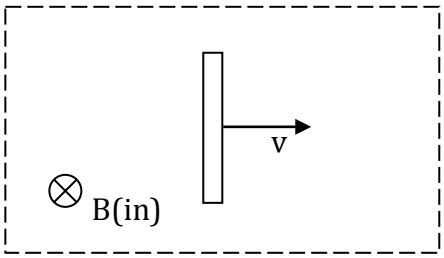
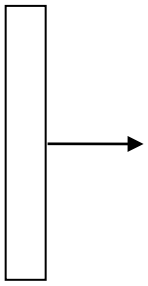
Motional EMF

A neutral metal bar is being pulled at constant velocity, speed v, to the right through a uniform magnetic field of magnitude B, as shown. The bar has been moving for some long time, and has achieved a dynamic steady-state.



(A) What is the magnetic force on charges in the bar (direction and magnitude)?

(B) In the diagram at right, sketch the distribution of charges in the bar.



(C) What is the electric field in the bar (direction and magnitude)? *Hint: remember that the bar has reached a dynamic steady-state.*

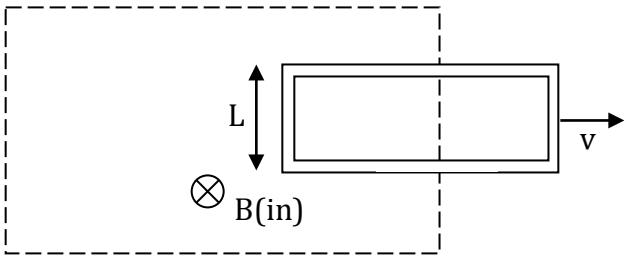
Motional EMF

Now consider a rectangular metal loop of height L, moving to the right with speed v, which is exiting a region with a constant magnetic field, magnitude B.

(D) The emf around any loop is defined as

$$emf = \oint \frac{\vec{F}_{onq}}{q} \cdot d\vec{l} \ .$$

What is the emf around the metal loop?



(E) What is the magnetic flux Φ through the metal loop? (Define any new symbols used.)

(F) Compute the time derivative of the flux through the loop dΦ/dt and compare with your computed emf. There is a +/- sign that you should worry about.