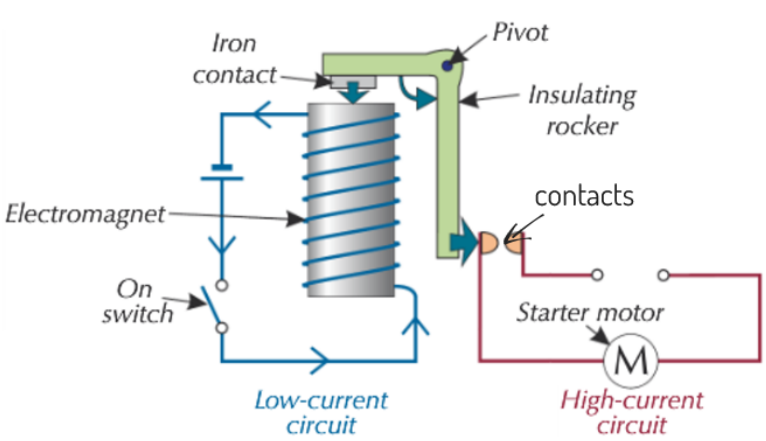
- Both have magnetic fields
- Both exert forces on magnetic objects

Differences between them:

- Electromagnets can be turned on and off
- Electromagnets use electrical current
- The strength of an electromagnet can be changed
- Can change the direction of an electromagnetic field

A material that is MAGNETICALLY SOFT (not actually soft) is one which MAGNETISES and DEMAGNETISES quickly. This makes them useful for electromagnets.

A material that is MAGNETICALLY HARD stays magnetic for a long time (even after the current is turned off).



* The switch in the low-current circuit is closed allowing a current to flow through the electromagnet.
* The current creates a magnetic field around/through the elecromagnet.
- The iron contact is attracted to the electromagnet
- The insulating rocker turns around the pivot and pushes the contacts together.
- This completes the high current circuit and allows a current to flow through the motor.

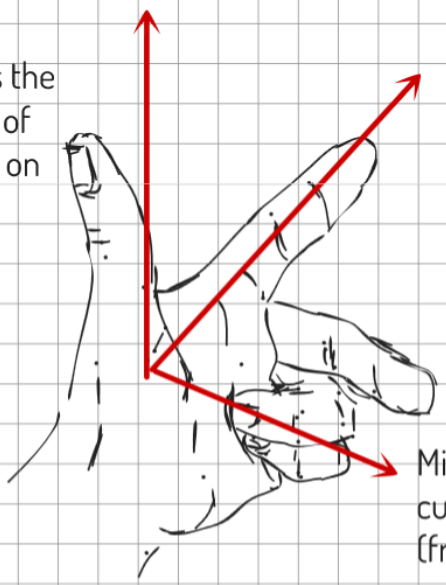
The Motor Effect

17th Nov

A current carrying wire has a magnetic field around it.
If the wire is placed in a permanent magnetic field, then the two magnetic fields INTERACT.

This produces a FORCE. This is called THE MOTOR EFFECT.

We can predict the direction of this force using FLEMING'S LEFT HAND RULE.



Thumb is the direction of the force on the wire

Index finger is permanent magnetic field direction

(North to South)

Middle finger is the current direction (from + to -)

Step 1:
Point the index finger in the direction of the permanent field.

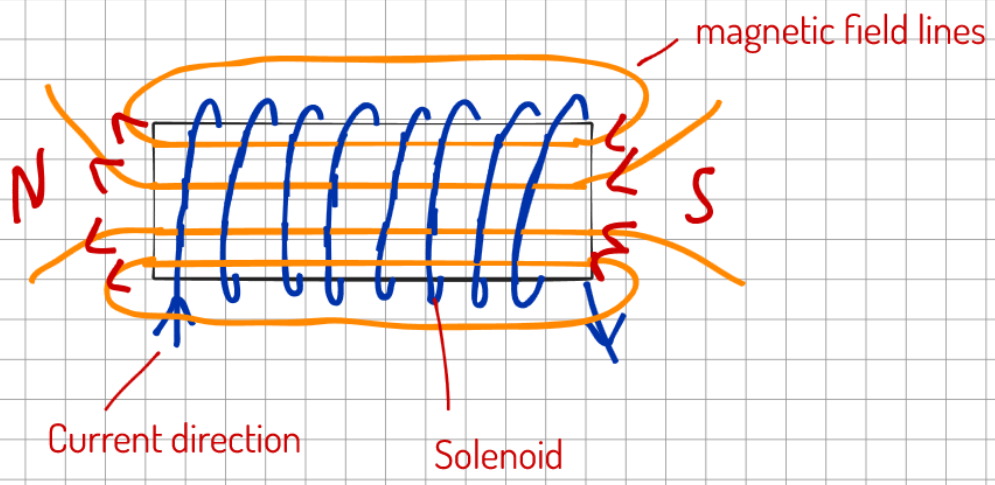
Step 2:
Rotate hand until middle finger is in the direction of the current (your index finger should NOT change direction)

Step 3:
Observe the direction your thumb points. This is the direction of the force on the wire.

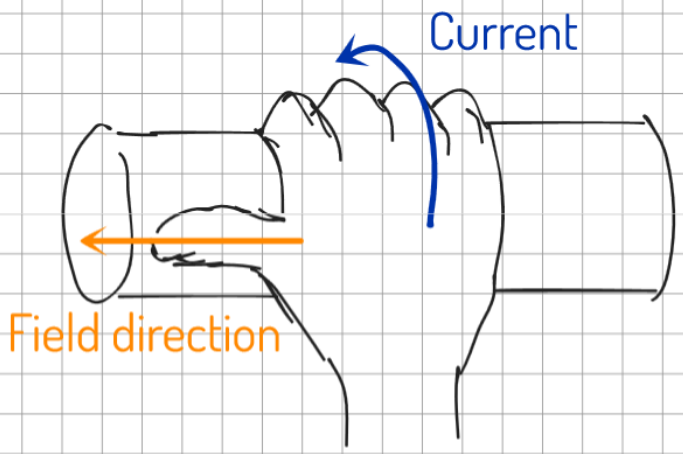
Electromagnets

13th Jan

A coil of wire is called a SOLENOID. When a current passes through a solenoid the magnetic fields around each loop of wire combine. This makes a much stronger field than just having one straight wire.



Right Hand Grip Rule



- Curl fingers in the direction of the current flow
- Thumb points in the direction of the field inside the solenoid

A solenoid with a current passing through it, wrapped around an iron core, is called an ELECTROMAGNET.