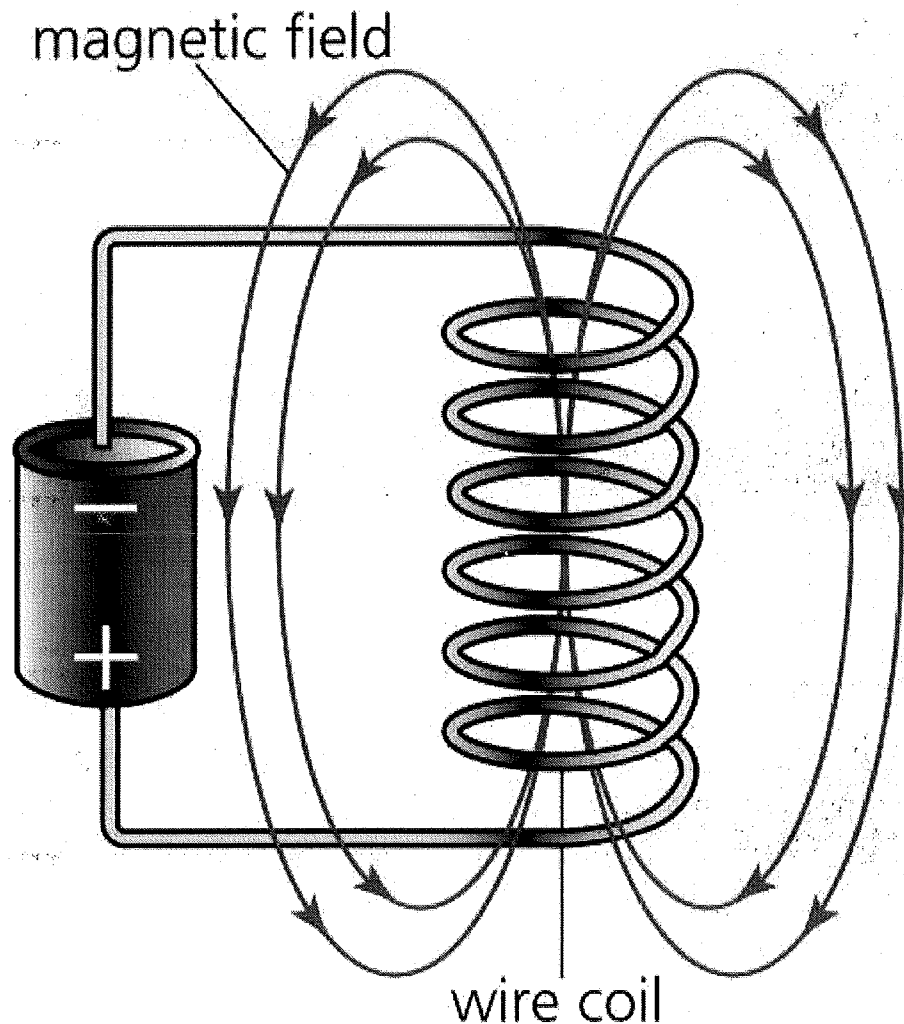1. Soon after Oersted's discovery of a magnetic field around a
   current carrying conductor, Andre-Marie Ampere developed a
   mathematical relationship that allows us to calculate the strength
   of the B field; this is known as Ampere's Law.

$$B = \frac{\mu_o I}{2 \pi r}$$

2. We can apply Ampere's Law to a solenoid (coil of wire).

magnetic field

wire coil

3. The magnetic field strength can be found by using a variation to
   Amperes Law.

$$B = \mu_0 n I$$

n is the number of coils or turns per length
μ_0 is the permeability of free space
I is the the current in amperes

4. The direction of the magnetic field lines can be found using the right hand rule. Also the North and South poles of the resulting electromagnet can be found.

NORTH
POLE

end-on view
of solenoid
current flow
(anticlockwise)

SOUTH
POLE

end-on view
of solenoid
current flow
(clockwise)

DC Power
Supply
- - - - -
(Battery)

current direction