ELECTROMAGNETIC INDUCTION

Objectives of the Lesson

- After the end of this lesson learners will be able to:-

1. Explain the process of electromagnetic induction.
2. State Faraday's law
3. Explain the working principle of generater.
4. Appreciate the importance of generator in our daily life.

Introduction

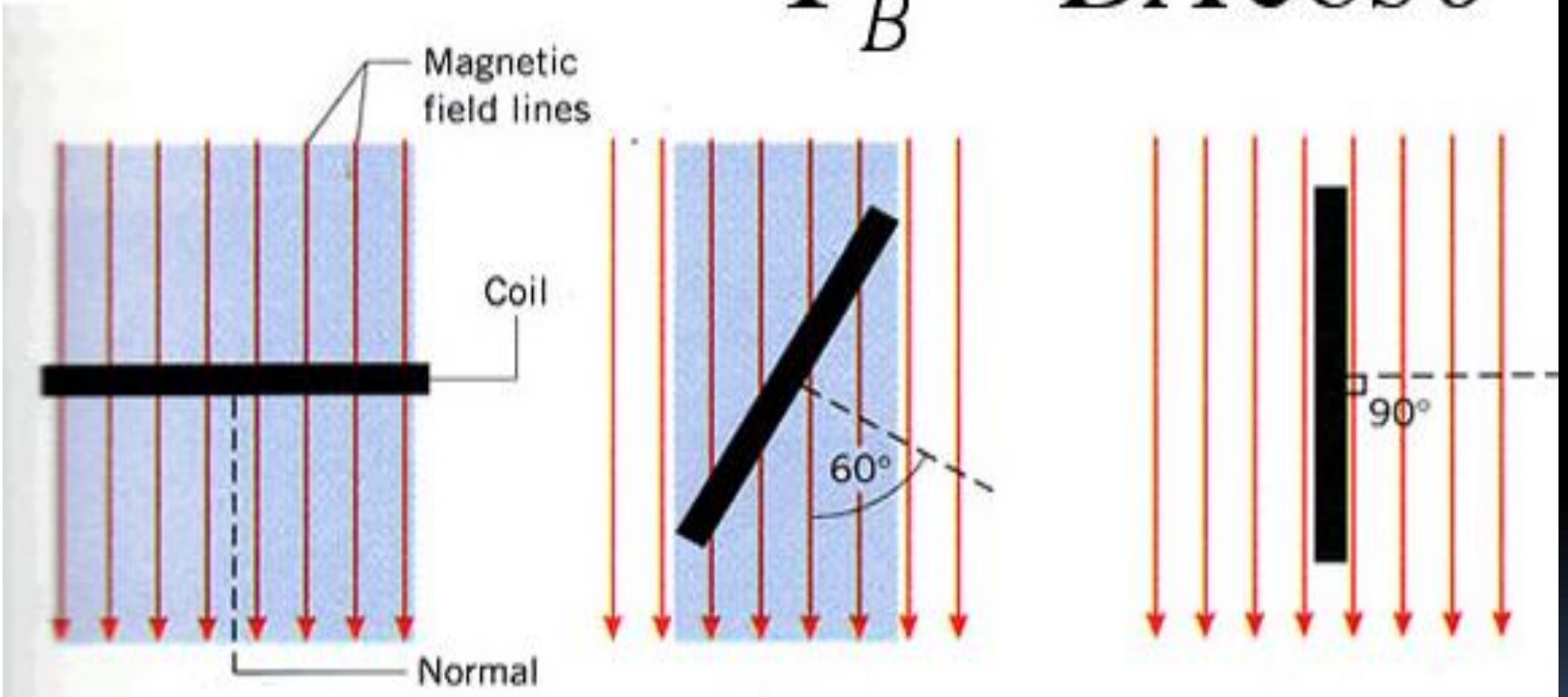
- What is the source of current in your home that used to light up the bulb, used to function TV, refrigerator, tap recorder etc ?
- Keeping this question in your mind, let us first revise magnetic flux.
- What is magnetic flux?

Introduction

- Magnetic flux is the product of the average magnetic field and the perpendicular area that it penetrates.

Magnetic Flux

$$\Phi_B = BA\cos\theta$$



Electromagnetic Induction

- Electro magenetic induction is the process of inducing/ creating/ electromotive force and current as result of change in magnetic flux.

