Read 14.5

Exam 3 Wednesday chp 12, 13, 14

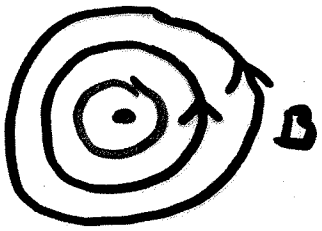
I will be gone Monday
no office hours
guest Lecturer

Read chp 9.1-9.2 for Friday

H.w Due Monday

Current in wire

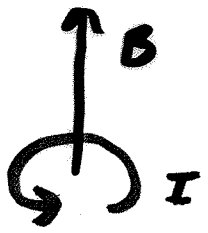
RHR-1



Thumb direction of current
fingers curl in direction of B field

wire loop

RHR-2



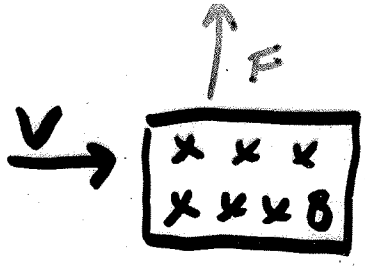
fingers curl in
direction of current
Thumb points in direction of B field

charged particle in magnetic field

magnitude of force: $F = qv_{\perp}B$

RHR-3

Fingers direction of V
curl towards B
Thumb: direction of force

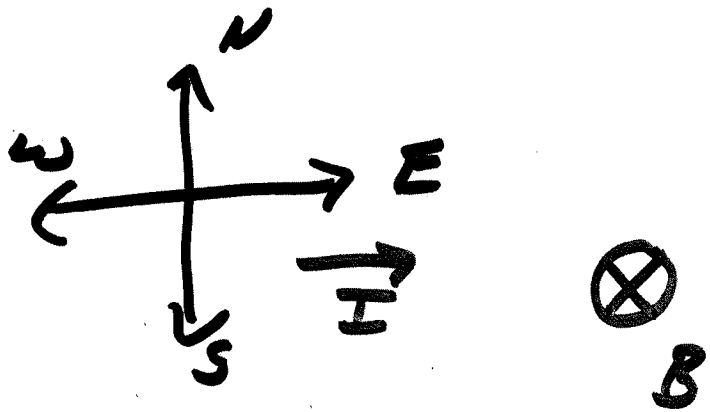


Problem: A straight 44 cm wire has an current of 2.3 A flowing east in a 0.65 T magnetic field that points down. What is the magnitude and direction of the force on the wire?

$L = .44\,m$

$I = 2.3\,A$

$B = .65\,T$



$F = ILB$

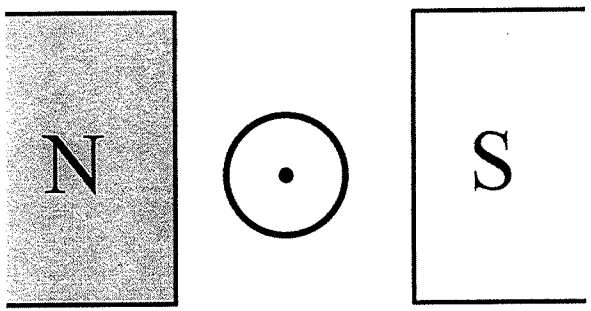
$= (2.3A)(.44m)(.65T) = .658\,N$

Force North

Interactive Question

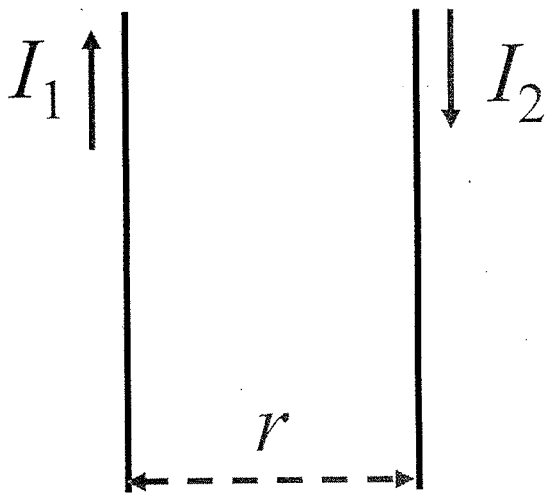
C

A long straight wire is placed between the poles of a magnet as shown. When a current is flowing out of the page as shown, the direction of the magnetic force on the wire will be:



A) toward the left
B) toward the right
C) toward the top of the page
D) toward the bottom of the page
E) out of the page

Problem: Two long parallel wires carry currents in opposite direction as shown in the figure with $I_1 = 2.2$ A, $I_2 = 4.4$ A and $r = 3.3$ cm.



A) What is the total force exerted on a 25 cm section of wire 1?

B) What is the direction and strength of the magnetic field produced by wire 2 at the position of wire 1.

C) Knowing the direction of the magnetic field, use the right hand rule to show that the force on wire 1 is repulsive.

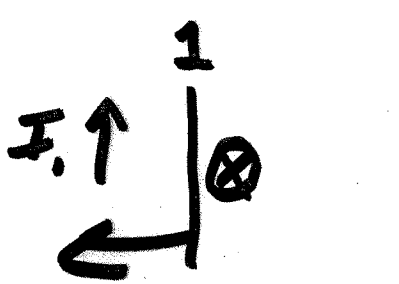
A) $\frac{F}{L} = \frac{2k' I_2 I_1}{r}$

$F = \frac{2k' I_2 I_1 L}{r}$

$F = \frac{2(1\times10^{-7}\ N/A^2)(4.4A)(2.2A)(.25m)}{.033m}$

$F = 1.5\times10^{-5}\ N$

B



$F = ILB$

$B = \frac{F}{I_1 L} = \frac{1.5\times10^{-5}\ N}{(2.2A)(.25m)}$

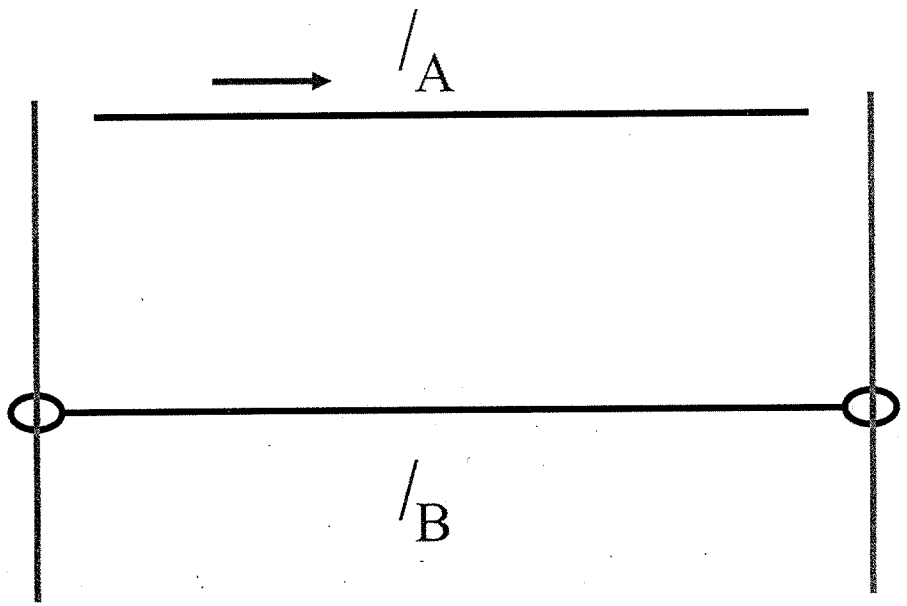
$B = 2.7\times10^{-5}\ T$

Interactive Question

(A)

Wire A carries a current of to the right as shown. Wire B is below and parallel to wire A and allowed to slide freely up and down between a set of nonconducting guides. If wire B is levitating with the magnetic force balancing the gravitational force, which direction does the current flow in wire B?

