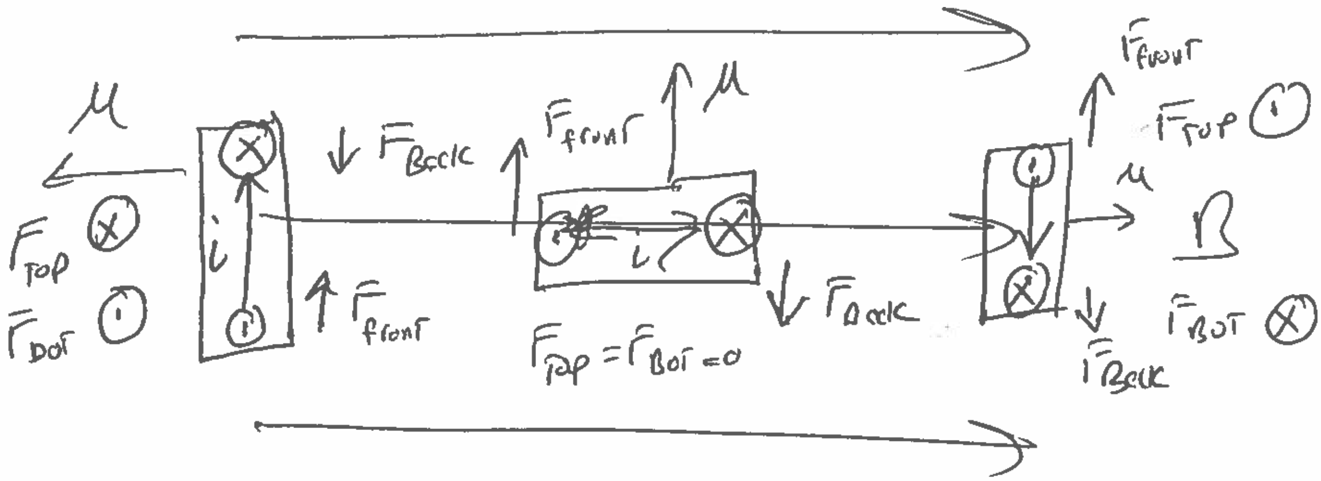
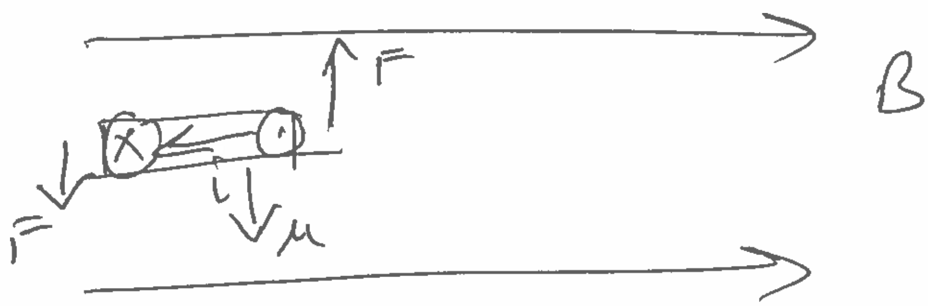




