

CONCEPT: MOTIONAL EMF

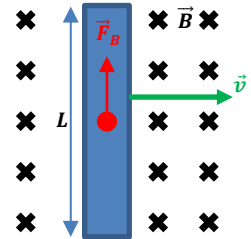
- Remember! A changing magnetic flux produces an INDUCED EMF.

- When this happens through _____, this is called MOTIONAL EMF.

1) Conducting rod moves through a B-Field with $\vec{v}$, charges feel a _____

2) (+) charges feel force [**UPWARD** | **DOWNWARD**] $\rightarrow$ Charges separate

3) Charges produces **E-Field** to eventually balance **B-Field** $\rightarrow \vec{F}_E \text{ ___ } \vec{F}_B$



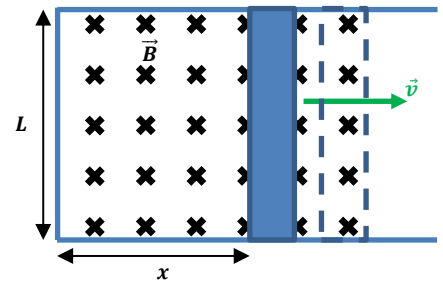
- Induced EMF $\mathcal{E} = \underline{\hspace{2cm}}$

- If we attach this moving conducting rod to a U-shaped wire, we can use Faraday's Law on the circuit it makes!

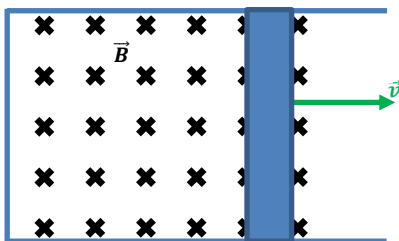
- As the rod slides, the [**B-Field** | **Area** | **Angle**] changes

$$\frac{\Delta \Phi_B}{\Delta t} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

- Induced EMF $\mathcal{E} = \underline{\hspace{2cm}}$

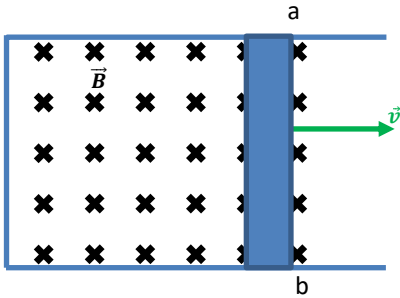


EXAMPLE: In the circuit below, if the wire has a resistance of $10 \text{ m}\Omega$, **a)** what is the current induced if the length of the bar is 10 cm , the speed of the bar is 25 cm/s , and the magnetic field is 0.2 T ? **b)** What about the power generated by the circuit?



PRACTICE: BAR MOVING IN UNKNOWN MAGNETIC FIELD

A thin rod moves perpendicular to a uniform magnetic field. If the length of the rod is 10 cm and the induced EMF is 1 V when it moves at 5 m/s, what is the magnitude of the magnetic field?



EXAMPLE: FORCES ON LOOPS EXITING MAGNETIC FIELD

A rectangular loop with length $L = 20 \text{ cm}$ and resistance $R = 0.40 \Omega$ is pulled out of a magnetic field $B = 0.5 \text{ T}$ at a constant velocity of 12 m/s . **a)** What is the magnitude and direction of the induced current in the loop at the instant when the loop is halfway out of the field? **b)** What is the magnitude of the external force needed to keep this loop exiting at constant velocity?