A) To the right
B) To the left
C) There is not enough information to decide.



Problem: Two long parallel wires are carrying currents in the same direction. Wire A carries a current of 150 A and is held firmly in position. Wire B carries I_B and is allowed to slide freely up and down parallel to A between a set of nonconducting guides. If the linear mass density of B is 0.010 kg/m, what value of the current I_B will result in wire B levitating when the distance between the conductors is 2.5 cm?

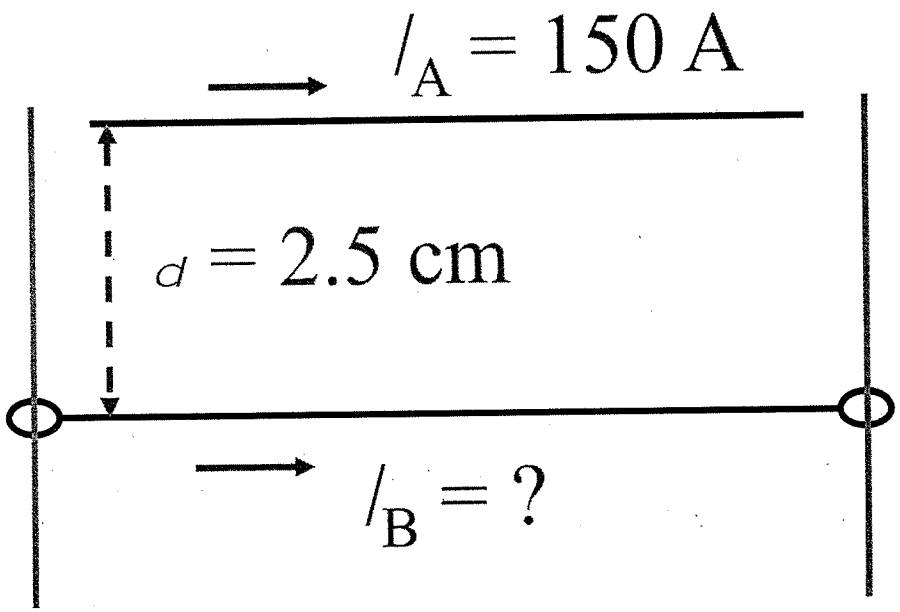
$F_{net} = 0$

$F - w = 0$

$\frac{F}{L} - \frac{w}{L} = 0$

$\frac{2k' I_A I_B}{r} - \frac{mg}{L} = 0$