$\vec{\mu} = NiA$ direction is RT hand rule following current

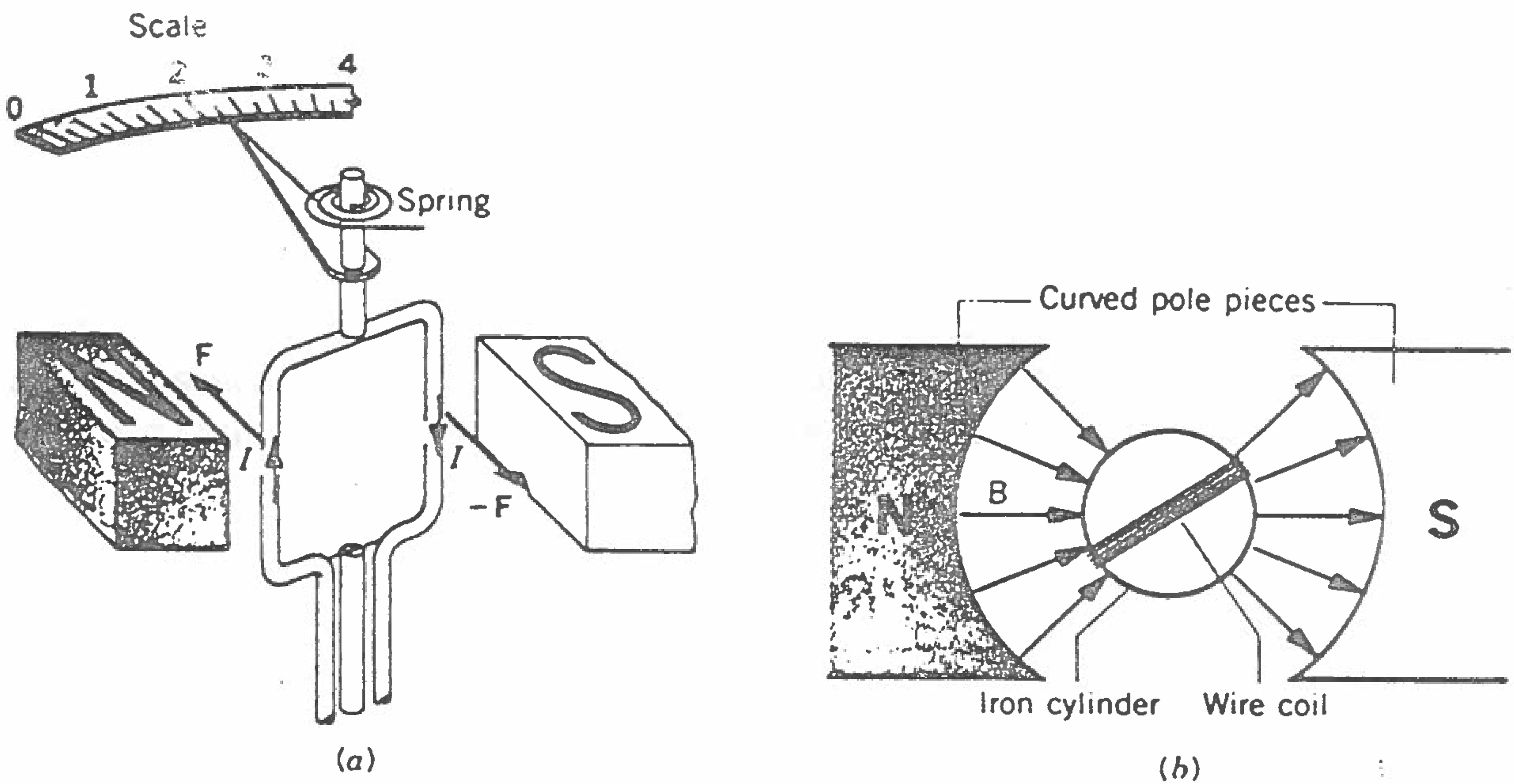
