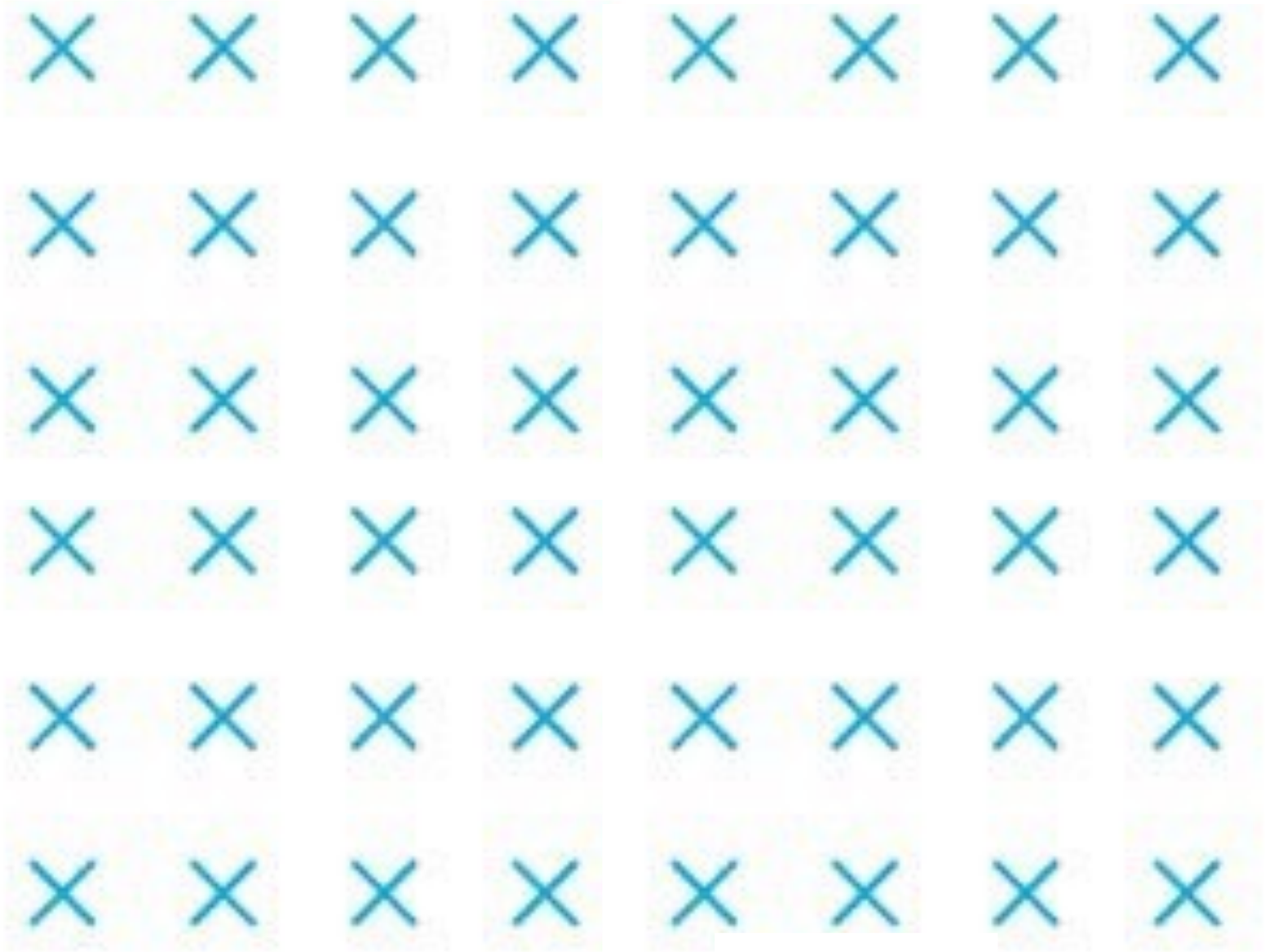
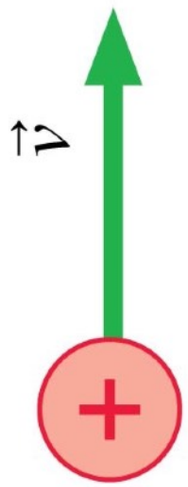
PH 220

Lance Nelson

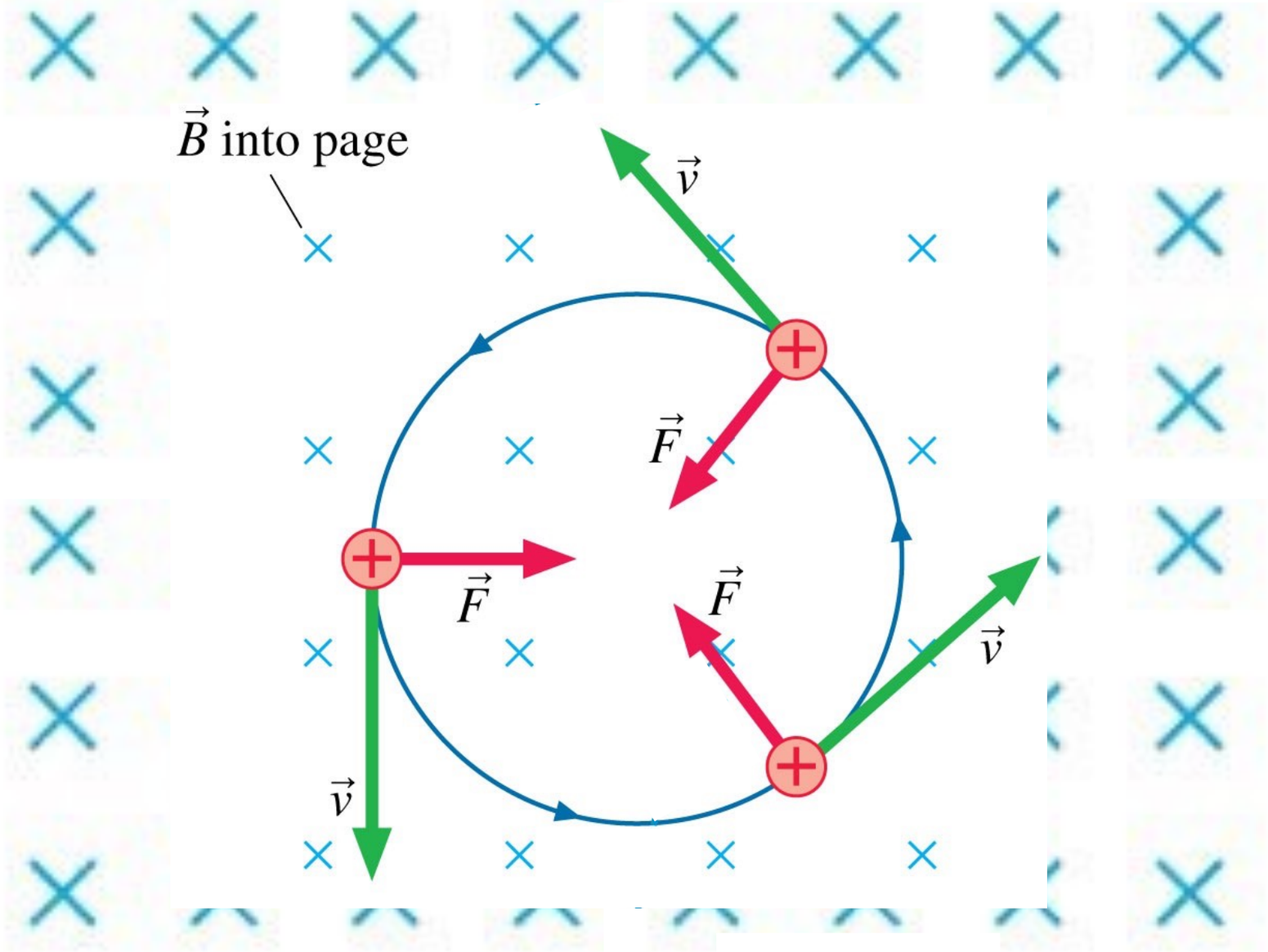
Cyclotron



What will the motion of the particle be after entering the field?



