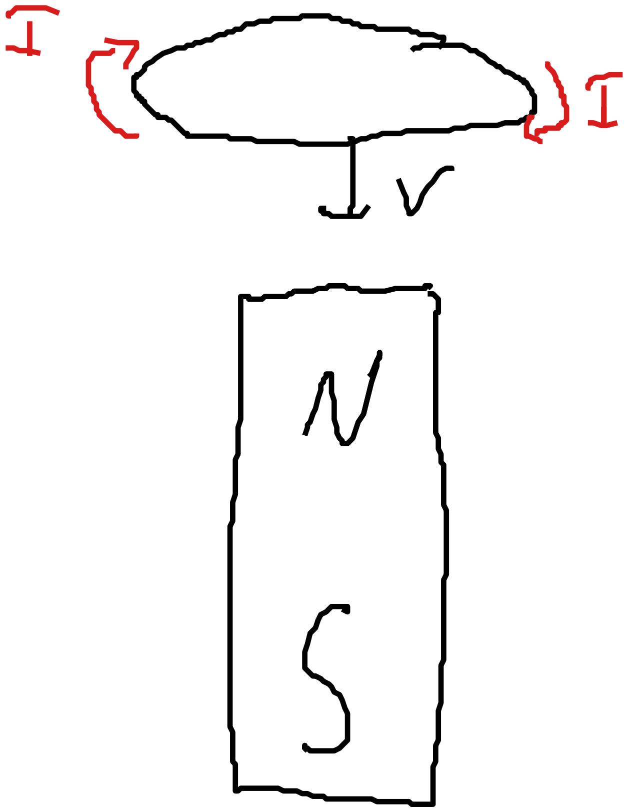
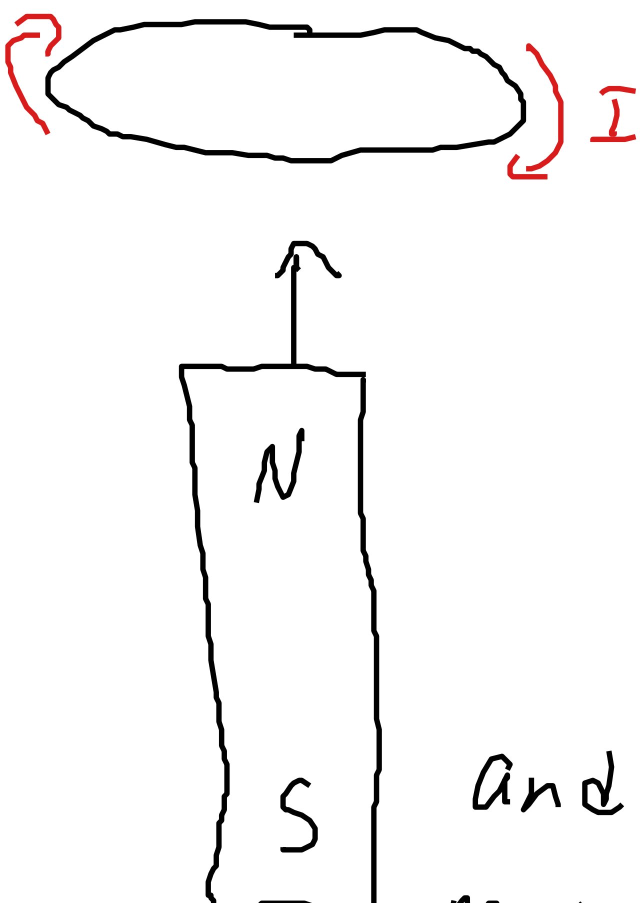


Induced current



$\vec{B}$ is changing with time

and a changing magnetic field induces an electric field

and this $\vec{E}$ pushes charge carriers around

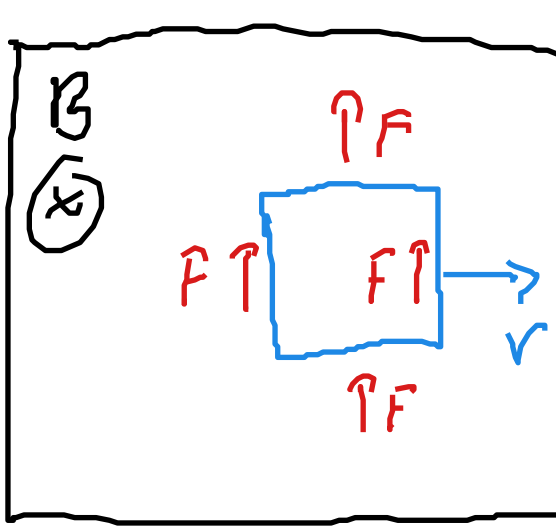
We want one uniform way of describing both of these behaviors.

direction of induced current

Lenz's Law

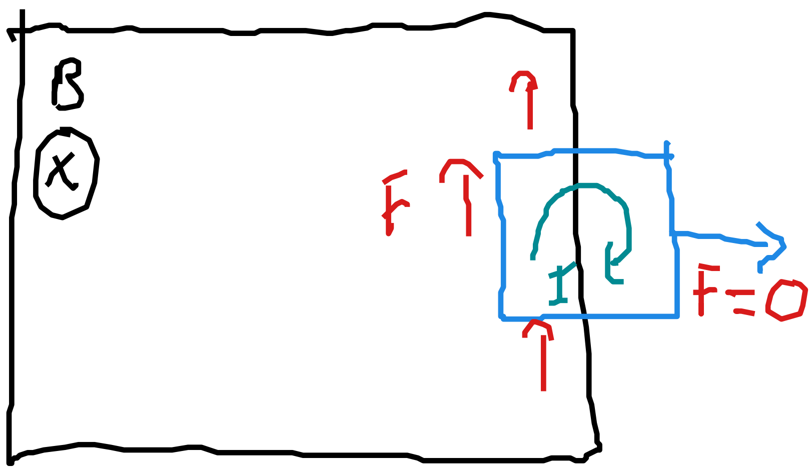
Faraday's Law

magnitude of induced current

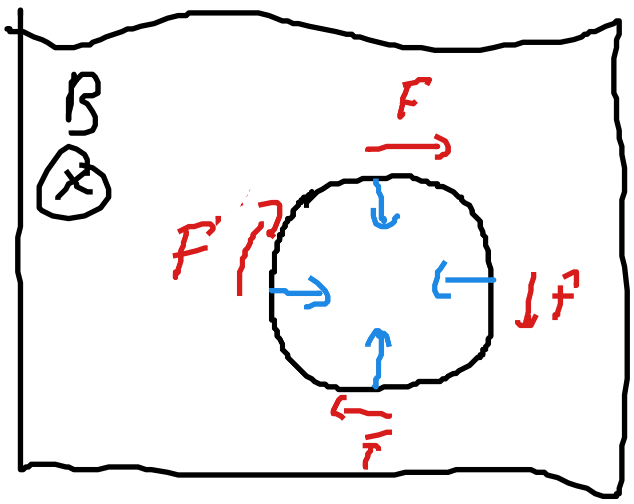


$B = 0$

no induced current here



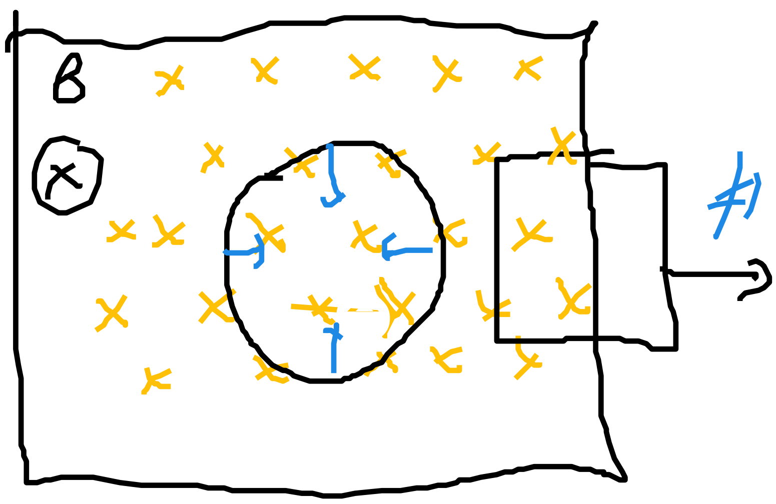
Seeing less field



less field is going through it

Magnetic Flux Φ_B

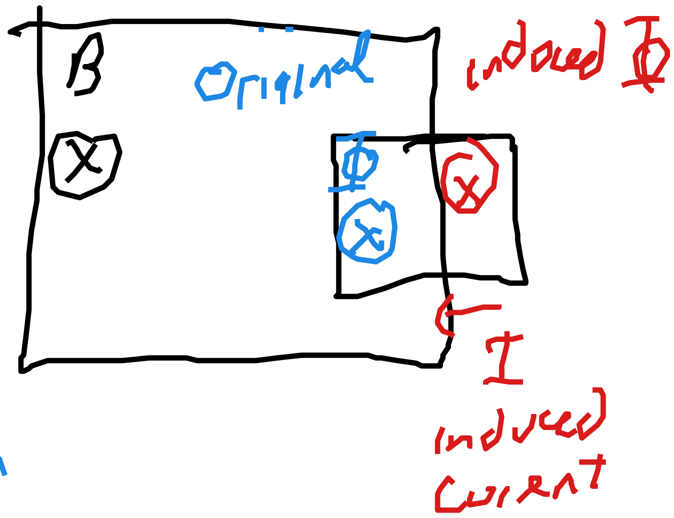
through a loop is proportional to # of magnetic field lines that pass through the loop.



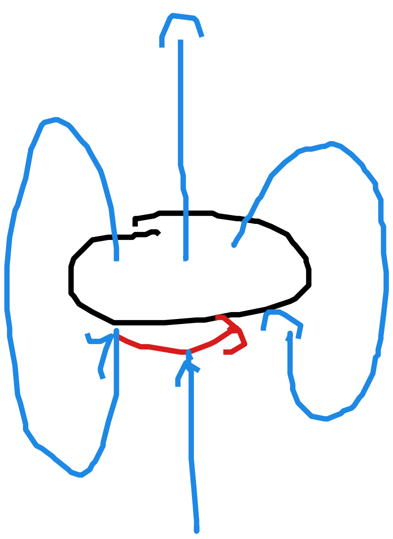
As loop shrinks, # field lines inside gets smalle

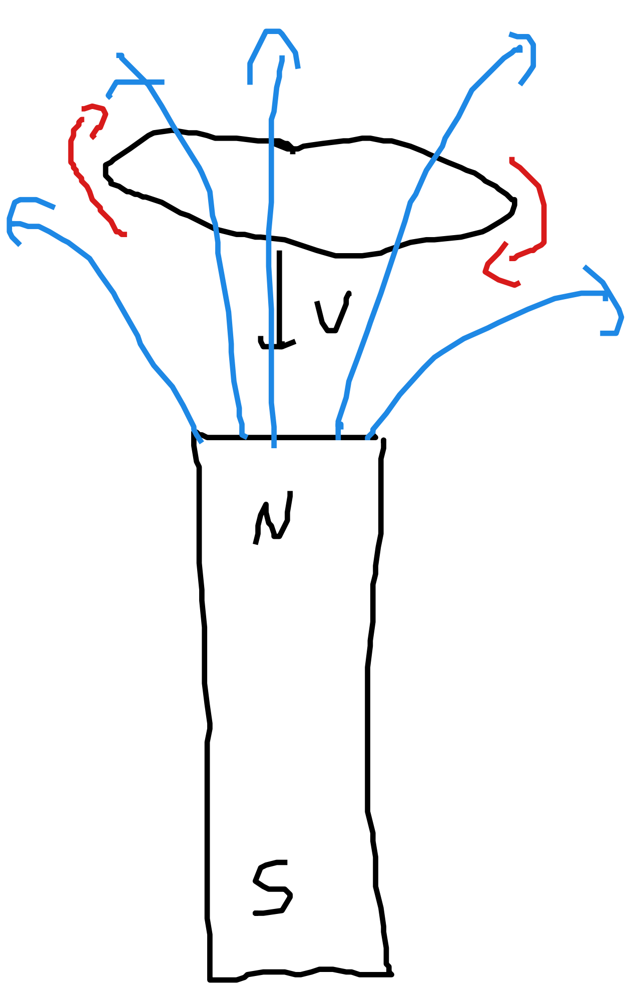
Curent is induced when Φ_B through loop is changing

Principle behind Lenz's Law:
induction prefers the status quo
hates change



Original flux is getting smaller.
Induction HATES this.
It creates an induced current to create an induced flux to replace what was lost.



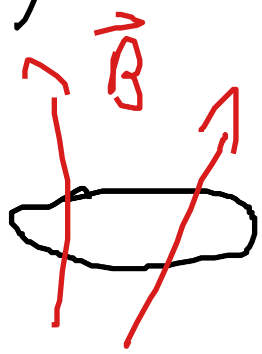


original flux $\Phi \uparrow$
is increasing
Induction HATES
this.

Creates an induced
flux $\downarrow$ via a
clockwise induced
current.

Four Questions of Lenz's Law

1) What is direction of the original ("external") magnetic flux through the loop?
(only one of two choices)

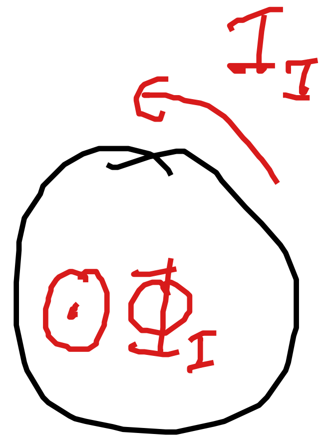


$$\Phi_{orig} = \uparrow$$

2) Is original flux increasing, decreasing, or constant?

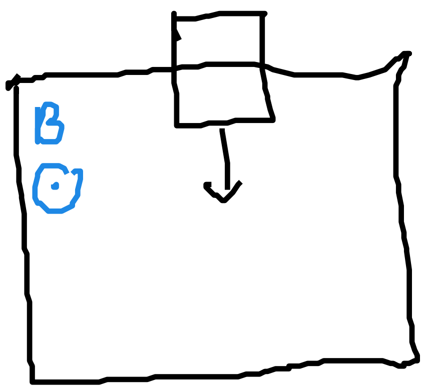
3) Find induced flux.
- if Φ_o is constant, no induction. STOP.
- if Φ_o is increasing, Φ_I is in opposite direction
- if Φ_o is decreasing, Φ_I is in same direction

4) Find induced current from Φ_I



RHR: thumb: Φ_I

fingers: I_I



1) Φ_0 is $\odot$

2) it is increasing/decreasing/constant

3) Φ_I is $\otimes$

4) I_I is