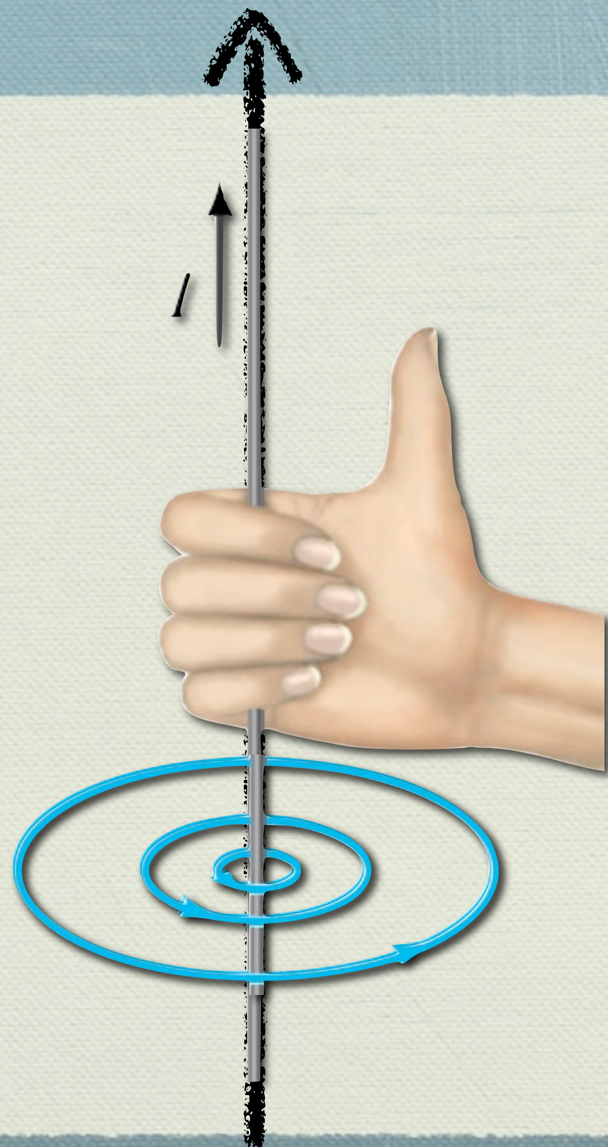
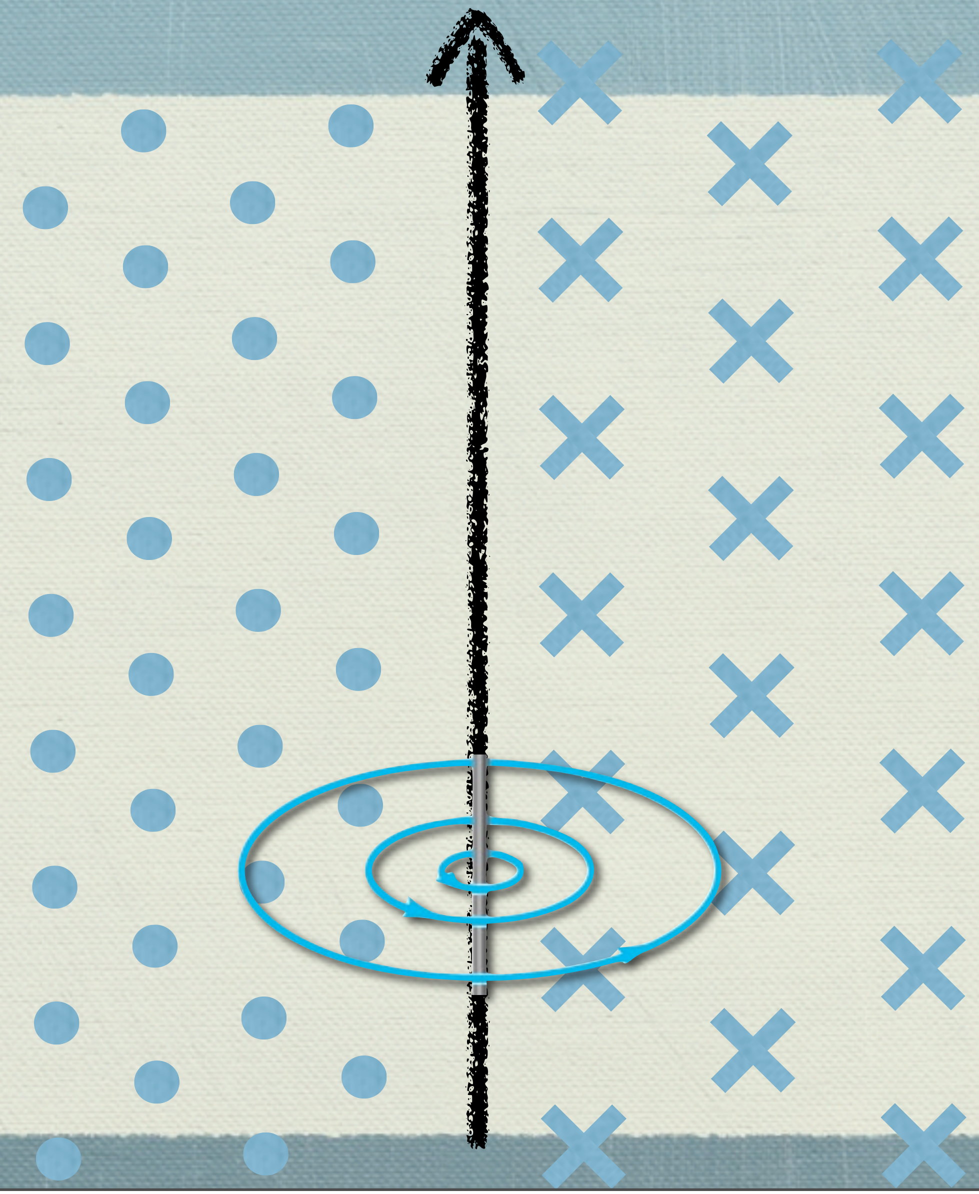
Magnetism
Day 2
Around a Wire