Cyclotron



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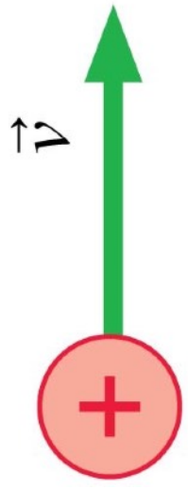
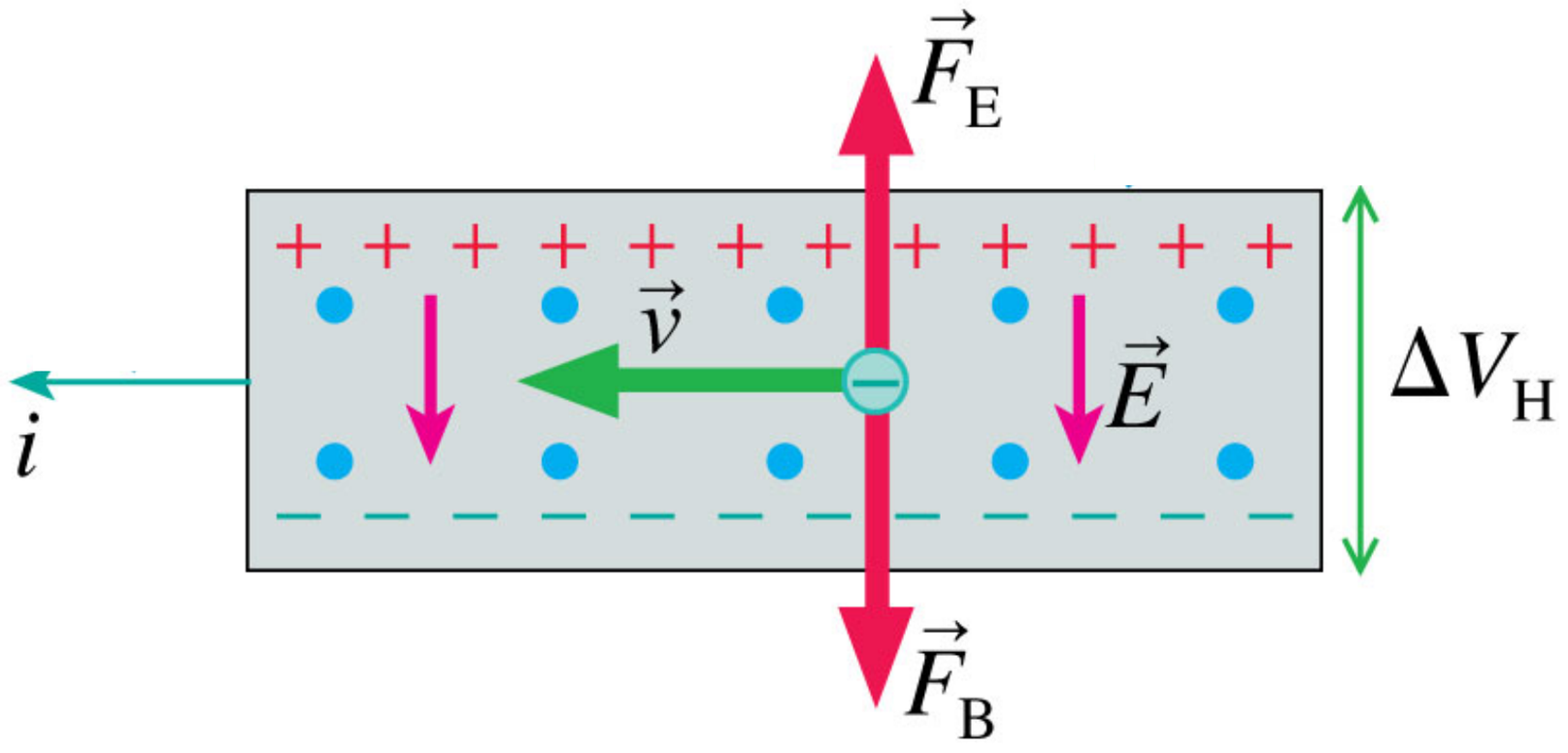