Faraday's Law of EMI

- The induced emf in a circuit is directly proportional to the time rate of change in the magnetic flux through the circuit.
- The mathematical Expression of Faraday's is

$$\varepsilon = -N\frac{\Delta\phi}{\Delta t}$$

$$\varepsilon = -N\frac{\Delta(BA\cos\theta)}{\Delta t}$$

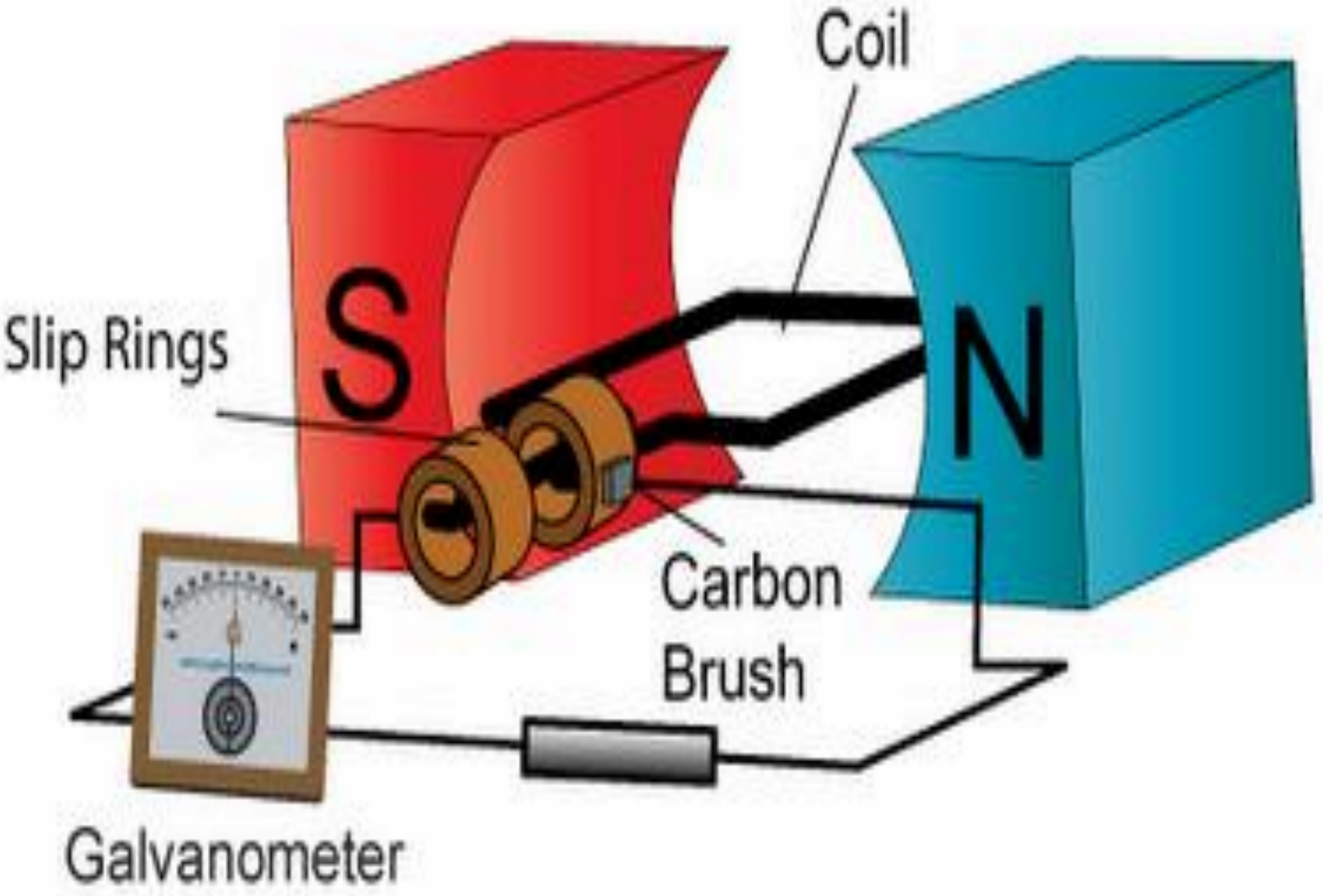
Where, ε is induced electromotive force, N is the number of loops, B is magnetic field that crocess the loops, A is the area of the cross-section of the coil and θ is the angle between the magnetic field and the normal unit vector to the coil.

- Thus indused emf & current depend on

1. the time rate of change inmagnatic field (this is what you have proved.)
2. the time rate of change in area
3. the time rate of change in the angle $\boldsymbol{\theta}$ (applied in generator.)
4. Number of loops.

One of applications Electromagnetic Induction is the work of generator

- Generator is a device that converts mechanical energy in to electrical energy.
- When the armature (coil) of the generater rotates contineously in magnetic field by external force, the angle θ is changed and hence magnatic flux changed contineously with time. Thus, by Faraday's law, Emf is induced and electric current begins to flow.


Coil
Slip Rings
S
N
Carbon
Brush
Galvanometer