Magnetism

Monday, April 23, 2012
10:30 AM

There are two types of magnetic POLARITIES, North and South. Opposite pole attract, similar poles repel.

Unlike electricity: magnetic poles MUST come in pairs (for every north there is an attached south pole). There are no magnetic monopoles.

Magnetic materials are attracted to magnetic fields. Iron, cobalt, nickel are magnetic on a macro-scale.

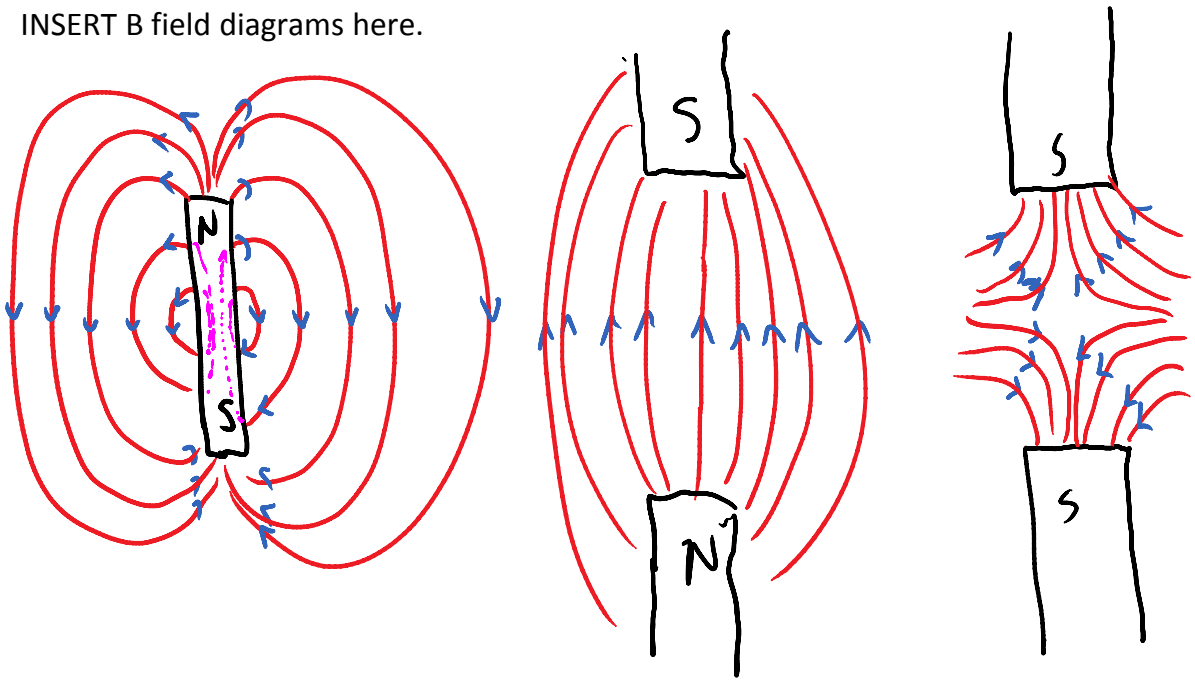
Permanent magnets hold their magnetic properties for long periods. This is because…..the valence electrons exert forces on neighboring atoms, forcing the neighboring electrons into a resonant frequency of oscillation which constructively interferes with the magnetic field created by the original valence electron.

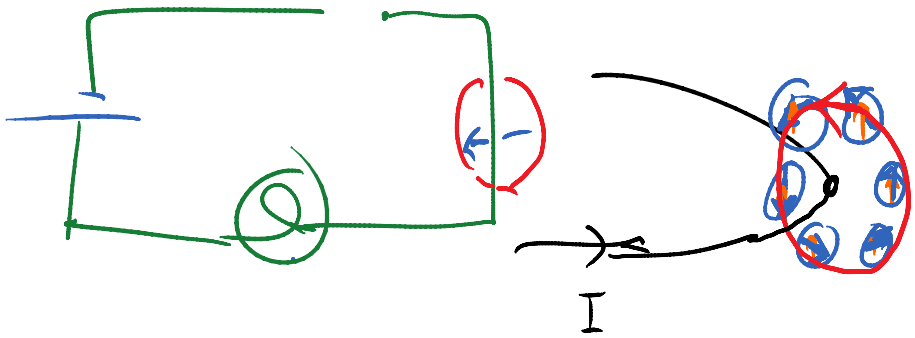
MOVING CHARGES CREATE MAGNETIC FIELDS.

Earth's B field $\approx 10^{-5}$ T

Magnetic field is symbolized with a B. Units are units of Teslas (T).

INSERT B field diagrams here.

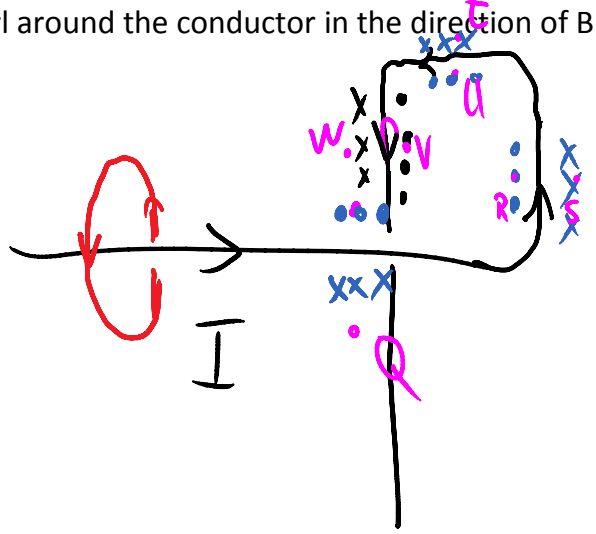


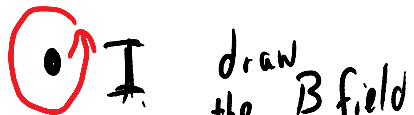


Hans Christen Oersted - made the discovery that a flowing current produces a magnetic field at 90° to the current direction. From this the direction of magnetic field was determined, using the RIGHT HAND RULE.