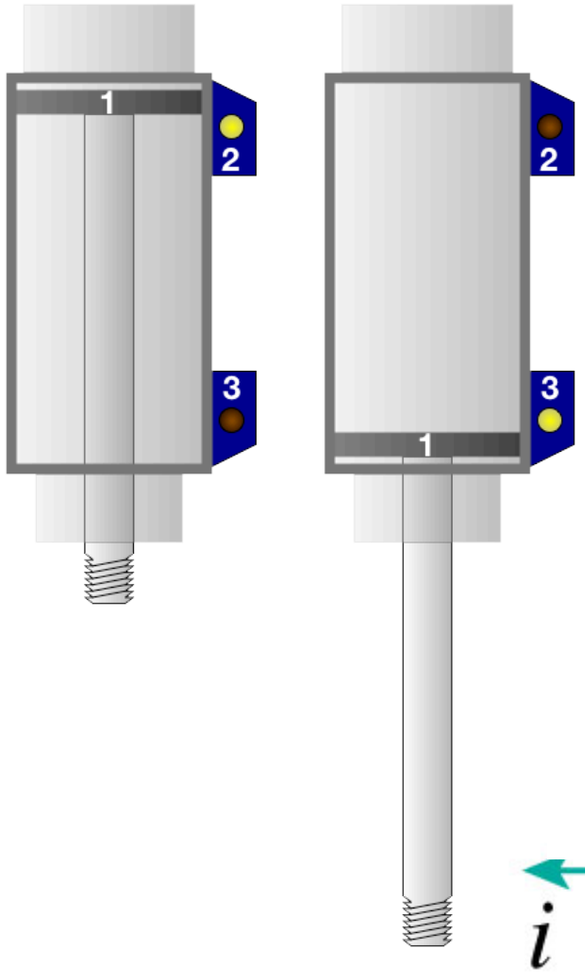
The Hall Effect

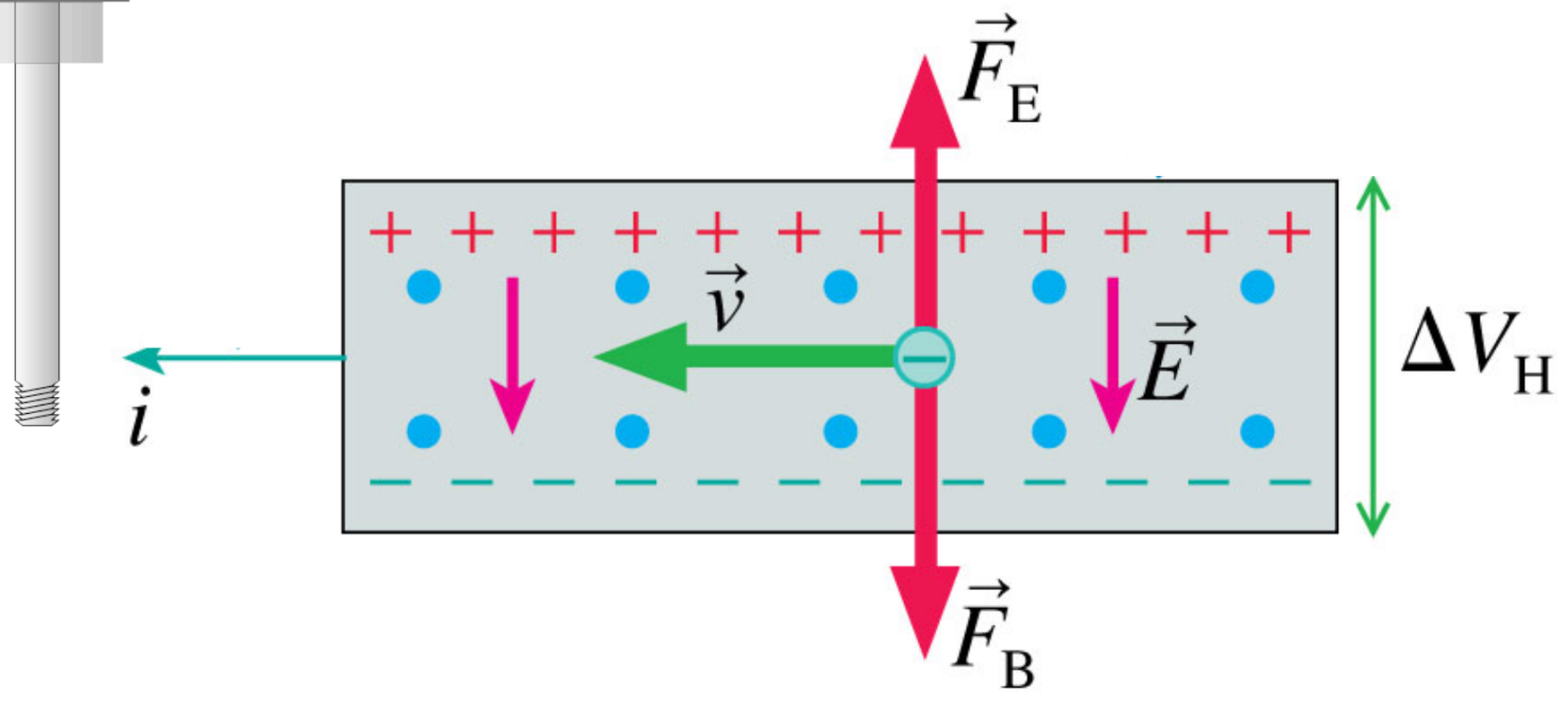


video demo

$$\Delta V_H = \frac{IB}{tne}$$

The Hall Effect

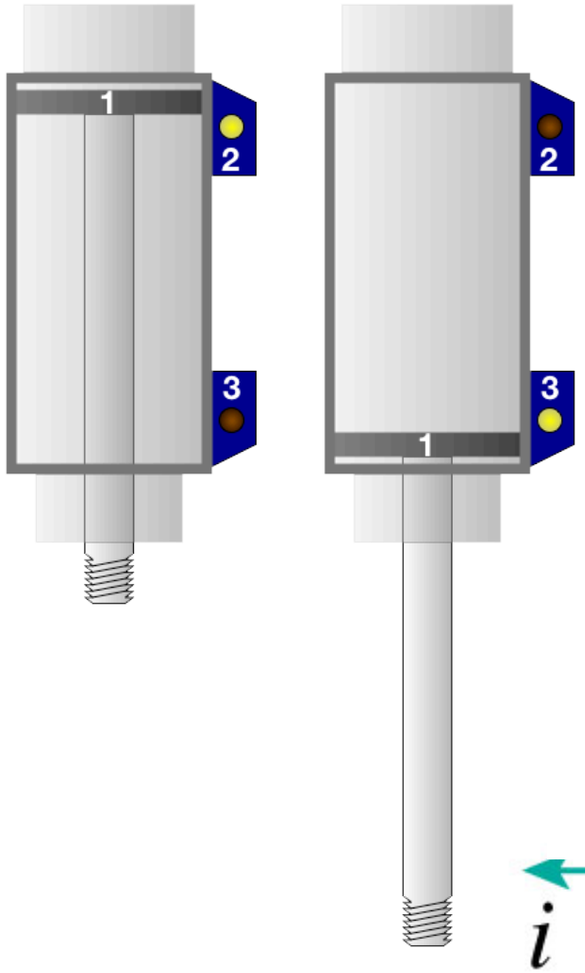


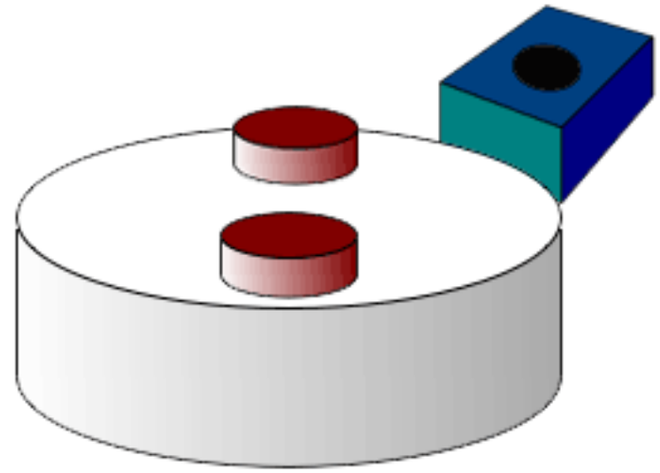


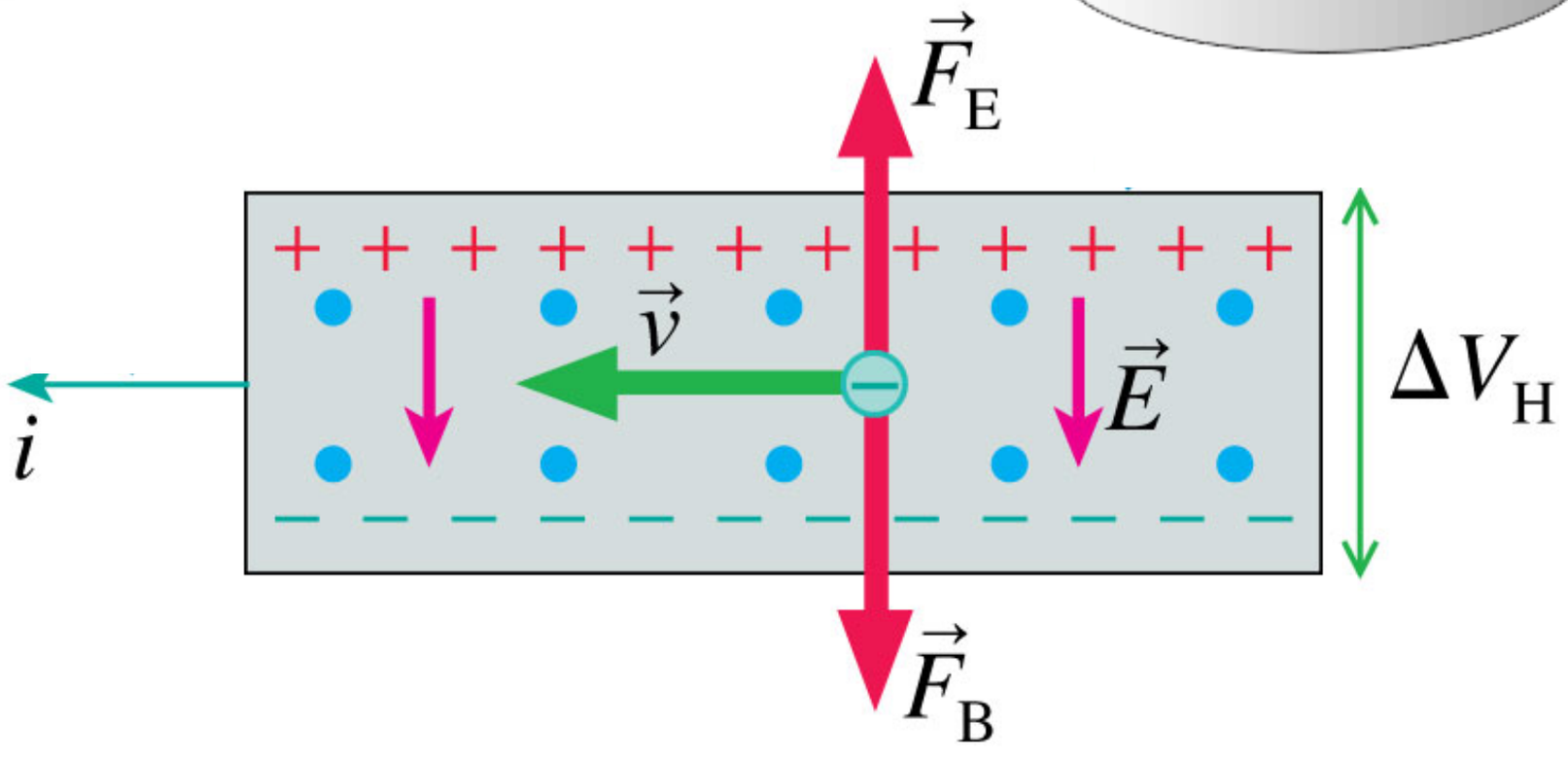
video demo

$$\Delta V_{\mathrm{H}} = \frac{IB}{tne}$$

