

Electromagnetic Induction & Faraday's Law

Classroom worksheet · Interactive simulation: <https://lkforge.com/tools/physics/electromagnetic-induction/>

Name: _____ Date: _____

Learning objectives

- State Faraday's law relating EMF to changing flux.
- Apply Lenz's law to find the induced current's direction.
- Identify what increases induced EMF.

Variables to change

- Magnet speed
- Number of coil turns
- Magnetic strength

Procedure

1. Move a magnet slowly through the coil and note the induced EMF.
2. Move it faster and compare.
3. Increase the number of coil turns and repeat.
4. Hold the magnet still inside the coil and observe.

Observations

Record induced EMF versus magnet speed and number of turns, and note direction changes.

Questions

1. State Faraday's law.
2. What happens to the EMF when the magnet moves faster?

3. Why is there no EMF when the magnet is held still in the coil?
4. What does Lenz's law say about the induced current's direction?
5. How does adding coil turns change the EMF?

Answer key (instructors)

- **1.** The induced EMF equals the rate of change of magnetic flux: $EMF = -N \cdot d\Phi/dt$.
- **2.** It increases, because flux changes more rapidly.
- **3.** The flux is constant, so $d\Phi/dt = 0$ and no EMF is induced.
- **4.** It flows so as to oppose the change in flux that produced it (the minus sign in Faraday's law).
- **5.** EMF scales with the number of turns N — more turns give a larger EMF.

A changing magnetic flux through a coil induces an EMF (Faraday's law, $EMF = -N \cdot d\Phi/dt$). Faster changes and more turns give larger EMF, and Lenz's law says the induced current opposes the change — the basis of generators and transformers.