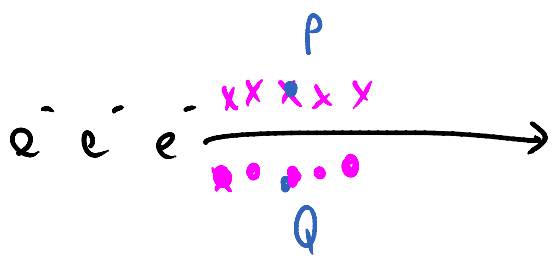
Right Rule for Linear Conductors (straight wires, and beams of charged particles) < used to determine the B-field direction based on the current direction.

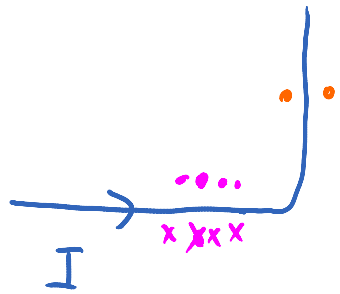
Place the thumb of your right hand in the direction of current (I), your fingers will curl around the conductor in the direction of B.



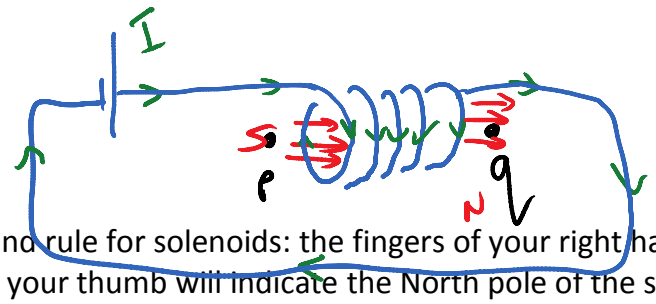


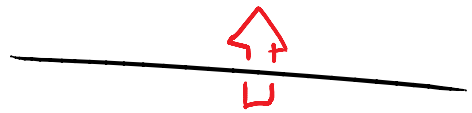
draw the B field around I



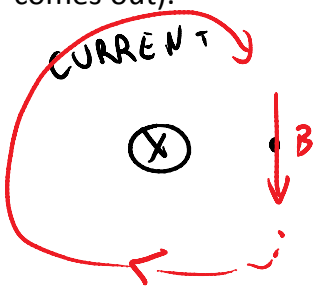


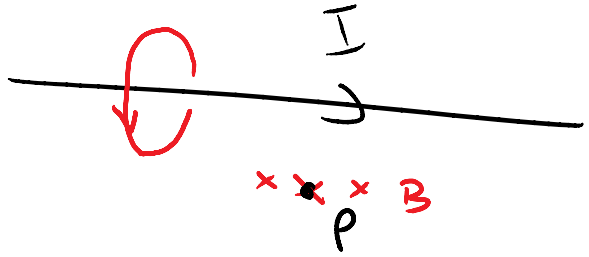
Solenoid: this is a series of loops of wire used to make an electro-magnet. Inside the loops the B-field is constant, multiple loops increase the magnetic field correspondingly.

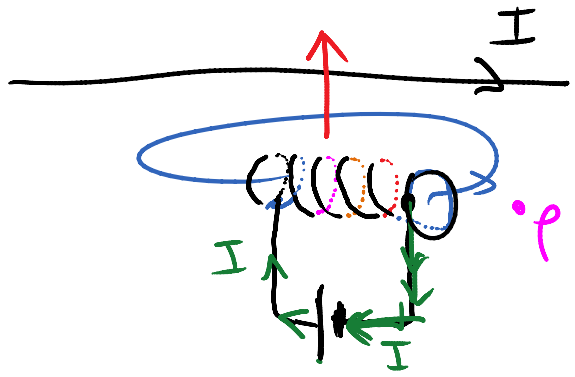


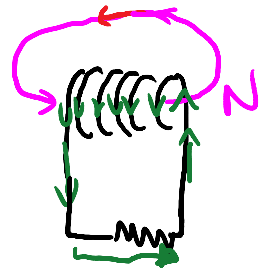


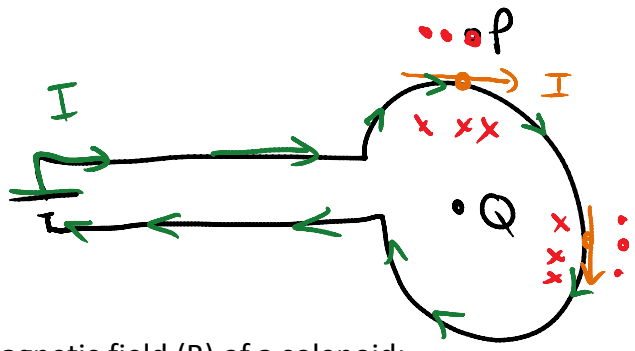
Right hand rule for solenoids: the fingers of your right hand curl in the direction of current, your thumb will indicate the North pole of the solenoid (the side the B-field comes out).











Calculating the magnetic field (B) of a solenoid:

$B = \mu_o n I / \ell$

B : magnetic field in Teslas (T)
μ_o : permeability of free space <= $4\pi \times 10^{-7}$ Tm /A
n : number of loops
I : current in amps (A)
ℓ : length of the solenoid (end to end) in meters (m)

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