

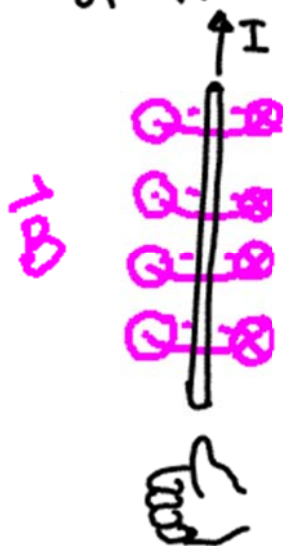
# AP Physics - Magnetism - Magnetic Field Due to Current

Note Title

4/4/2008

## Right Hand Rule for $\vec{B}$ Field Due to Current in a Wire

Experimentally, we have found that current flowing in a wire produces a magnetic field. The direction of the  $\vec{B}$  field is around the wire.



$\vec{B}$  field strength  $\propto$  current  
inversely  $\propto$  radius from wire

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

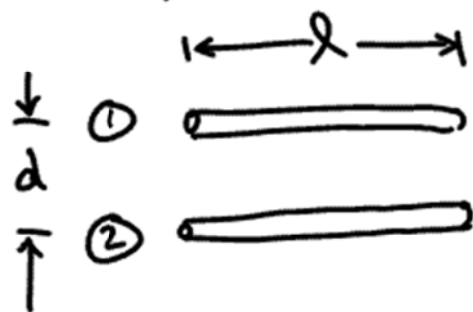
$$\vec{B} = \frac{\mu_0 I}{2\pi r}$$

$$\mu_0 = 4\pi \cdot 10^{-7} \frac{\text{T}\cdot\text{m}}{\text{A}}$$

$\mu_0$  = Permeability of Free Space

## Example - Force Between Two Parallel Wires

Two parallel wires will feel a force between them when they both have current flowing.



$\vec{B}$  field on ① from ② is  $B_2 = \frac{\mu_0 I_2}{2\pi d}$

Force on ① from ② is  $F_1 = B_2 I_1 l$

$$\rightarrow F_1 = \left( \frac{\mu_0 I_2}{2\pi d} \right) I_1 l$$

$$F_1 = \frac{\mu_0 \cdot I_1 \cdot I_2 \cdot l}{2\pi d}$$

$$\frac{F_1}{l} = \frac{\mu_0 \cdot I_1 \cdot I_2}{2\pi d}$$