The Hall Effect







video demo

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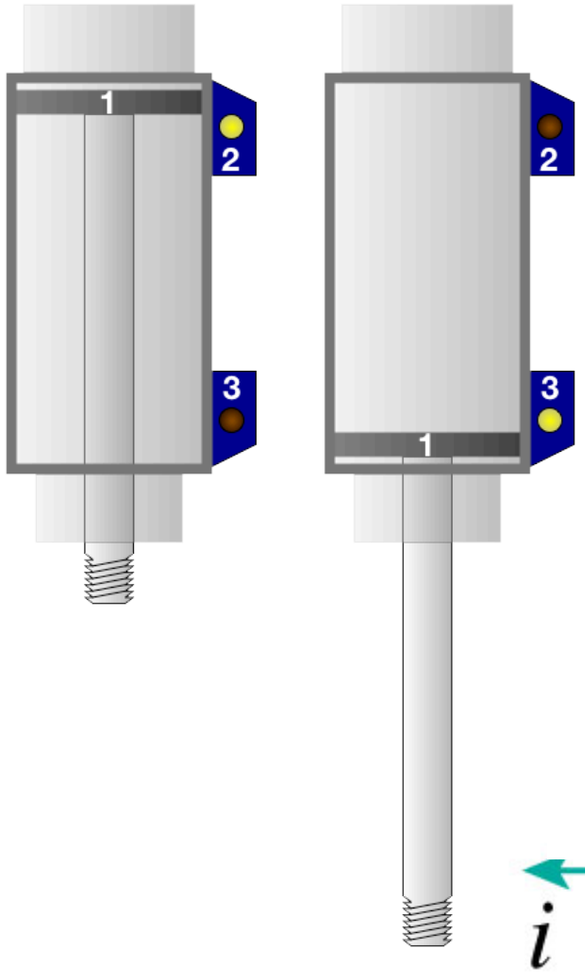
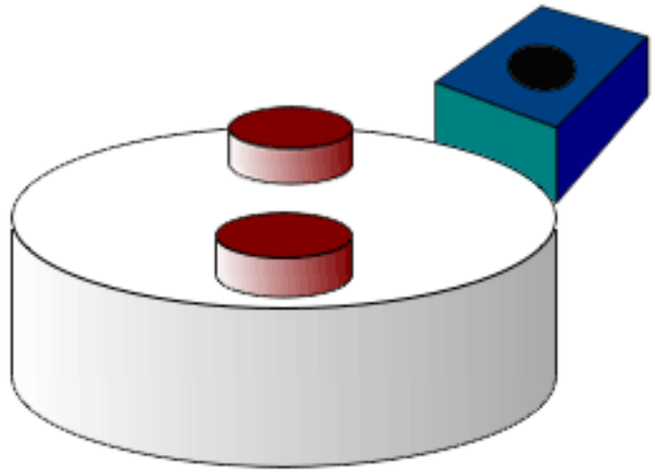
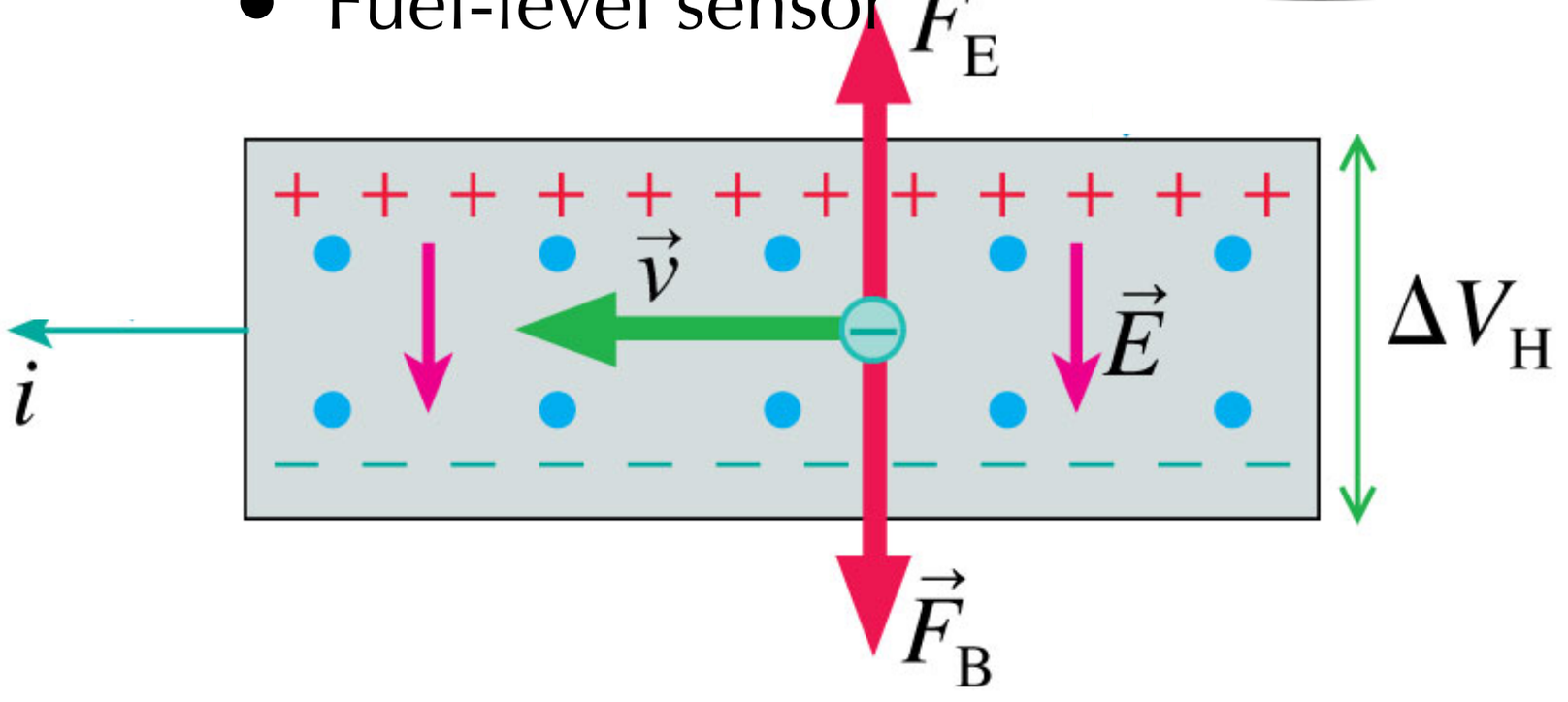
The Hall Effect



- Proximity Sensing
- Positioning
- Speed Detection
- Current Sensing
- Fuel-level sensor