Magnetic Field around a Wire



Magnetic Field around a Wire



Field Strength Around a Wire

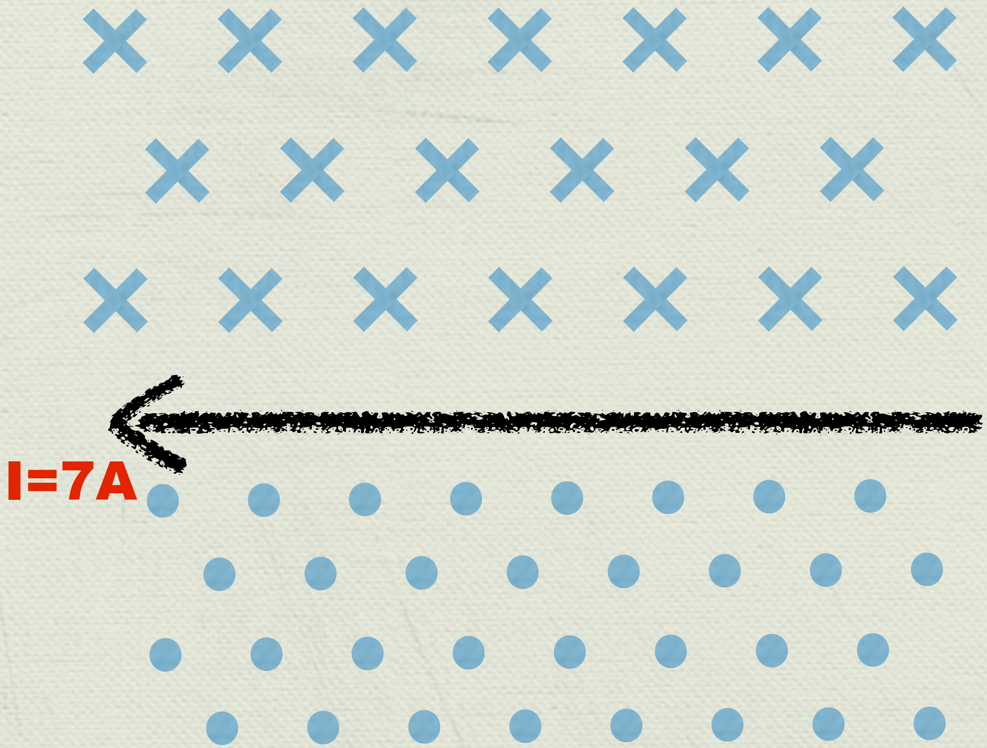
$$B = \frac{\mu_0 I}{2\pi r}$$

The field is inversely proportional to the distance from the wire:

The constant μ_0 is called the permeability of free space, and has the value:

$$\mu_0 = 4\pi x 10^{-7} \frac{Tm}{A}$$

Sample Problem



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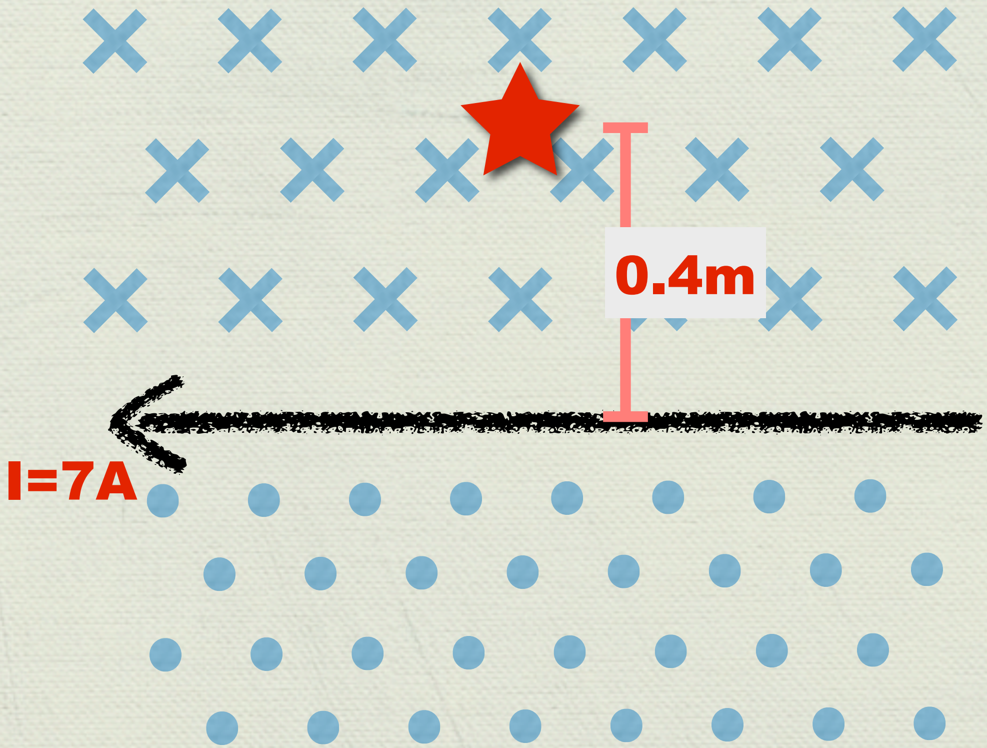