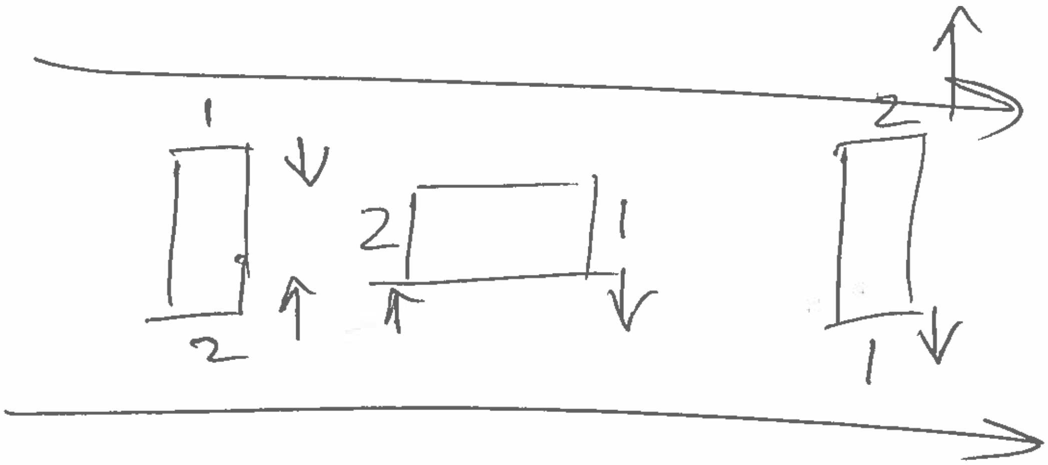
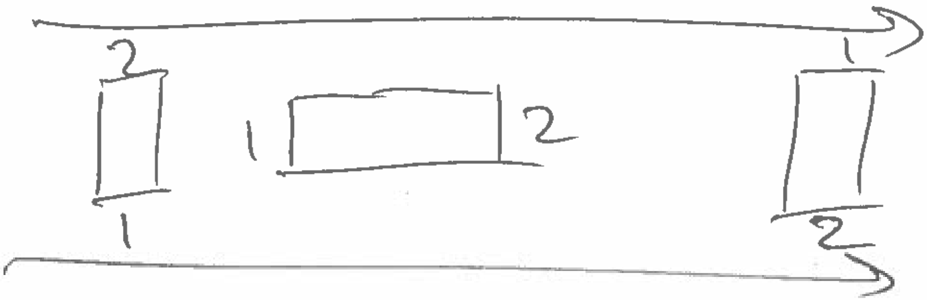


