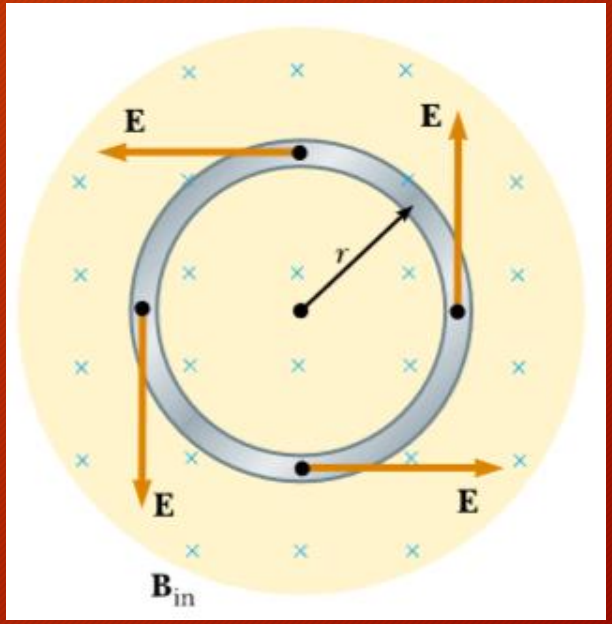
22-Induced EMF and Electric Field

Induced EMF and Electric Field

- An electric field is created in the conductor as a result of the changing magnetic flux.
- This induced Electric Field has two important properties that distinguish it from the electrostatic field. The induced field is neoconservative and can vary in time.



Induced EMF and Electric Field

- The induced EMF is given by: $\mathcal{E} = -d\Phi_B/\Delta t$
- The current in the loop implies the presence of induced **E.**
- The work done in moving charge q once around the loop is $q\mathcal{E}$.
- Electric Force = qE, and work done by this force is qE(2πr).
- Two expressions for work must be equal
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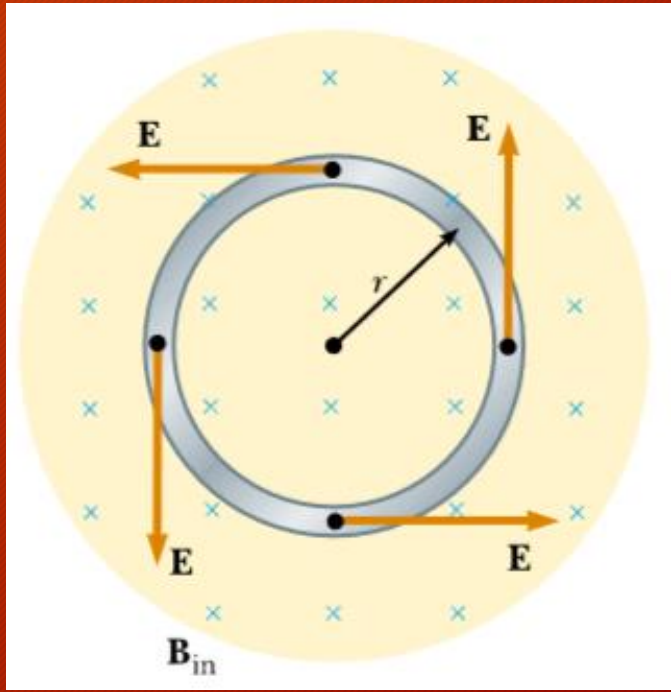
$$q\mathcal{E} = qE(2\pi r)$$

$$E = \frac{\mathcal{E}}{2\pi r}$$



Induced EMF and Electric Field

$$q\mathcal{E} = qE(2\pi r)$$

$$E = \frac{\mathcal{E}}{2\pi r}$$

$$E = -\frac{1}{2\pi r}\frac{d\Phi_B}{dt} = -\frac{r}{2}\frac{dB}{dt}$$

- Faraday's Law in general form

$$\oint \mathbf{E} \cdot d\mathbf{s} = -\frac{d\Phi_B}{dt}$$