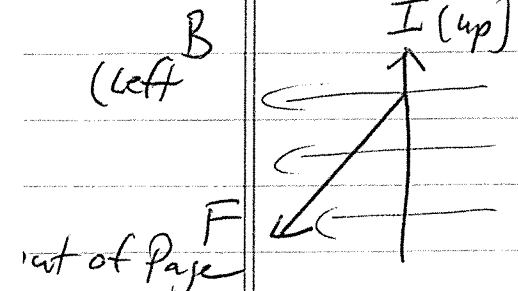
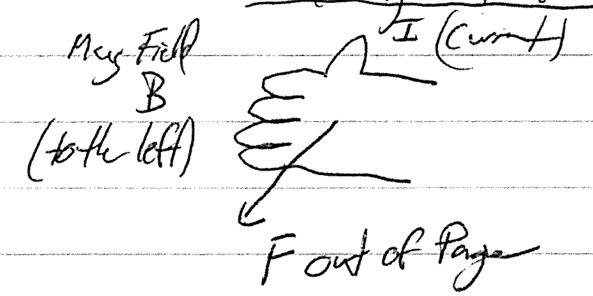
4/12

Forces on a Current Carrier in a Magnetic Field #13

- I a wire carrying current is placed in a magnetic field so that the direction of the current is ⊥ to the direction of a magnetic field the field will produce a force on the wire.



Third Right Hand Rule



(Try Some Problems)

What determines Force? ① Current
② length of Wire
③ Strength of Mag. Field

$F = I l B$

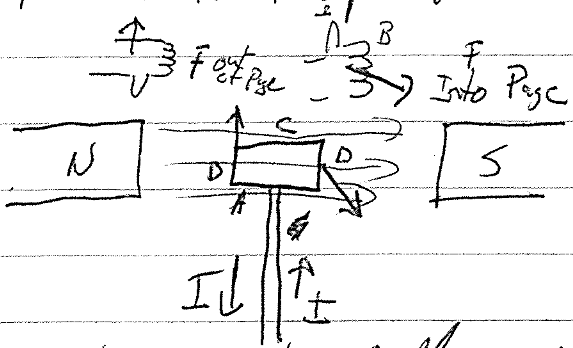
Calc the force on the wire shown is the current in the wire is 100A & the length is 200cm (2m) in a magnetic field whose induction is 3×10^{-3} T.

$F = I l B = 100A (2m)(3 \times 10^{-3} T) = 6 \times 10^{-1} N$

What happens if wire is not ⊥ to the magnetic field, (only partial Force occurs)

$F = I l B \sin \theta$

Forces that produce Rotational Motion is called Torque



Portions of loop parallel to the mag. Field will exp. no Force
B - Force up out of Page
d - Downward into Page

Net result of these two forces is to rotate the loop

1,3,5,6,7,8 Text.

IB 4/12 #4

Free Charge in a Magnetic Field

If a charged particle is introduced into a Mag. Field, it will exp. a force that is always perpendicular to the direction of its velocity

l = distance of wire $F = I l B$ & $I = \frac{q}{t}$

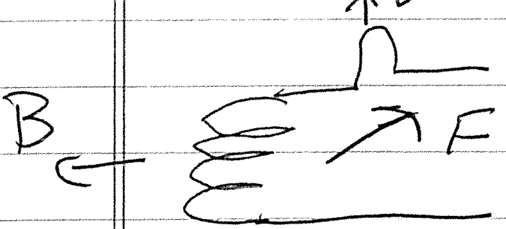
$l = d$

$F = \frac{q l B}{t}$ $F = q\left(\frac{d}{t}\right)B$ $\boxed{F = qvB}$

Calc. the force on a proton moving at a speed of 2×10^{6} m/s in a Mag. Field of .5 T?

$F = qvB = (1.6\times10^{-19}C)(2\times10^{6} m/s)(.5 T) = 1.6\times10^{-13} N$

Modify Right Hand Rule #3



Thumb represents the direction of the velocity of the positively charged particle.

Since particles are free to move, vel. is continually changing direction & force always remains ⊥ to the direction of v. (The force is centripital Force)