Induced $\mathcal{E}$

- Units of potential difference
- Not a potential difference between two locations
- Direction determined by Lenz's Law

Induced $\mathcal{E}$

Induced $\mathcal{E}$ in a conducting loop results in current that produces magnetic field.

Direction of induced current is such that induced field opposes direction of change in magnetic flux.

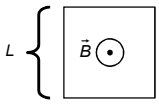
If $\frac{d\Phi_B}{dt} > 0$, then Φ_{Induced} is in the opposite direction from Φ_B

If $\frac{d\Phi_B}{dt} < 0$, then Φ_{Induced} is in the same direction as Φ_B

Example: A square loop of wire has area vector, $\vec{A} = L^2\hat{k}$, in a region with a magnetic field, $\vec{B} = B_0 \cos(\omega t)\hat{k}$.

- Changing magnitude of field

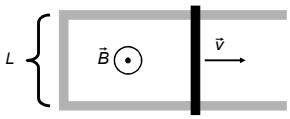
Lenz's Law



Example: A conducting bar is slid along a U-shaped conductor such that the formed loop has an area vector parallel to a uniform magnetic field in the region.

- Changing size of loop relative to field

Lenz's Law



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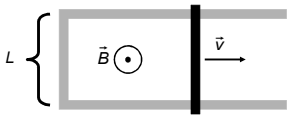
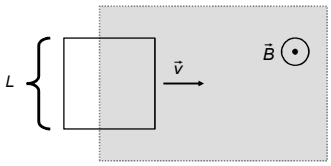


With what force is the bar being pulled?

Example: A square conducting loop is moved into a region of uniform magnetic field such that the loop's area vector is parallel to the magnetic field.

- Changing size of loop relative to field

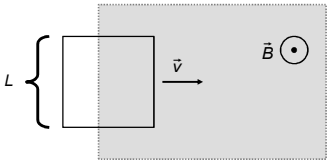
Lenz's Law



Example: A square conducting loop is moved into a region of uniform magnetic field such that the loop's area vector is parallel to the magnetic field.

- Changing size of loop relative to field

Lenz's Law

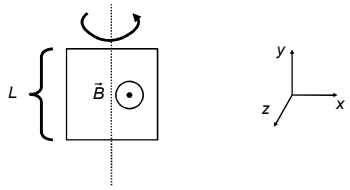


What would be the magnetic force on the loop?

Example: A square conducting loop is rotated in a region with a uniform magnetic field.

- Changing loop direction relative to field

Lenz's Law



$$\vec{A} = L^2[\sin(\omega t)\hat{i} + \cos(\omega t)\hat{k}]$$