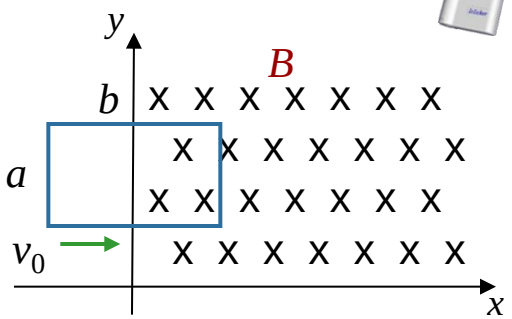
Calculation

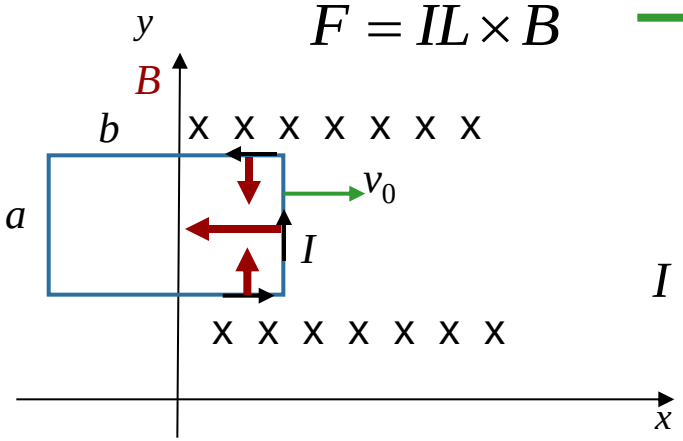
A rectangular loop (height = a, length = b, resistance = R, mass = m) coasts with a constant velocity v_0 in $+x$ direction as shown. At $t = 0$, the loop enters a region of constant magnetic field B directed in the $-z$ direction.



What is the magnitude of the net force on the loop just after it enters the field?

$$\vec{F} = I\vec{L} \times \vec{B} \qquad \varepsilon = Bav_0 \qquad emf = -\frac{d\Phi_B}{dt}$$

A) $F = 4aBv_oR$ B) $F = a^2Bv_oR$ C) $F = a^2B^2v_o^2/R$ D) $F = a^2B^2v_o/R$



$$\vec{F} = I\vec{L} \times \vec{B} \rightarrow F = ILB \quad \text{since} \quad \vec{L} \perp \vec{B}$$

$$I = \frac{\varepsilon}{R} = \frac{Bav_o}{R} \rightarrow F = \left(\frac{Bav_o}{R}\right)aB = \frac{B^2a^2v_o}{R}$$

ILB