Figure 21.20 (*a*) The basic elements of a galvanometer. (*b*) Top view of a galvanome-
ter mechanism showing the curved pole pieces, the iron cylinder, and the coil. For cla-
ity, the scale, pointer, and spring have been omitted.


1
2
2
1
2
1


2
1
1
2
1
2

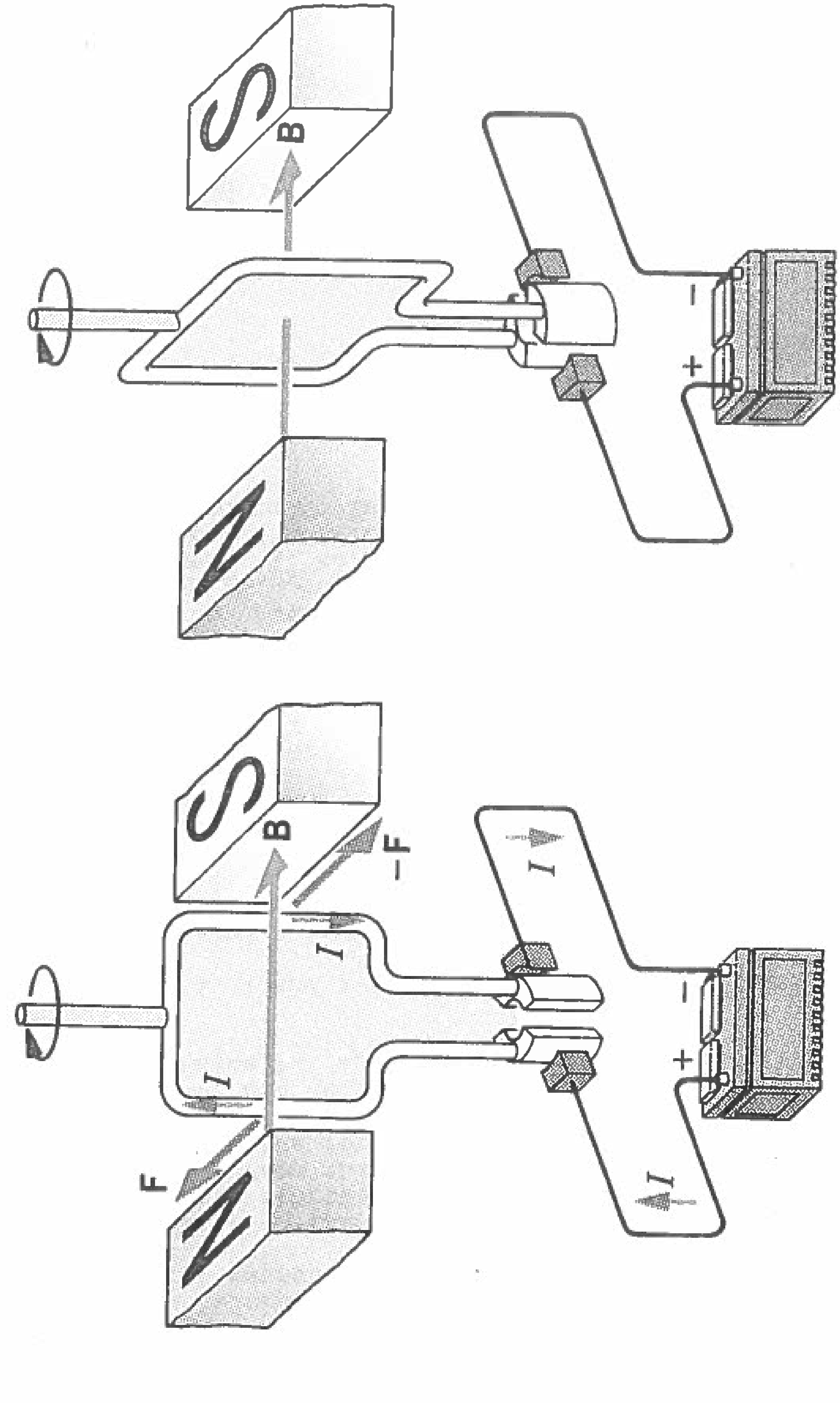
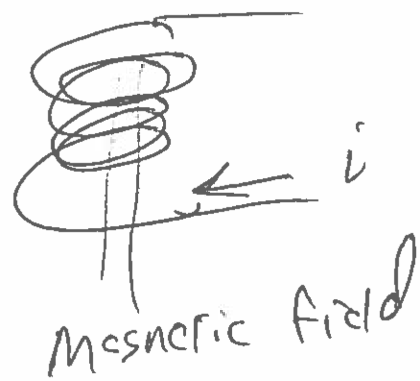