$F_B = \frac{mg\left(\frac{m}{L}\right)}{(2k' I_A)}$



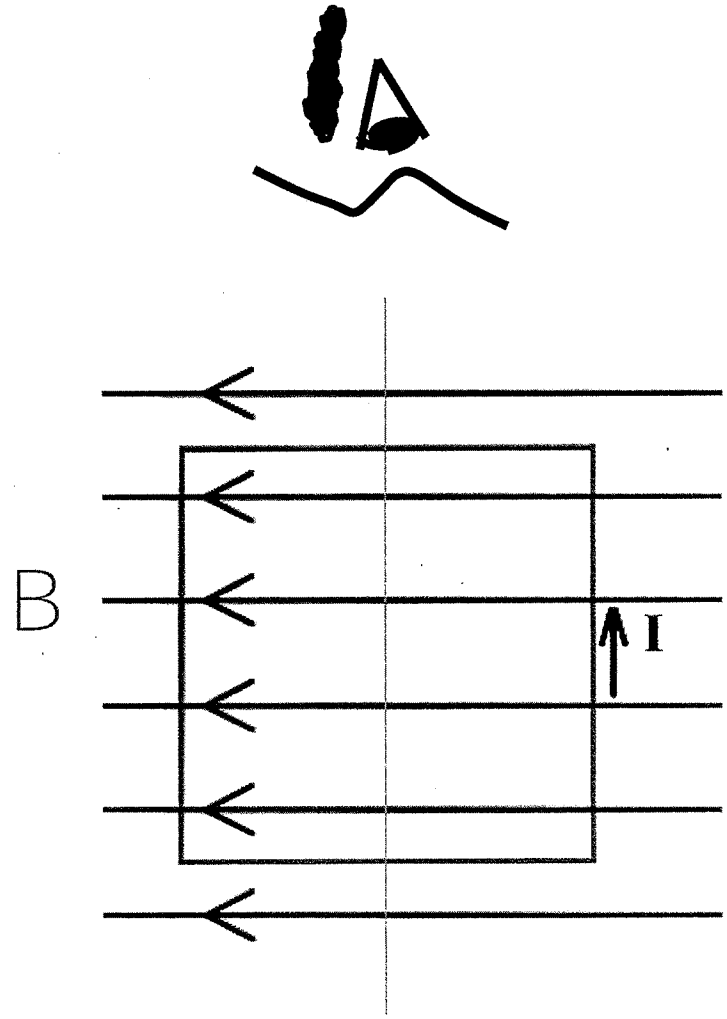
$I_B = \frac{(.025\text{m})(9.8\text{m/s}^2)(.01\text{kg})}{2(1\times10^{-7}\text{N/A}^2)(150\text{A})}$

$I_B = 82$ A

Interactive Question

A

A current loop is placed in a magnetic field as indicated. Will the loop tend to rotate (viewed from above) clockwise, counter-clockwise, or not at all about a vertical axis?



A) Clockwise
B) Counter-clockwise
C) Not at all

Interactive Question

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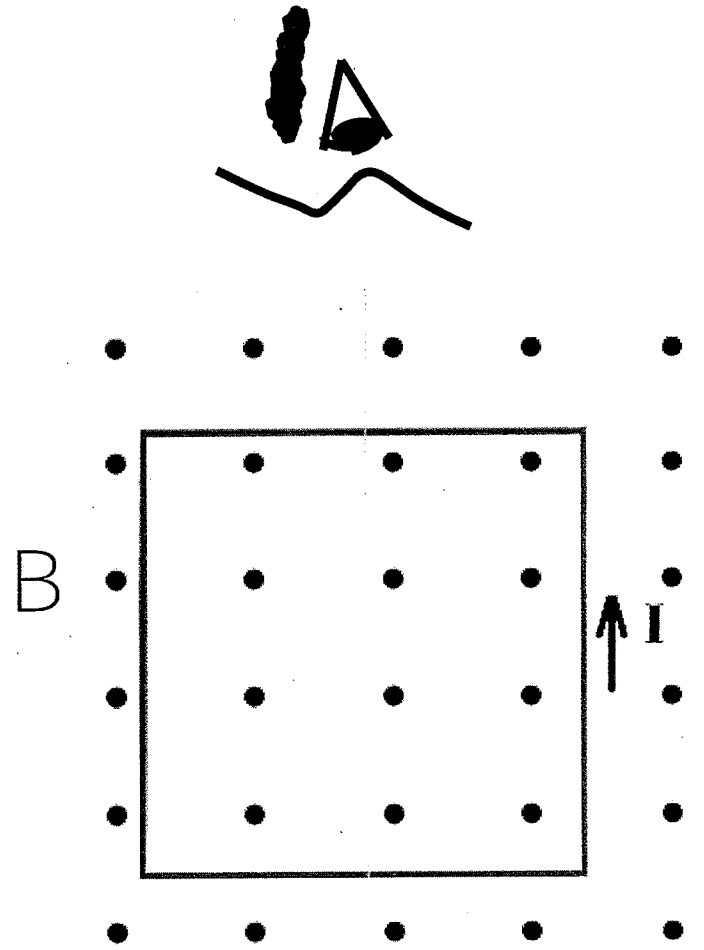

A) Clockwise
B) Counter-clockwise
C) Not at all