What is Electromagnetic Induction?

Worksheet

Electromagnetic induction produces an EMF whenever magnetic flux through a coil changes: = N(/t), known as Faraday's law of induction.

@varepsilon = -@frac{d@Phi}{dt}

Questions

1. What does Faraday's law state?

A) EMF depends only on the number of turns
B) Induced EMF equals the rate of change of magnetic flux times turns
C) Current always flows without a changing field
D) Flux is always constant in a coil

2. What does Lenz's law describe?

A) The size of the magnet
B) The direction of the induced current
C) The material of the coil
D) The color of the field lines

3. A coil with more turns, all else equal, produces

A) Less EMF
B) The same EMF
C) More EMF
D) No EMF

4. Which device works directly on electromagnetic induction?

A) Battery
B) Resistor
C) Generator
D) Capacitor

5. A 100-turn coil experiences a flux change from 0.02 Wb to 0.05 Wb in 0.5 s. Find the induced EMF.

6. A single loop (N = 1) has a flux change of 0.01 Wb in 0.1 s. Find the induced EMF.

7. A 200-turn coil produces an EMF of 12 V over 0.2 s. Find the flux change.

8. Define: What is Faraday's law of induction?

9. Define: What does Lenz's law tell you?

10. Define: What are two real-world uses of electromagnetic induction?

Answer Key

1. B) Induced EMF equals the rate of change of magnetic flux times turns - = N(/t) - Faraday's law of induction.

2. B) The direction of the induced current - Lenz's law gives the direction: induced current opposes the flux change.

3. C) More EMF - EMF is proportional to N, so more turns means more EMF.

4. C) Generator - Generators convert motion into electricity via induction.

5. = 0.05 0.02 = 0.03 Wb = N /t = 100 0.03/0.5 = 6 V

6. = N /t = 1 0.01/0.1 = 0.1 V

7. = N /t = t/N = 12 0.2/200 = 0.012 Wb

8. The induced EMF equals the number of turns times the rate of change of magnetic flux: = N(/t).

9. The induced current always flows in a direction that opposes the change in flux that created it.

10. Electric generators and transformers both rely on changing magnetic flux to induce EMF.