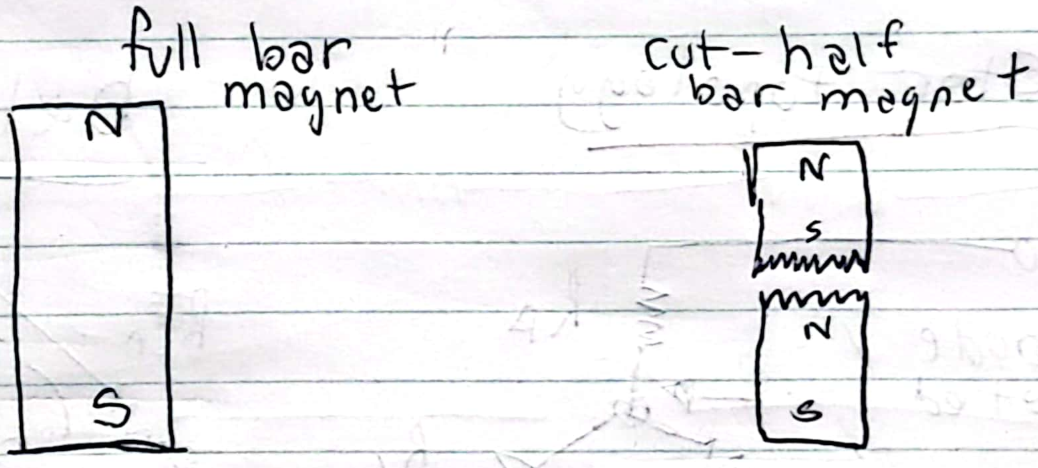
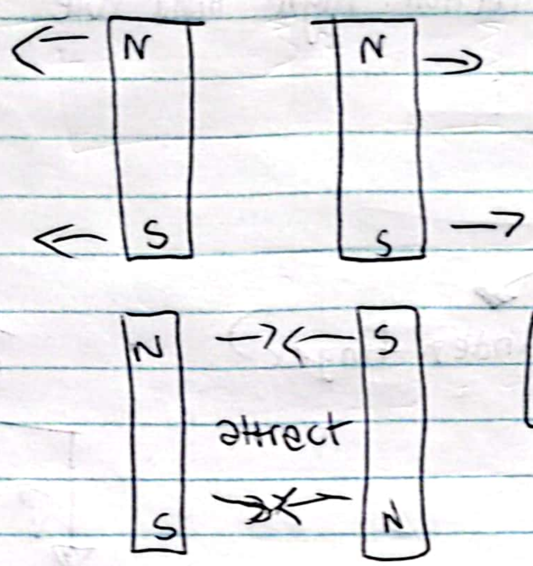
Magnetism

Bar magnet

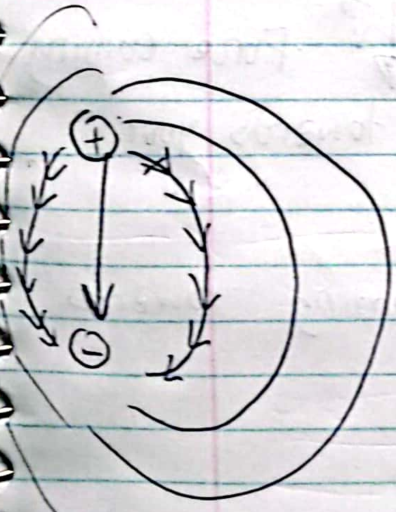


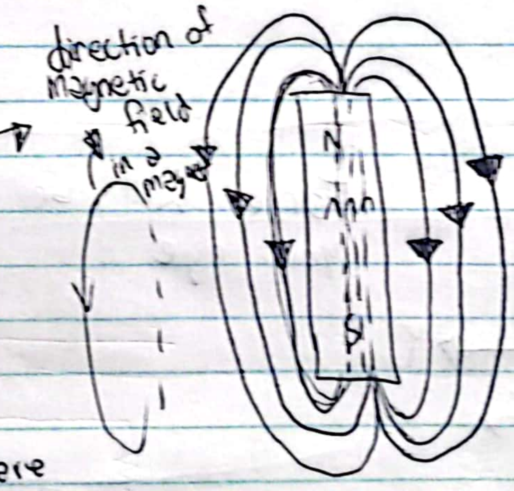
- When bar magnet cut in half, you still have two new bar magnets and so on.
  - until no magnetic monopoles
- [because you can't just have N OR S]
- North and south come together

Bar magnet



$\boxed{\text{likes repel, opposites attract}}$





lines of $\vec{B}$ are continous [magnetic field]

lines of $\vec{E}$ are not continous [electric field]

for electric field are going down positive to negetive

for magnetic field it goes up

—x—x—x—x—x—x—x—x—x—

<u>Magnetic force</u>

$$F = qvB\sin(\theta)$$

F → magnetic force

q → charge

v → velocity

B → magnetic field

θ → angle between velocity and magnetic field

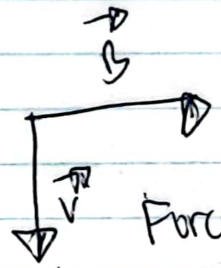
determining direction

Direction: Right hand rule

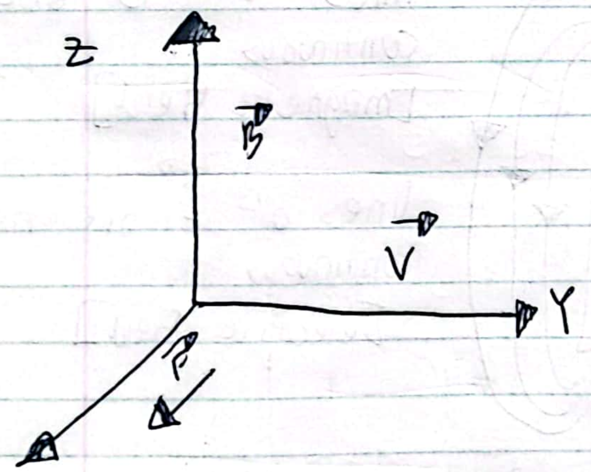
$F = qvB\sin(\theta)\,\hat{n}$ →

$F = qVB\sin(\theta)\,\hat{n}$

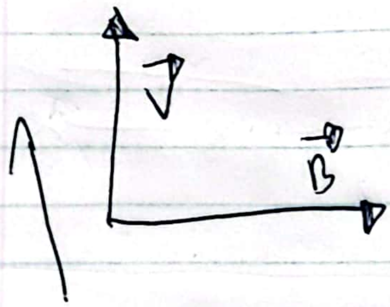
Thumb → (Finger) (Index finger)
Straight



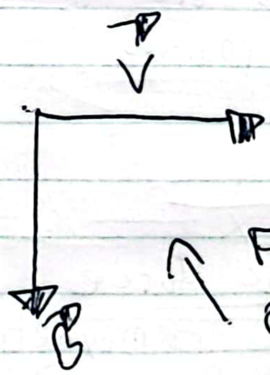
Force coming towards your eye



Force will be coming towards your eye

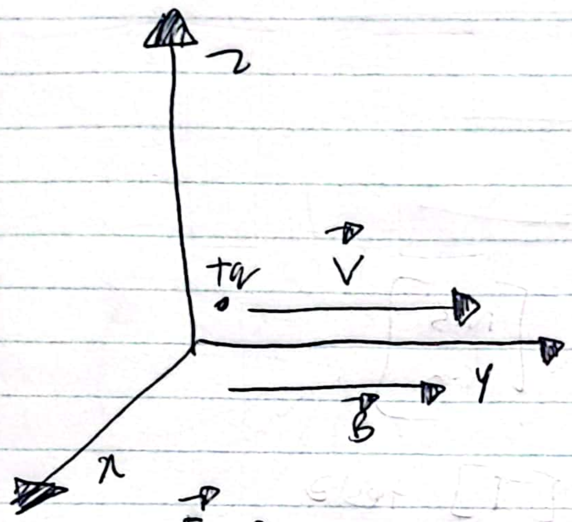


Force going away from your eyes



Force going away from your eyes

example



$\vec{F} = 0$

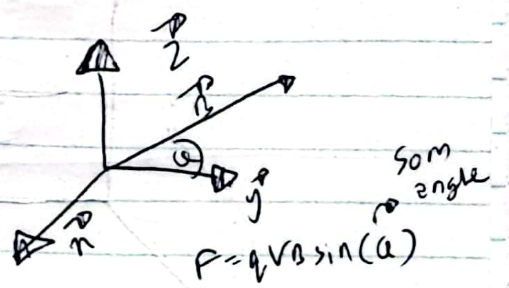
Decause its impossible to identify the velocity & B

Mathematical description

$\vec{F} = qvB\sin\theta\,(\hat{n})$

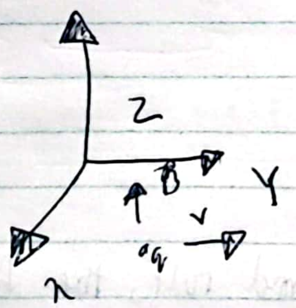
↳ Angle between $\vec{V}$ + $\vec{B}$

$F = qvB\sin(\theta)$
$= qvB\,0$
$F = 0$



$F = qVB\sin(\theta)$

Force moves towards my eye



$F = qVB\sin(90)\,\hat{n}$

$F = qVB\sin(90)\hat{n}$

$F = qVB\,\hat{i}$

Units

$F = qVB\sin(\theta)$

$\frac{F}{qV\sin(\theta)} = B$

$\frac{N}{[C]\left[\frac{m}{s}\right]} = [T] = \left[\frac{N \cdot s}{C \cdot m}\right]$

$= [T]$ tesla

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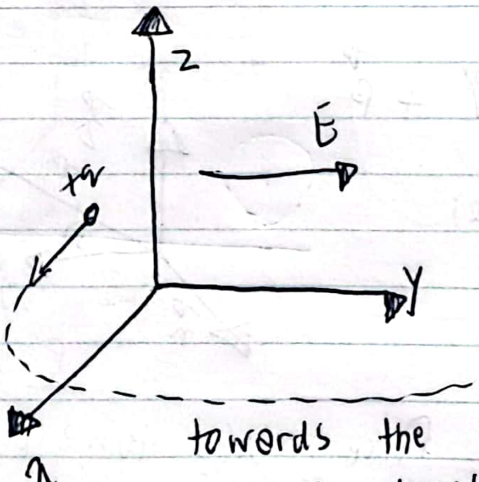
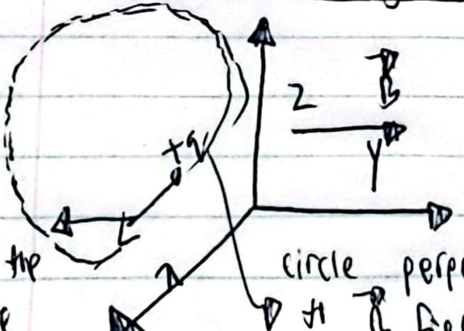
motion of q in electric field



Circle lies and rotates in the x-y plane

towards the y-direction

Motion for a magnetic field



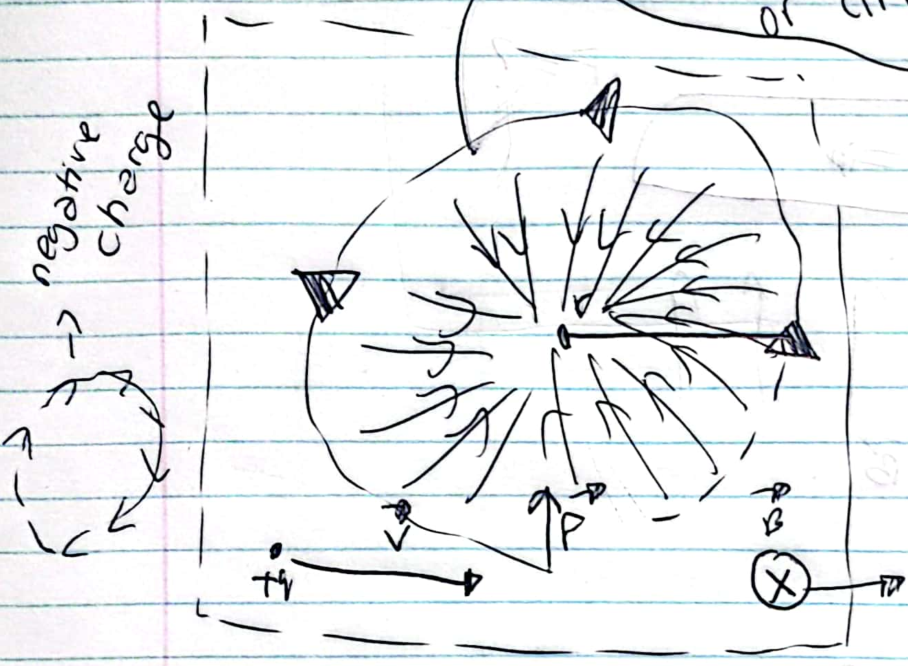
charge moving towards the eye

circle perpendicular to B field

By right hand rule, the force will go up.

it will go up, feel a force towards the right and eventually moves in a spiral motion example

magnetic field motion is in a spherical or circular motion



magnetic force

$F = qvB \sin(\theta)$

$= qvB \cdot (90)$

$= qvB$

away from the eyes

straight finger

$\boxed{\text{cyclotron}}$

Note
If moving in a circle

Centripetal force

$$\Sigma F = \frac{mv^2}{r}$$

$$qvB = \frac{mv^2}{r}$$

$$qvBr = mv^2$$

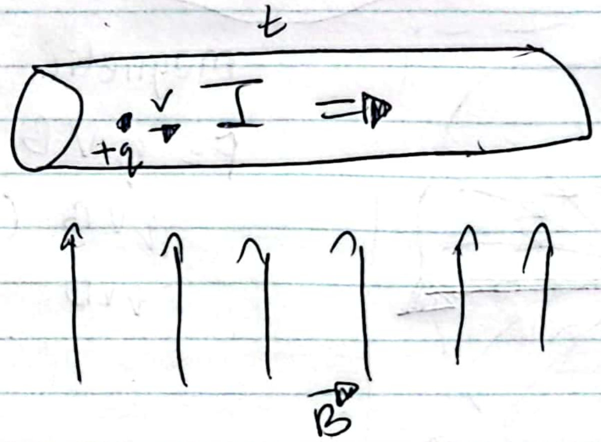
$$qBr = mv$$

$$r = \frac{mv}{qB}$$

speed = dis

Force on a wire in magnetic field

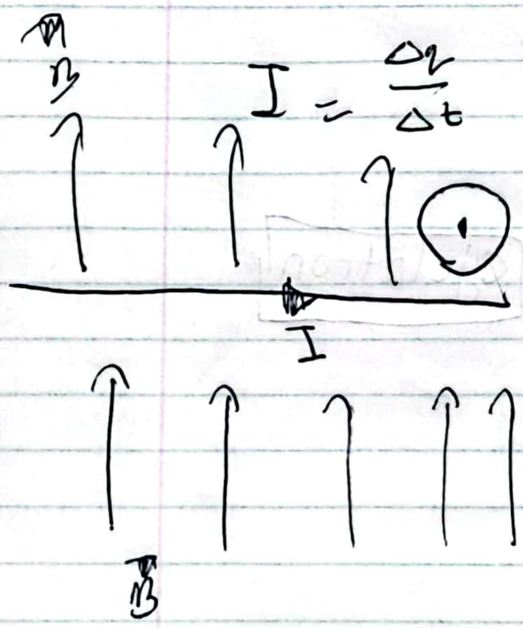
$F = ?$



magnetic force

$F = qVB\sin(\theta)\,\hat{n}$

$I = \frac{\Delta q}{\Delta t}$



$F = \Delta q\, V B\sin(\theta)$

$F = \frac{\Delta q}{\Delta t}(v\Delta t)\, B\sin(\theta)\,\hat{n}$

$= I(v\Delta t)\, B\sin(\theta)\,\hat{n}$

$\boxed{\vec{F} = I(l)\, B\sin(\theta)\,\hat{n}}$

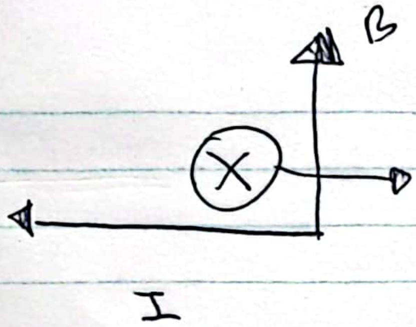
Force moves towards the eye

$\vec{F} = ILB\sin(\theta)\,\hat{n}$

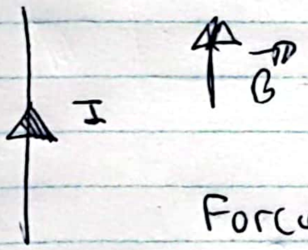
Angle between I and B

$= ILB\sin(90)$

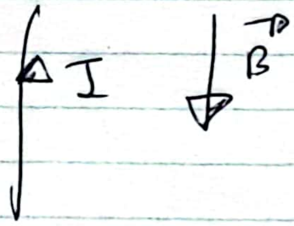
[out of the screen towards the eye]



Force moving away from the eyes.



Force $= 0$



$F = qvB\sin(180)$
$= 0$