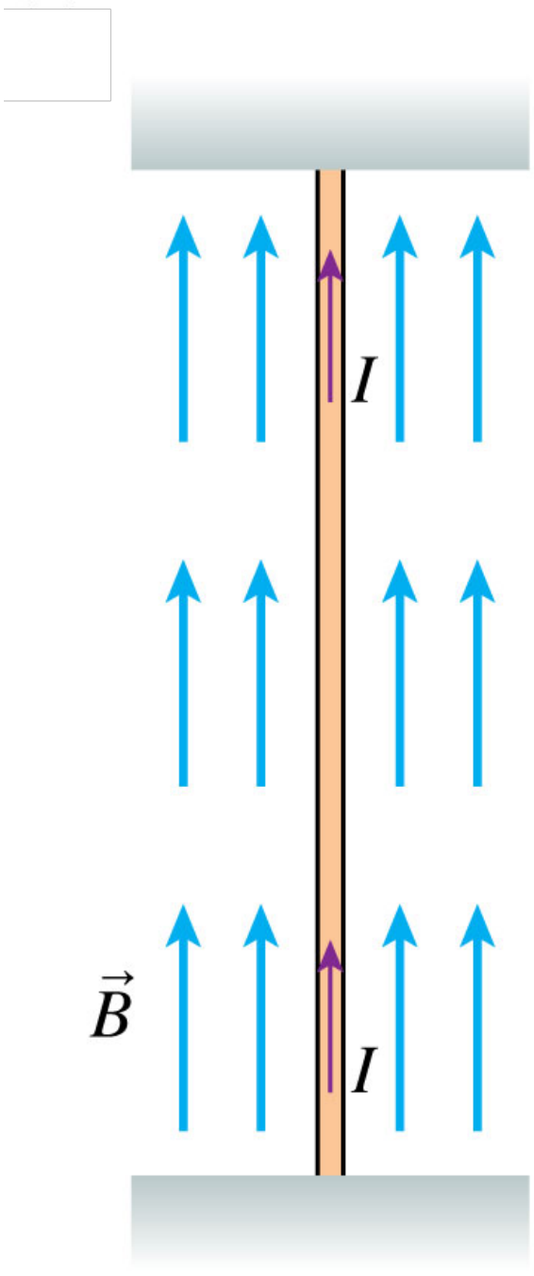




video demo

$$\Delta V_H = \frac{IB}{tne}$$

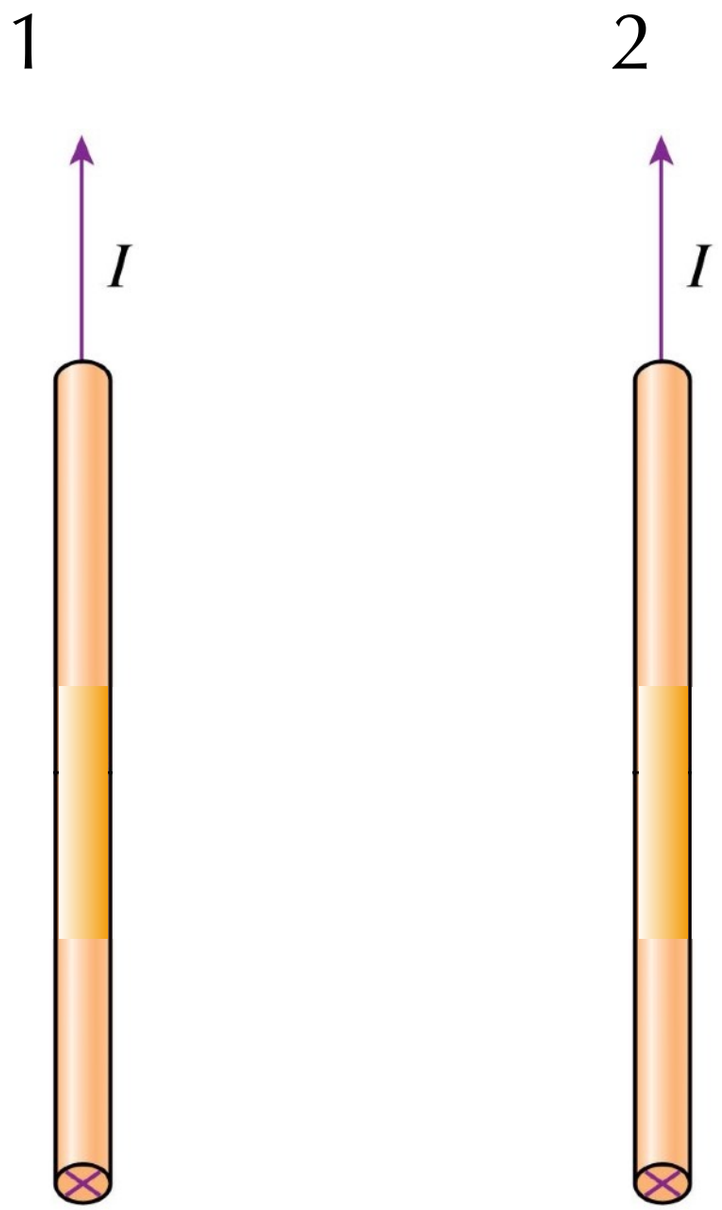
Magnetic force on current



Demo!

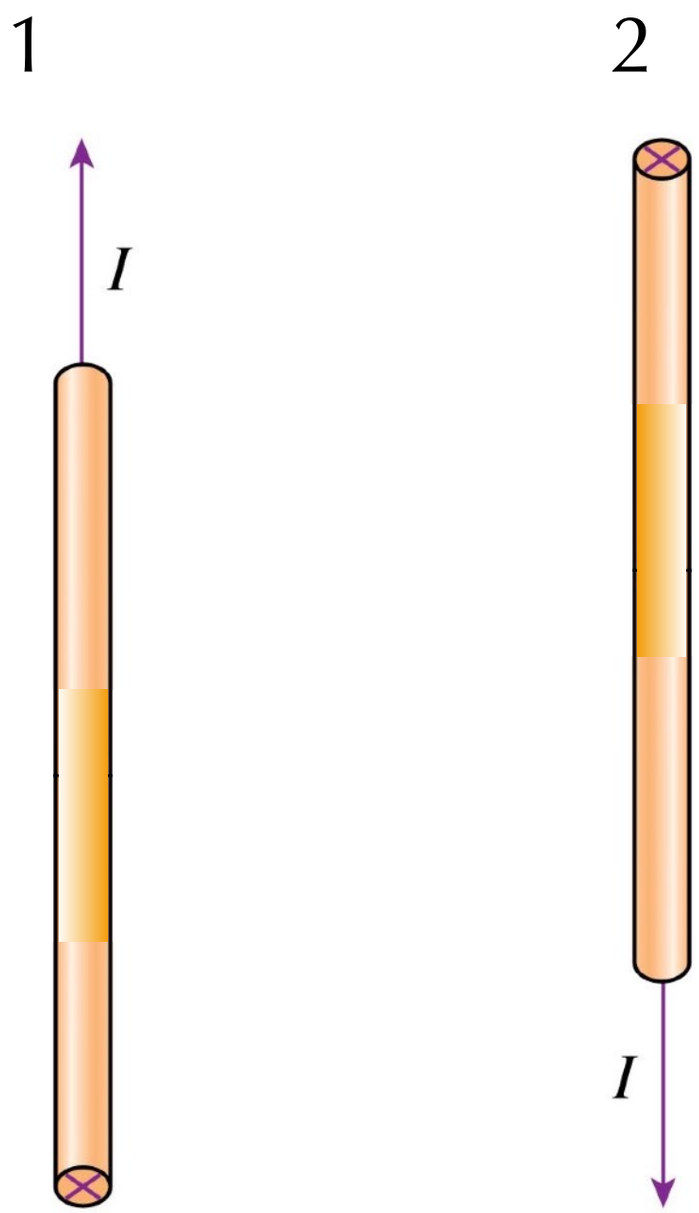
$$\vec{F} = I\vec{l} \times \vec{B}$$

Force on two current-carrying wires



What is the direction of the force exerted by wire 1 onto wire 2?