step 1: magnetic field strength

$B = 4\pi \times 10^{-7}\ (7)\ /\ 2\pi\ (0.4)$

$B = 3.5 \times 10^{-6}$ T

ans: B=3.5μT, in

Sample Problem

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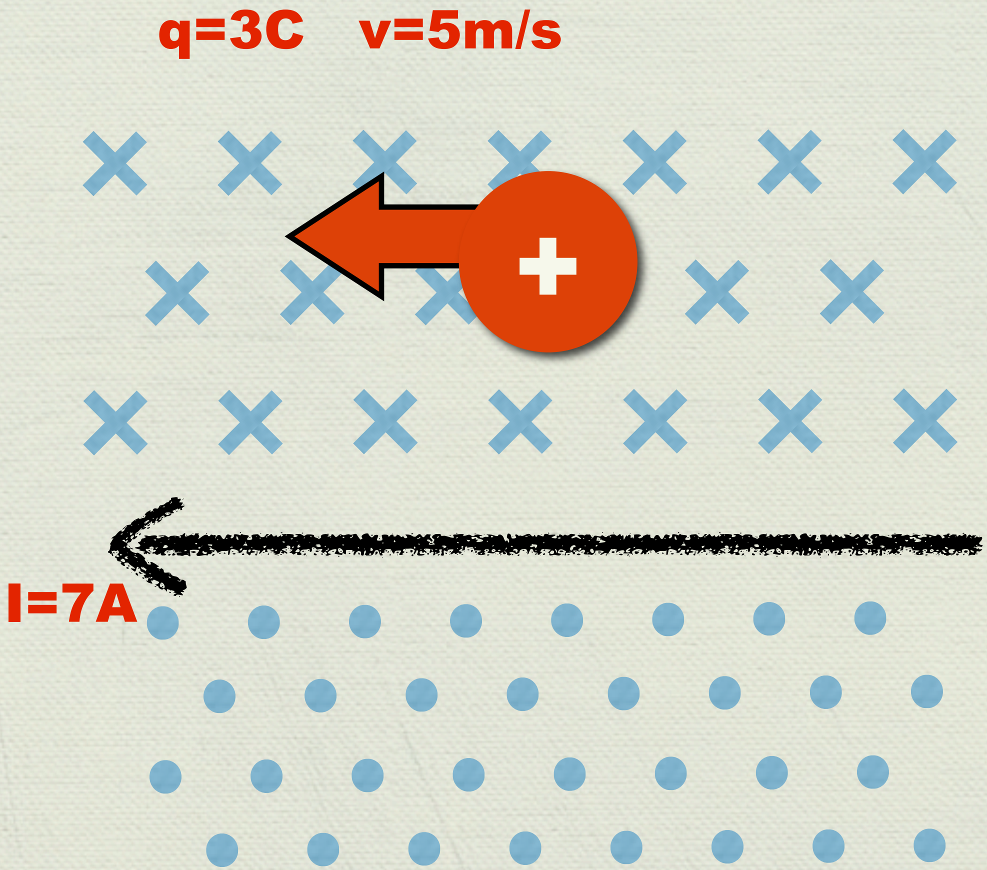