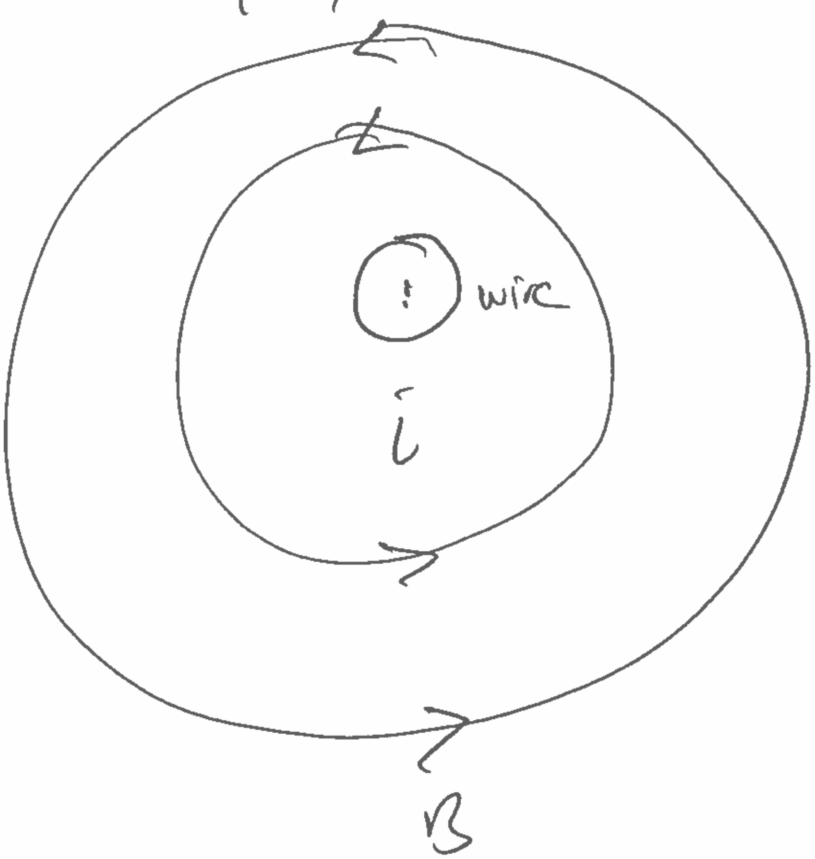
FIGURE 21.22

Magnetic fields are created by electrical currents.

Electromagnets.



long straight wire



RT hand rule $\vec{B}$ makes circles as your fingers curl with Thumb in direction of current

$$\vec{B}_{\text{long straight wire}} = \frac{\mu_0 i}{2\pi r} \quad \hat{\ } \text{ right rule}$$

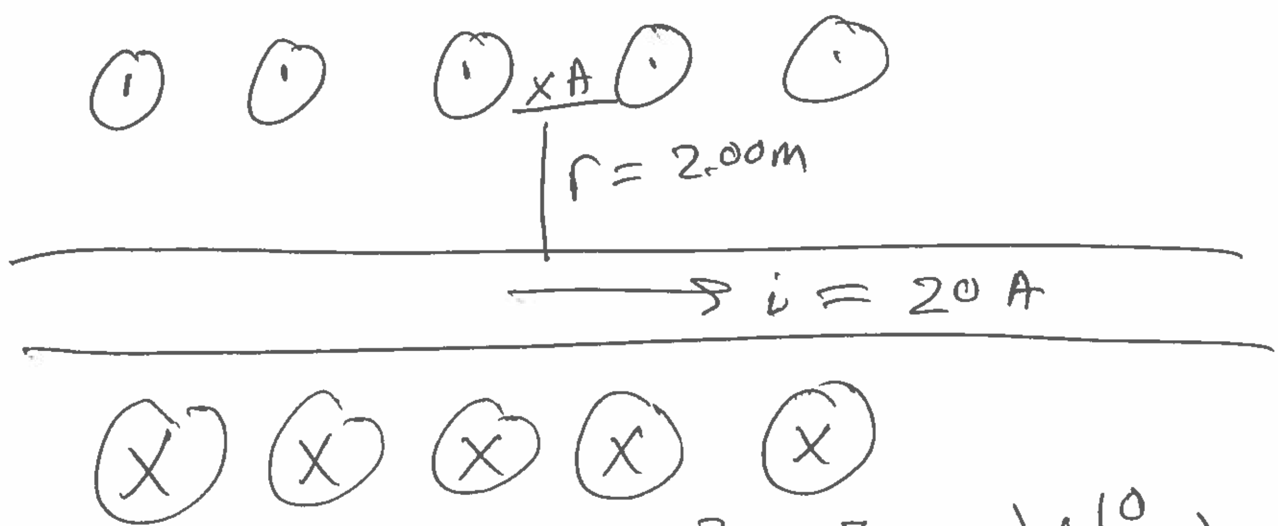
$$\mu_0 = 4\pi \times 10^{-7} \frac{T\,m}{A}$$ – Permeability of free space

Similar To ε_0 – for electric fields

Permeability is a measure of how easily A magnetic field propagates in a medium.