Force on two current-carrying wires



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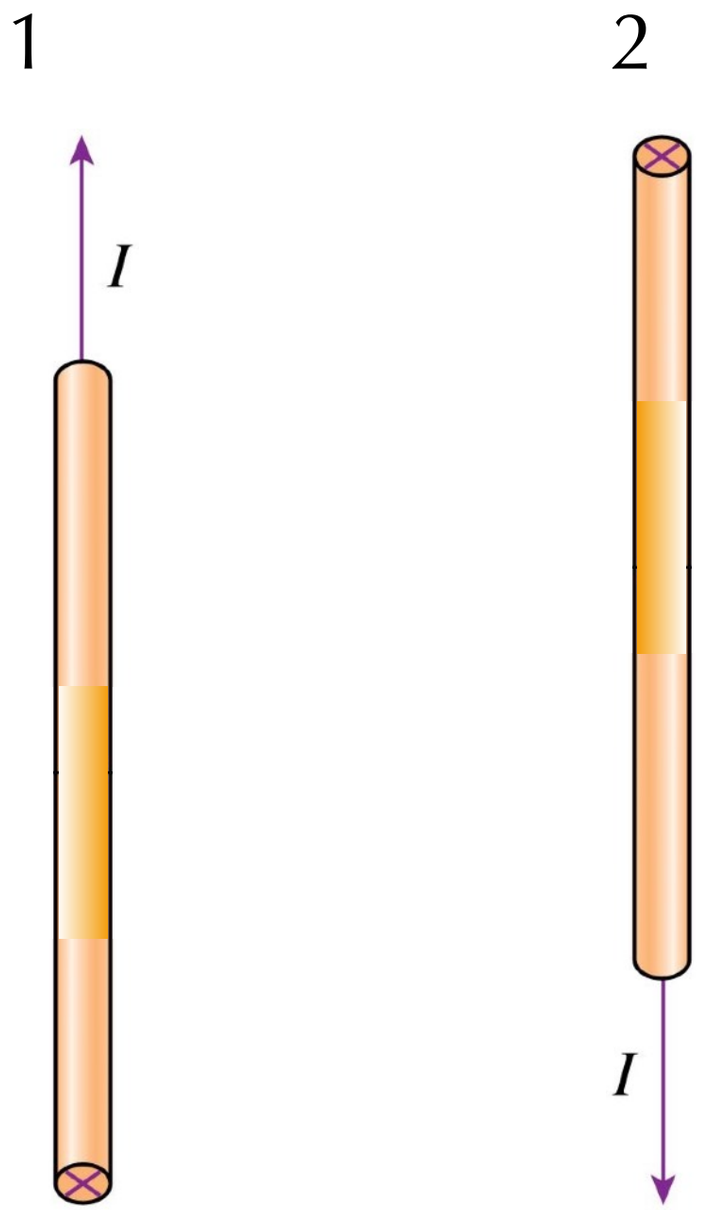
What about now?

Force on two current-carrying wires

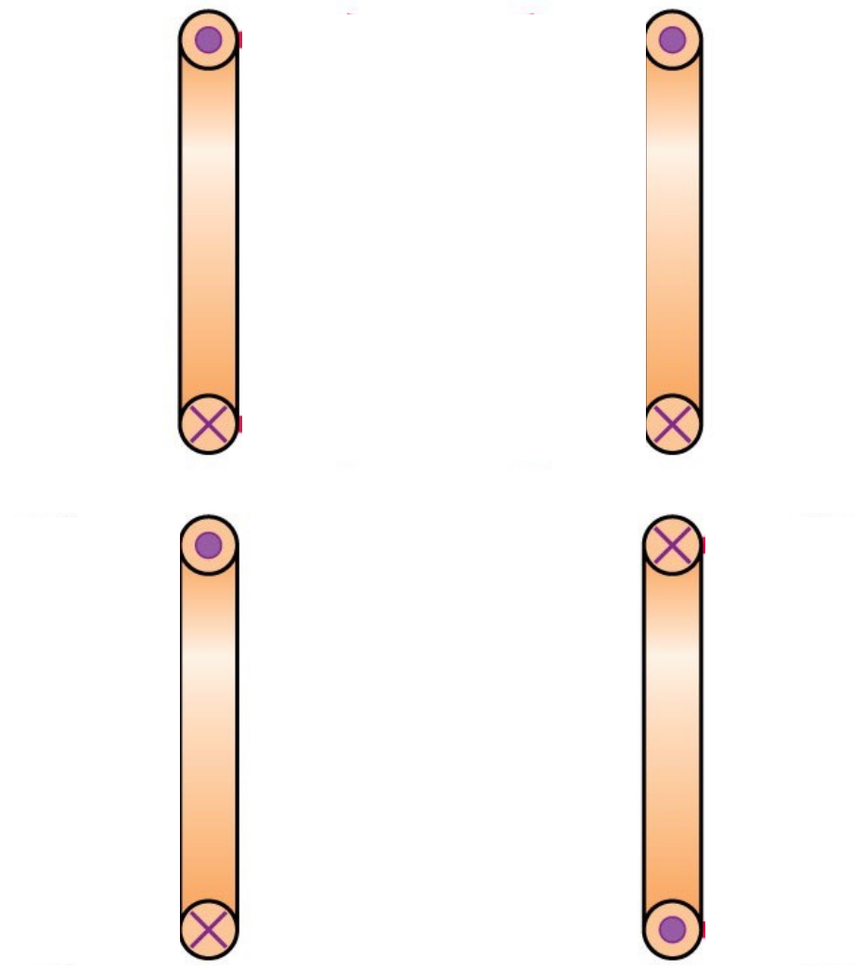


What is the direction of the force exerted by wire 1 onto wire 2?

What about now?

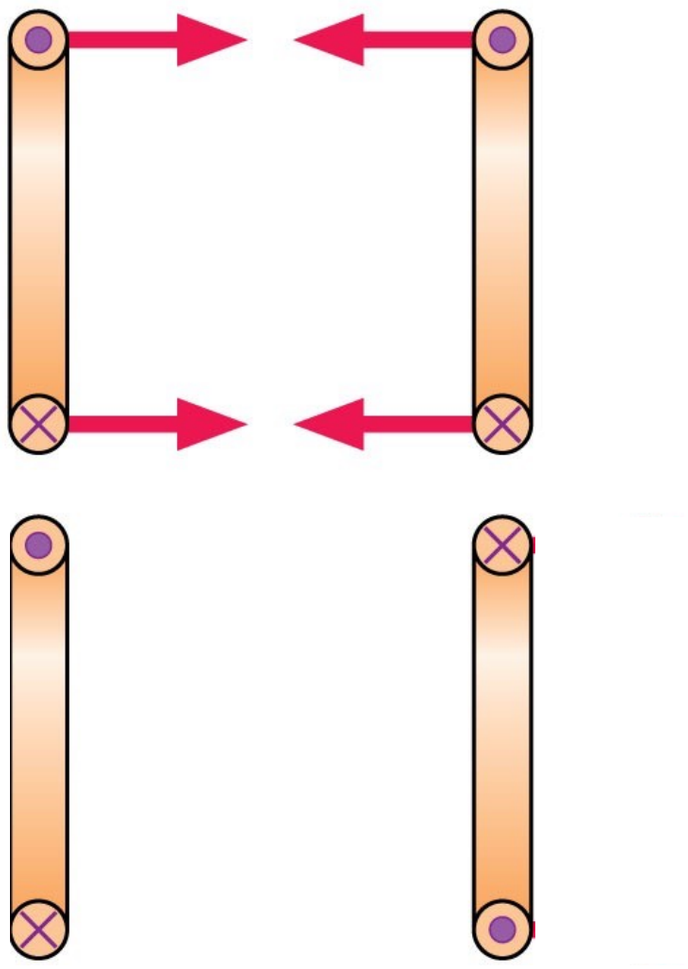
$$F = I_1 l B_2 = I_1 l \frac{\mu_0 I_2}{2\pi d}$$

Force on current loops



What are the forces on these current loops?