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step 1: force on a charge

Sample Problem

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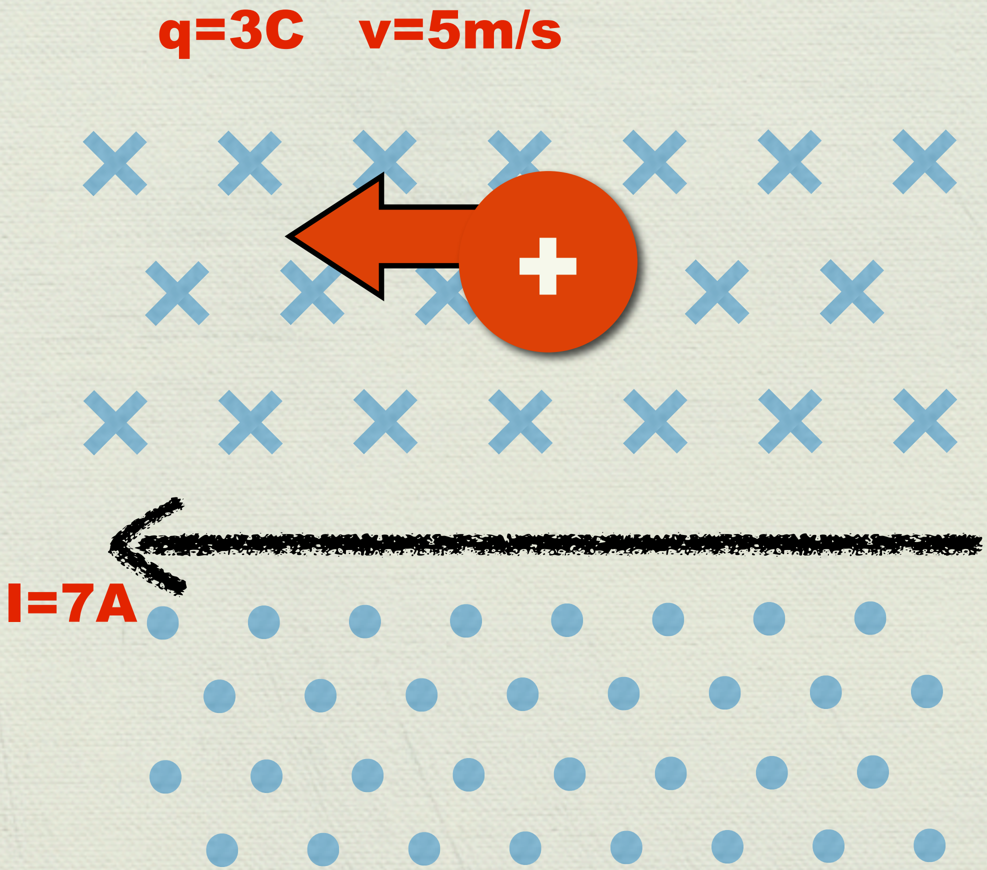