Do Not confuse μ_0 with $\vec{\mu}$ (magnetic moment)

$\frac{T\,m}{A}$ $\qquad$ $A\,m^2$



$$\vec{B}_A = \frac{\mu_0 i}{2\pi r} \odot = \frac{(4\pi \times 10^{-7}\,T\,m/A)(20\,A)}{2\pi\,(2.00\,m)}$$

$$\vec{B}_A = 2 \times 10^{-6}\,T$$

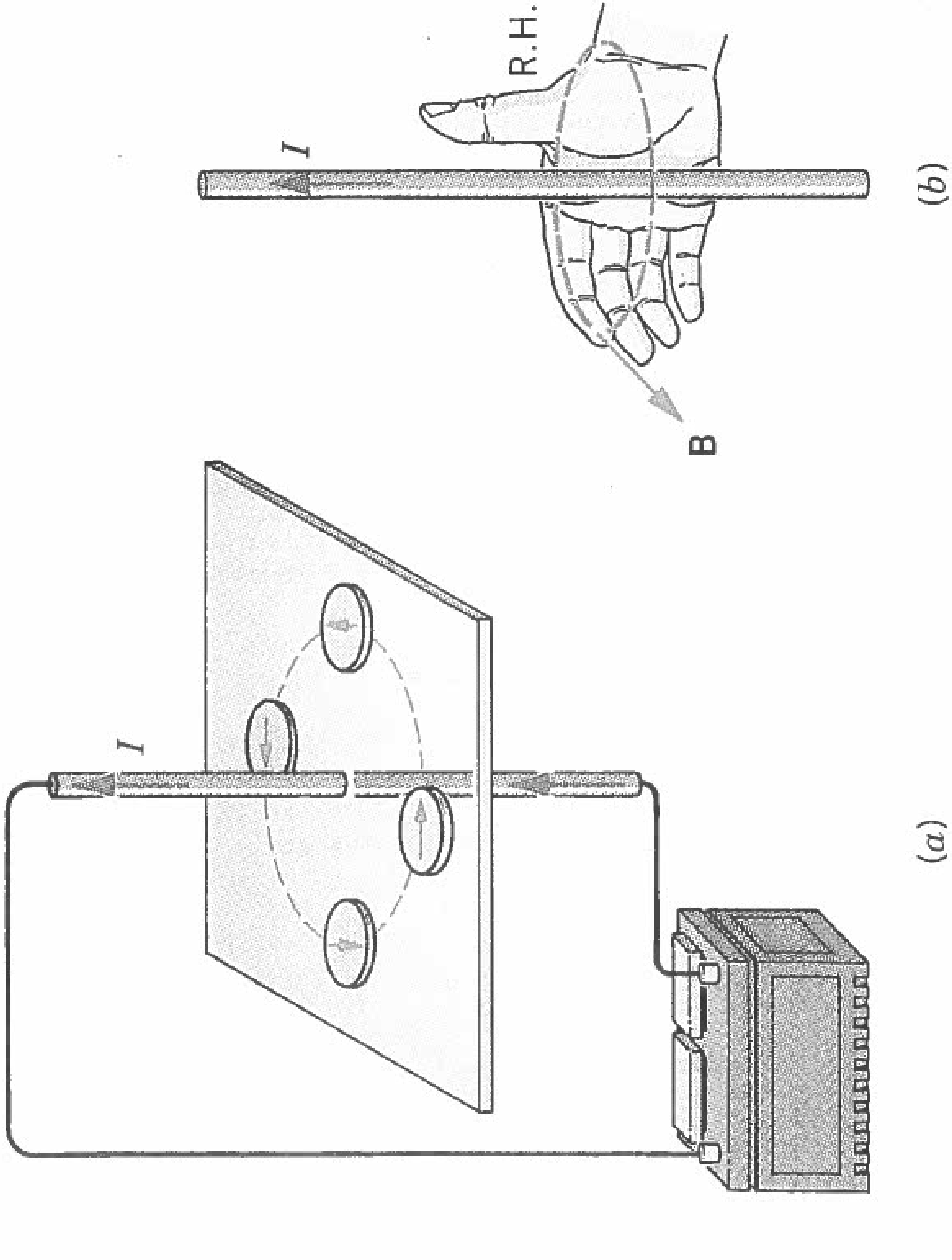
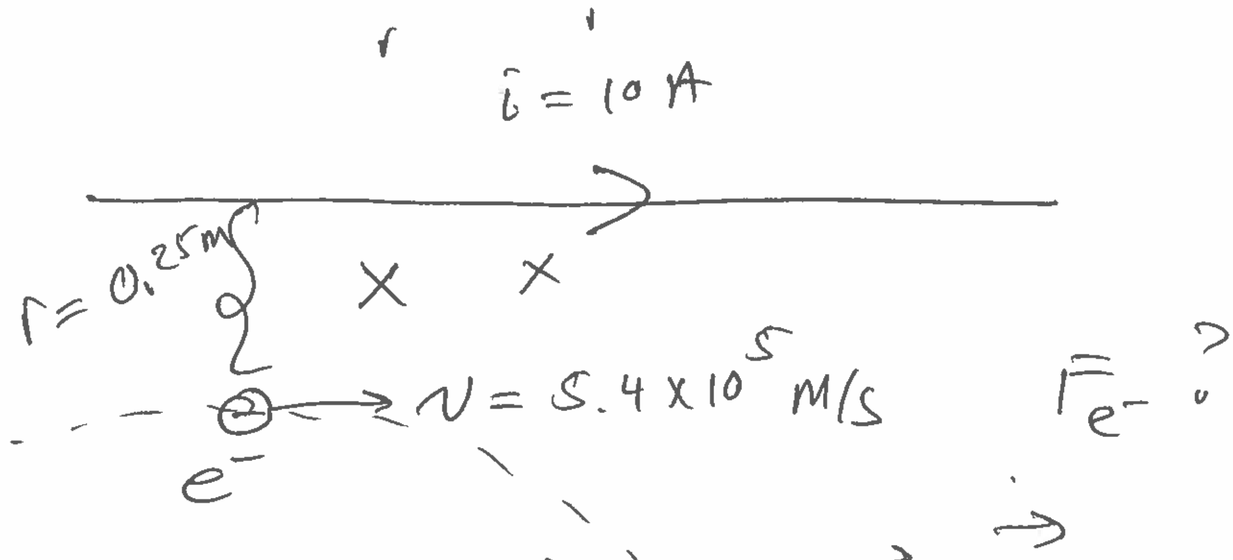


