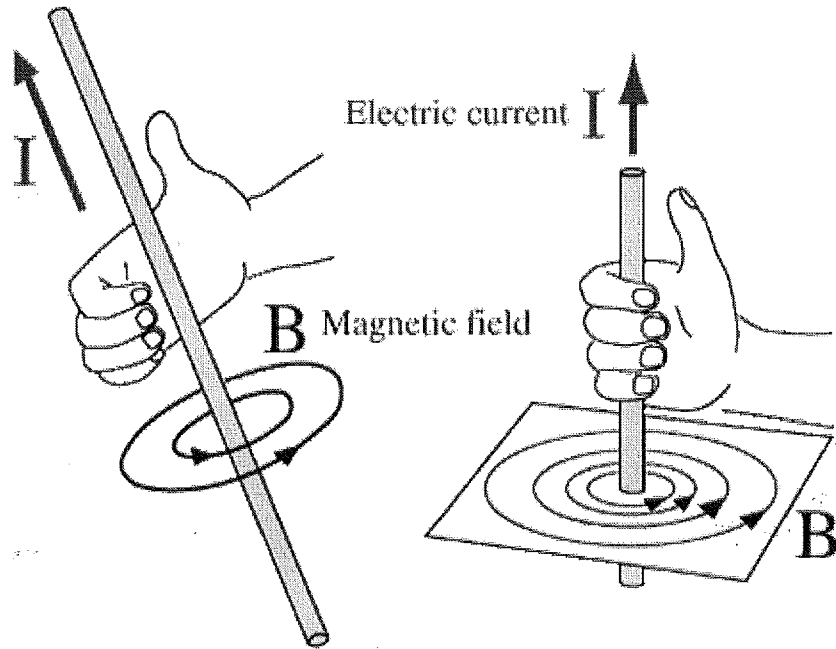


Physics 12 Section 20-5
Magnetic Field Due to a Straight Wire

1. A magnetic field is produced around a current carrying wire.



2. The magnetic field is directly proportional to the amount of current and inversely proportional to the distance away from the wire.

$$B \propto \frac{I}{r}$$

3. The above relationship holds as long as r is much smaller than the length of the wire.
4. To make the above proportionality an equality, a constant of proportionality must be introduced. The constant is μ_0 and it is the permeability of free space ($4\pi \times 10^{-7} \text{ Tm/A}$). Making the above equation:

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

Example: A vertical electric wire in the wall of a building carries a dc current of 25A upward. What is the magnetic field at a point 10cm due North of this wire?

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

$$B = \frac{4\pi \times 10^{-7} \text{ Tm/A} \times 25\text{A}}{2 \pi 0.10\text{m}}$$

$$B = 5.0 \times 10^{-5} \text{ T}$$