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step 1: force on a charge

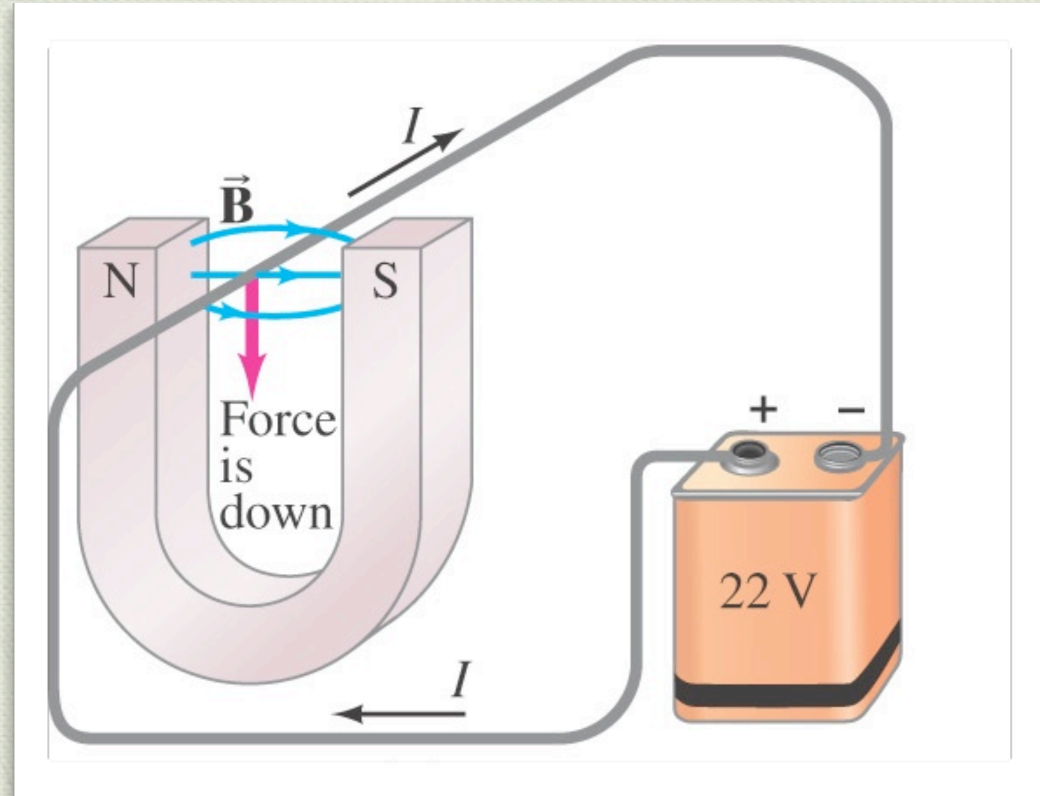
F=qvBsinθ

$F = (3)(5)(3.5 \times 10^{-6})$

ans: 5.25×10^{-5} N, down

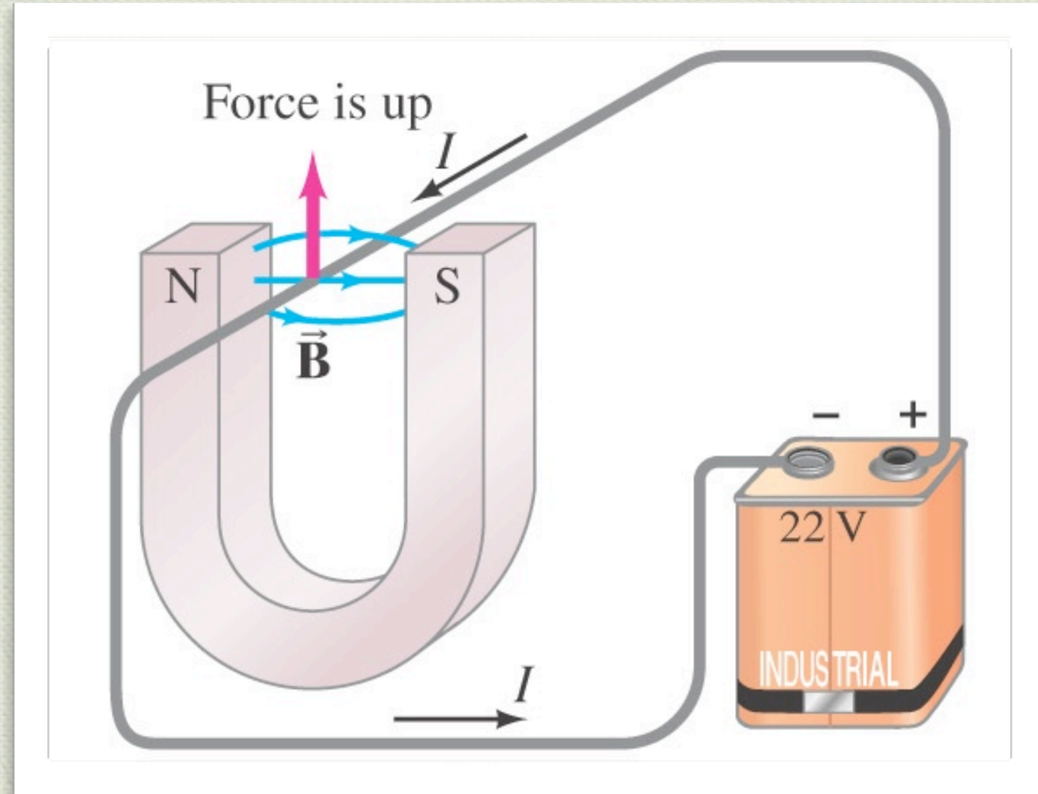
RHR - Current in a field

A magnet exerts a force on a current-carrying wire. The direction of the force is given by a right-hand rule.



RHR - Current in a field

Switching the leads for the battery



Force on a Wire

$$F = IlB\sin\theta$$

- Force - Newtons
- I - Current in Amperes
- L - Length - meters
- B - Magnetic Field in Tesla
- Strongest at a right angle

The force on the wire depends on the current, the length of the wire, the magnetic field, and its orientation.

Two equations for the same thing

I L

Coulombs/second x meters

q v

Coulombs x meters/second