News

- Quiz #3 next Mon, 4/11, 10AM
- Exp MF, Pset 8 due Fri, 4/8
- Review in class, Fri, 4/8 10AM
- No evening review
- Tutoring session, Sun, 3-8PM, 24-402

Magnetic Induction

- Currents give rise to B-Field
- Q: Can B-Field give rise to current?
- A: Only if Magnetic Flux changes with time!

Faradays Law

$$\Phi_B = \int_A \vec{B} \cdot d\vec{A}$$

Magnetic Flux
(usually, A not closed surface)

$$\xi_{ind} = -\frac{d\Phi_B}{dt}$$

Faradays Law

$$\Rightarrow I_{ind} = \frac{\xi_{ind}}{R}$$

Faradays Law

- Φ_B can change because
  - |B| changes
  - Angle between $\vec{B}$ and $\vec{A}$ changes
  - |A| (size of circuit in B) changes

Lenz' Rule

$$\xi_{ind} = -\frac{d\Phi_B}{dt}$$

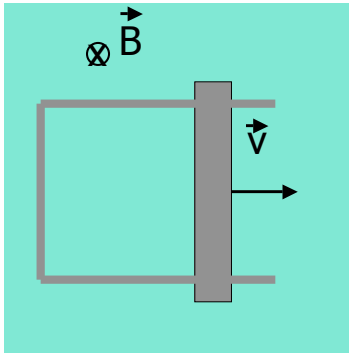
$$\Rightarrow I_{ind} = \frac{\xi_{ind}}{R}$$

Lenz' Rule:

Sign of I_{ind} such that it opposes the flux change that generated it

Use of Faradays Law

- To find direction of I_{ind}:
  - Determine Φ_B
  - Does $|\Phi_B|$ increase or decrease
  - Find sign of I_{ind} using Lenz' rule



Lenz' Rule

Field of I_{ind} DOES NOT necessarily oppose Φ_B

Field of I_{ind} DOES oppose change of Φ_B (= $d\Phi_B/dt$)

Lenz' Rule redux

In most cases:

- **If $|\Phi_B|$ increases:**
  $B(I_{ind})$ opposite direction to B_{ext}
- **If $|\Phi_B|$ decreases:**
  $B(I_{ind})$ same direction as B_{ext}