Force on current loops



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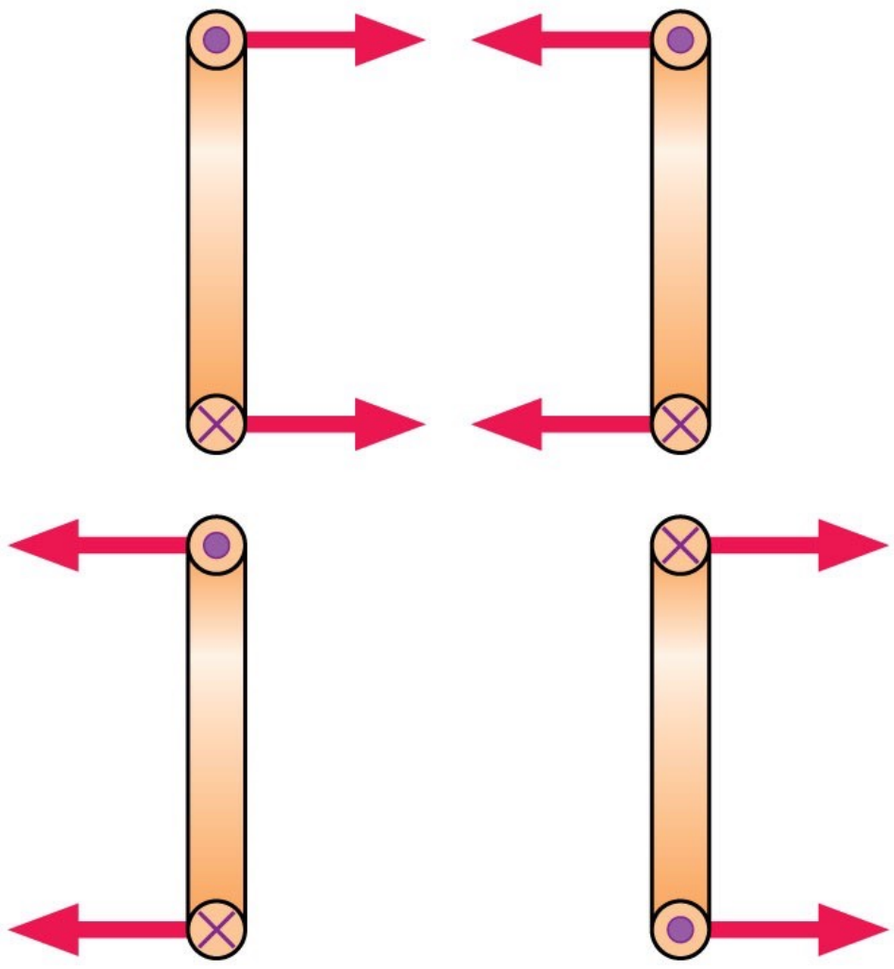
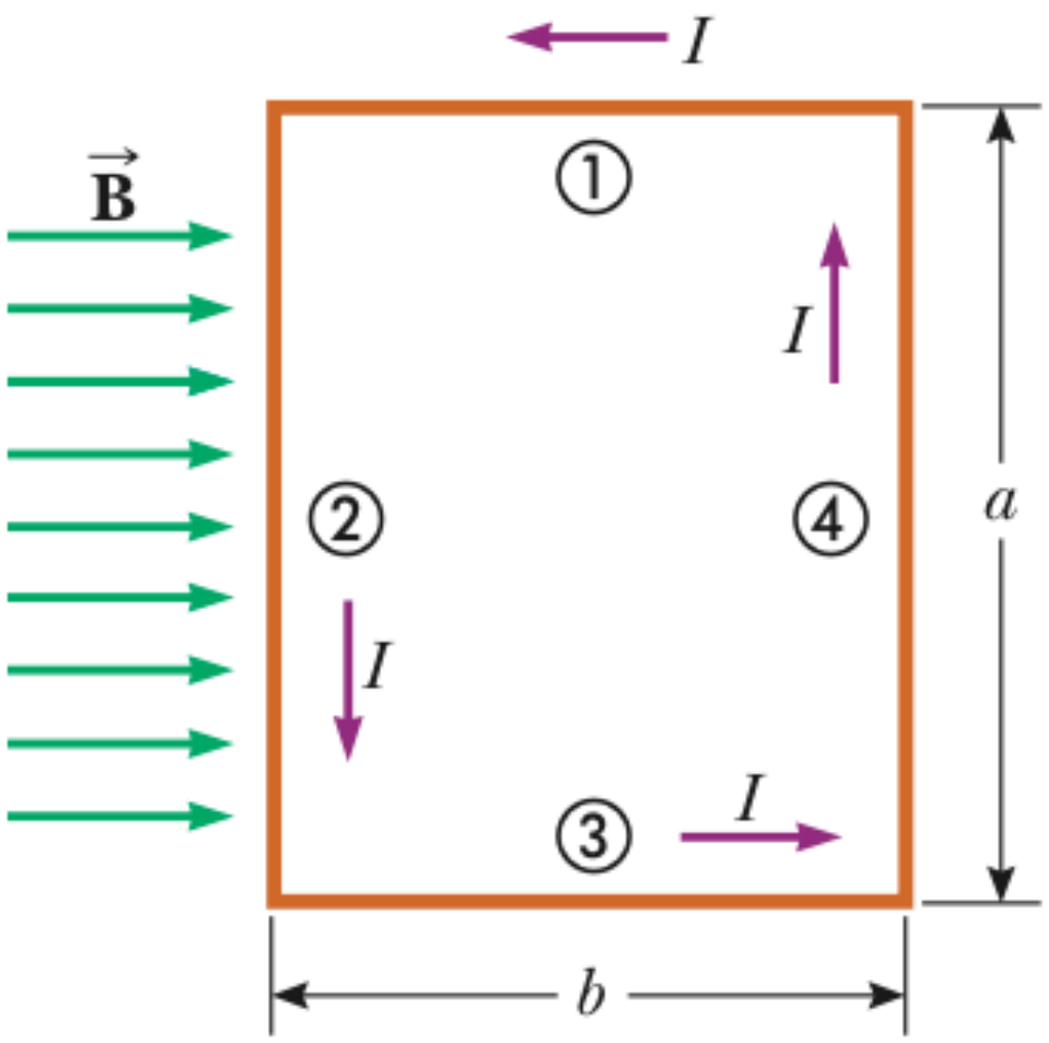


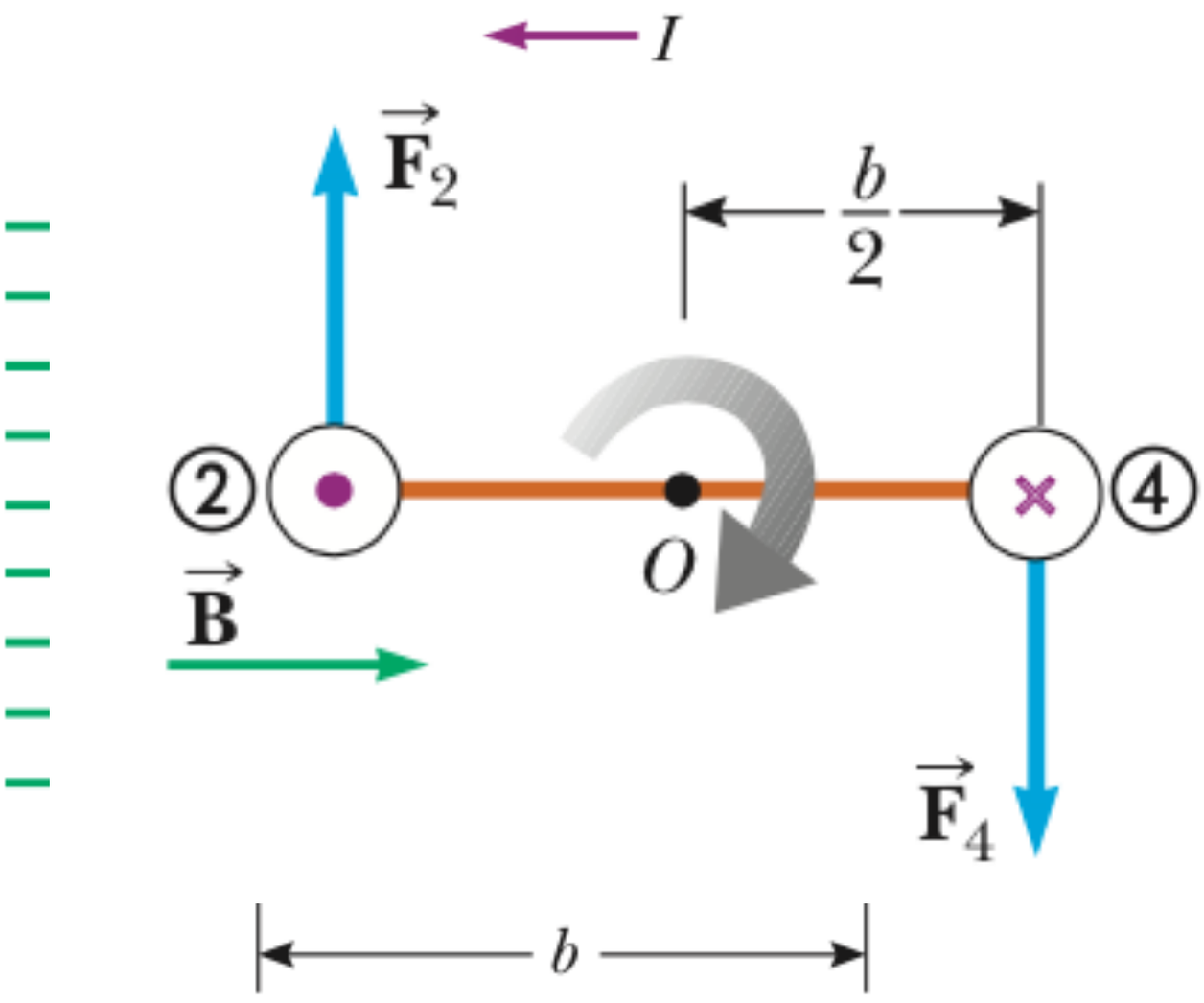
What are the forces on these current loops?