FIGURE 21.23 a, b



$$\vec{F}_{e^-} = Q\vec{v} \times \vec{B} = -e\vec{v} \times \vec{B}_{wire}$$

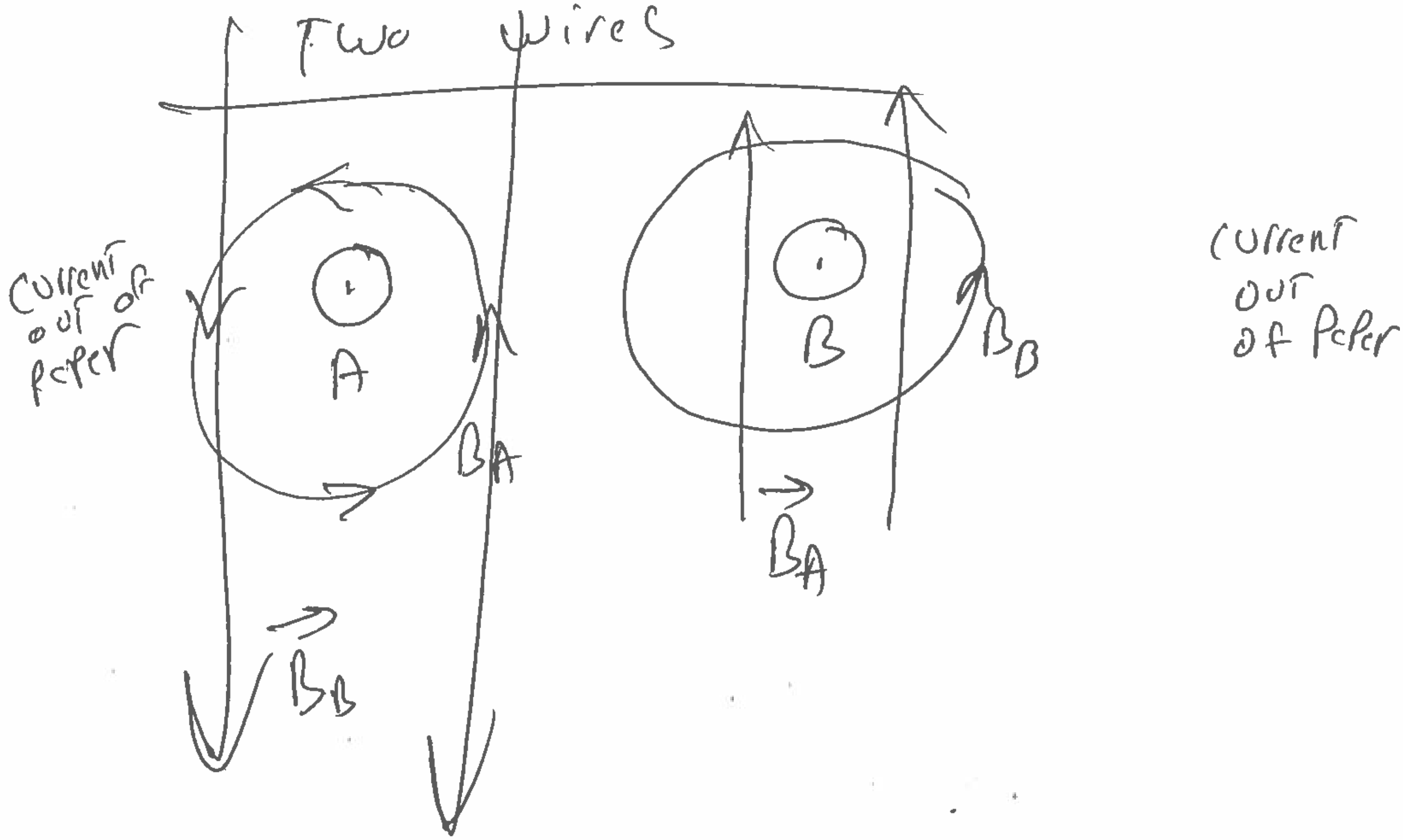
$$\vec{B}_{wire} = \frac{\mu_0 i}{2\pi r} \hat{\otimes}$$

$$F_{e^-} = \frac{-e v \mu_0 i}{2\pi r} \underbrace{\hat{R} \times \hat{\otimes}}_{\hat{up}}$$

$$F_{e^-} = \frac{e v \mu_0 i}{2\pi r} \underbrace{\left(-\hat{up}\right)}_{\left(\hat{down}\right)}$$

$$F_{e^-} = \frac{(1.6 \times 10^{-19}\,C)(5.4 \times 10^5\,m/s)(4\pi \times 10^{-7}\,\frac{T\,m}{A})(10\,A)}{2\pi\,(0.25\,m)}$$

$$\boxed{F_{e^-} = 6.9 \times 10^{-19}\,N\ \hat{down}} \qquad C\,\frac{m}{s}\,T = N$$



$$\vec{F}_{A \to B} = i_B \vec{L}_B \times \vec{B}_A \qquad \hat{\text{Left}}$$

$$\vec{F}_{B \to A} = i_A \vec{L}_A \times \vec{B}_B \qquad \hat{\text{Right}}$$