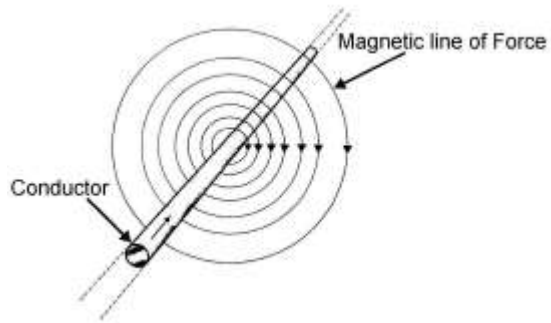
Electromagnetism

Electromagnetism is the study of the relationship between electricity and magnetism

Oersted's Discovery – when electrons move through a conductor, a magnetic field is created in the region around the conductor.



- The strength of the magnetic field depends on the amount of current flowing through the wire and the distance away from the wire.

- Using calculus, the magnetic field strength about a current-carrying conductor is…

Biot's Law

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

B is the magnetic field strength (in Tesla, T)

μ_o is the magnetic permeability ($4\pi x10^{-7}$)

I is the current (in Amperes)

r is the perpendicular distance away from the conductor (in m)

Ex. What is the strength of the magnetic field 15 cm from a long, straight current carrying conductor with a 100 A current?

$B = ?$

$r = 15\,cm$

$= 0.15\,m$

$I = 100\,A$

$\mu_0 = 4\pi \times 10^{-7}\,Tm/A$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$B = \frac{(4\cancel{\pi} \times 10^{-7}\,Tm/A)(100\,A)}{2\cancel{\pi}(0.15\,m)}$$

$$B = 1.3 \times 10^{-4}\,T$$

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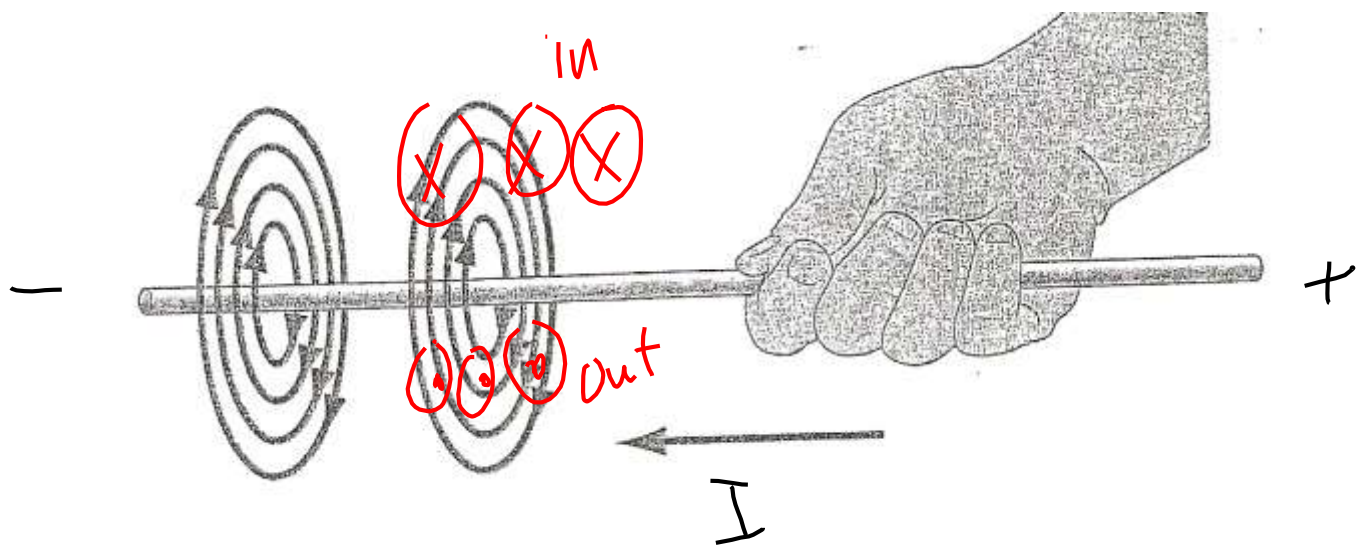
The Right Hand Rule for Conductors

If a conductor is held in the right hand with the right thumb pointing in the direction of the current flow (from positive to negative), then the curled fingers will point in the direction of the magnetic field lines



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b)

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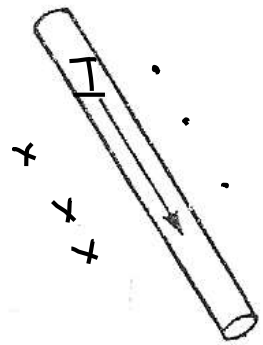

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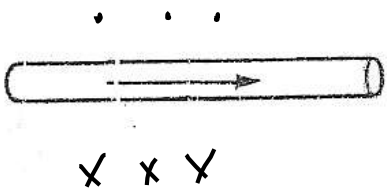

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