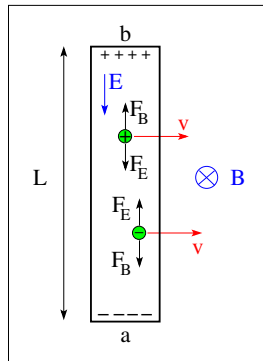Conducting rod moving across region of uniform magnetic field

- moving charge carriers
- magnetic force $\vec{F}_B = q\vec{v} \times \vec{B}$
- charge separation
- electric field $\vec{E}$
- electric force $\vec{F}_E = q\vec{E}$

Equilibrium between electric and magnetic force:

$$F_E = F_B \quad \Rightarrow \quad qE = qvB \quad \Rightarrow \quad E = vB$$

Potential difference induced between endpoints of rod:

$$V_{ab} \equiv V_b - V_a = EL \quad \Rightarrow \quad V_{ab} = vBL \quad \text{(motional EMF)}$$