Magnetic force

On a charged particle moving in a magnetic field

$$\vec{F}_B = q\vec{v} \times \vec{B}$$

The magnitude is:

$$|\vec{F}_B| = |q||\vec{v}||\vec{B}| \sin\theta$$

Wire

The magnetic force exerted on a very small segment $d\vec{s}$ is:

$$d\vec{F}_B = Id\vec{s} \times \vec{B}$$

Thus for a straight segment:

$$\vec{F}_B = I\vec{L} \times \vec{B}$$

where $\vec{L}$ is a vector that points in the direction of the current I and has a magnitude equal to the length L of the segment.

Direction

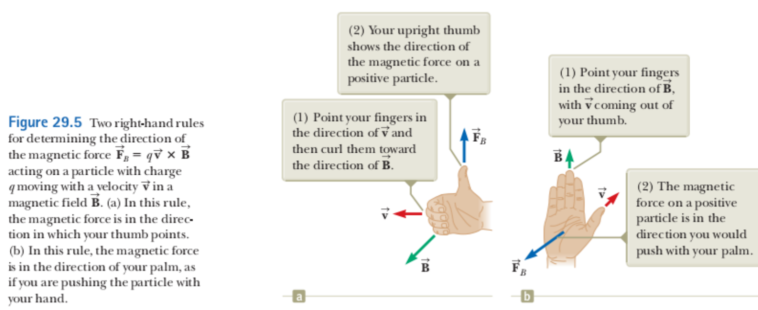

Figure 1:

Unit

$$1T = 1\frac{N}{C \cdot m/s} = 1\frac{N}{A \cdot m} = 10^4 G$$

Exercises

2. W Determine the initial direction of the deflection of charged particles as they enter the magnetic fields shown in Figure P29.2.

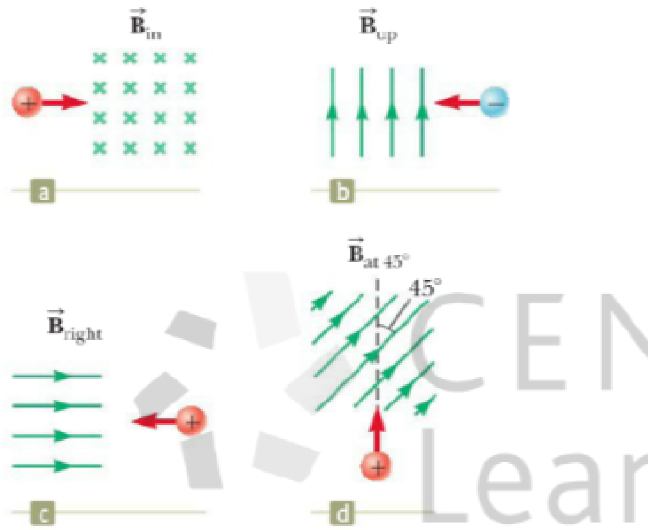

Figure P29.2

Figure 2:

65. AMT **Review.** A 0.200-kg metal rod carrying a current of 10.0 A glides on two horizontal rails 0.500 m apart. If the coefficient of kinetic friction between the rod and rails is 0.100, what vertical magnetic field is required to keep the rod moving at a constant speed?

Answer: **65.** 39.2 mT

Figure 3: