Objectives:
- *Under stand Faraday's Laws of electromagentic induction*
- *Define Magnetic flux and Magnetic flux linkage*
- *Determine the factors that affect the magnitude of an induced EMF*

Electromagnetic Induction

Set up the apparatus as shown

Observe what happens when:
a) the magnet is moved into the solenoid
b) the magnet is withdrawn from the solenoid
c) the speed of the magnet increases
d) the magnet is left stationary inside the solenoid

Nov 22-20:10

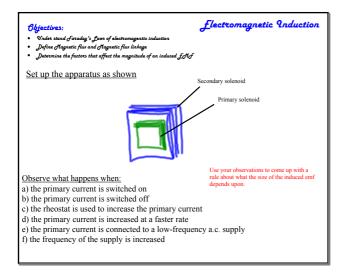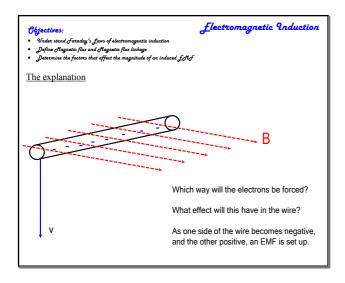*Objectives:*
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Electromagnetic Induction

Set up the apparatus as shown

Secondary solenoid

Primary solenoid

Use your observations to come up with a rule about what the size of the induced emf depends upon.

Observe what happens when:
a) the primary current is switched on
b) the primary current is switched off
c) the rheostat is used to increase the primary current
d) the primary current is increased at a faster rate
e) the primary current is connected to a low-frequency a.c. supply
f) the frequency of the supply is increased

Nov 22-20:10

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Electromagnetic Induction

The explanation

B

v

Which way will the electrons be forced?

What effect will this have in the wire?

As one side of the wire becomes negative, and the other positive, an EMF is set up.

Nov 22-20:10

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Flux is: The magnetic flux (often denoted Φ or Φ_B) through a surface is the surface integral of the normal component of the magnetic field B passing through that surface. The SI unit of magnetic flux is the weber (Wb) Therefore $\Phi = BA\cos\theta$

Weber (unit of magnetic flux) – The weber is the magnetic flux which, linking a circuit of one turn, would produce in it an electromotive force of 1 volt if it were reduced to zero at a uniform rate in 1 second

Flux density is: The magnetic flux density is the Flux per unit area.

           $B = \Phi/A$ (Therefore 1 Tesla is $1Wb/m^2$)

Flux linkage is: The magnetic flux multiplied by the number of turns (assuming all flux passes through all "areas")
           Φ linkage = BAN

Nov 22-20:10

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How much flux links a 200 turn coil of area 0.1 m^2 when it is placed at 90° to a magnetic field of strength 2.5 x 10^{-3} T?

Nov 22-20:23

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Faraday's Law of electromagnetic induction: $\epsilon = -N\dfrac{\Delta\Phi}{\Delta t}$

The induced emf is equal to the rate of change of magnetic flux linkage

An induced electromotive force (emf) always gives rise to a current whose magnetic field opposes the original change in magnetic flux.

Lenz's law is shown with the negative sign in Faraday's law of induction

A single turn of wire of cross-sectional area 5.0 cm^2 is at 90° to a magnetic field of 0.02 T, which is reduced to 0 in 10 s at a steady rate. What is the e.m.f. induced?

Nov 22-20:46

Feb 24-09:50