Torque on current loop



What are the forces on each wire segment?

Torque on current loop



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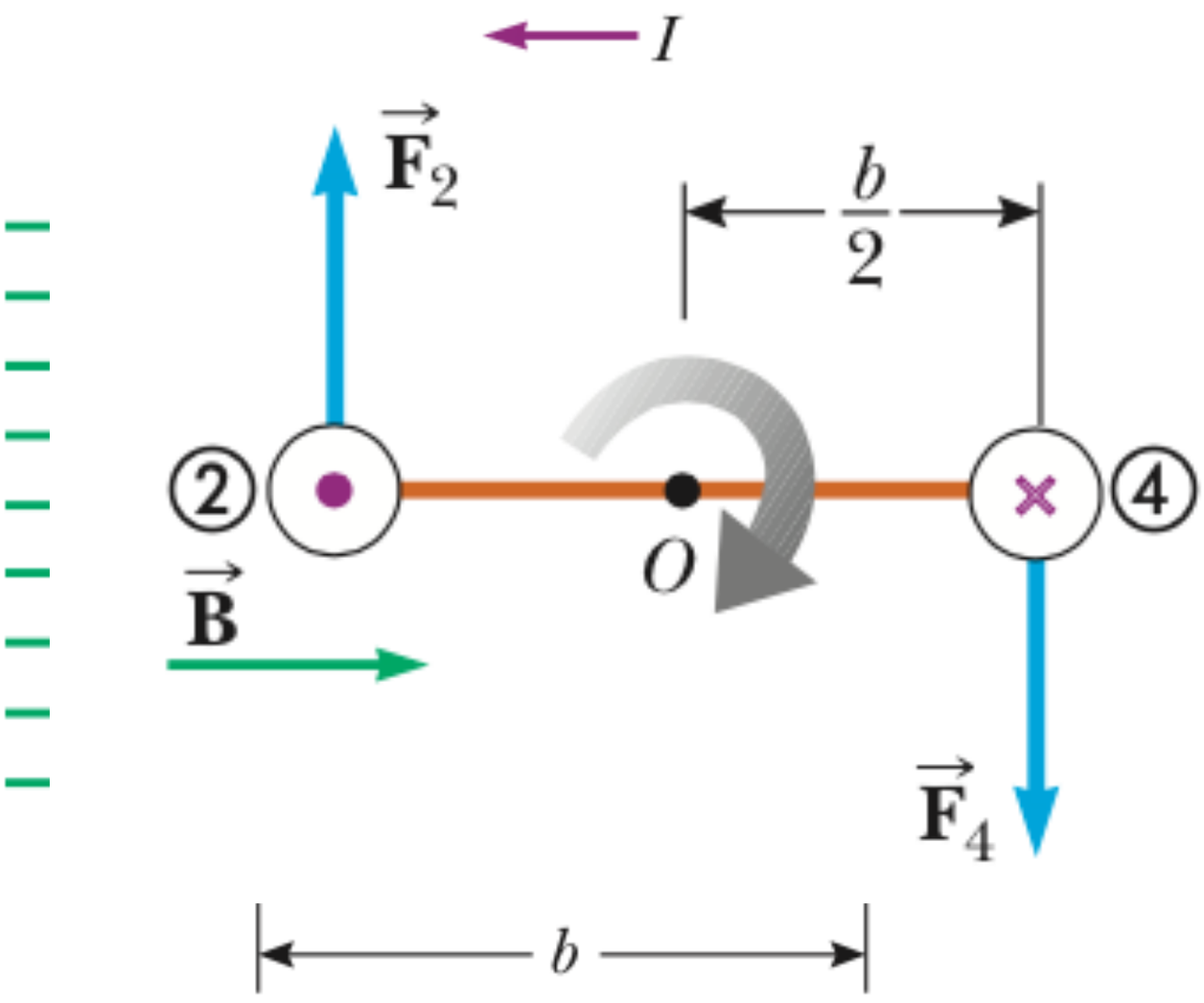

What are the forces on each wire segment?

$$\vec{\tau} = \vec{\mu} \times \vec{B}$$

Question #10

If released from rest, the current loop will

A. Move upward.
B. Rotate counterclockwise.
C. Rotate clockwise.
D. Move downward.
E. Do something not listed here.

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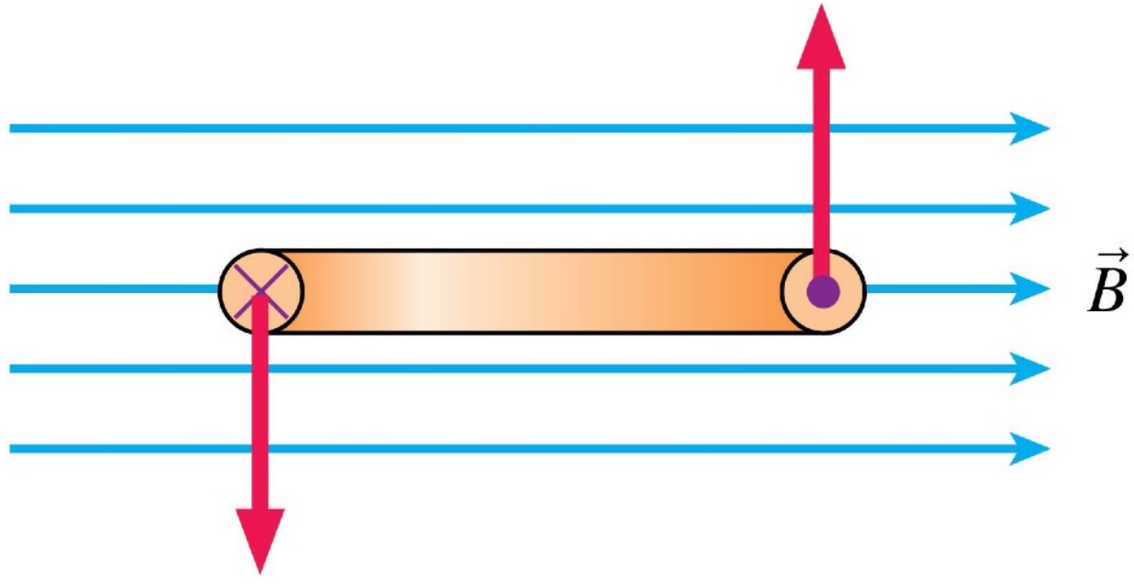
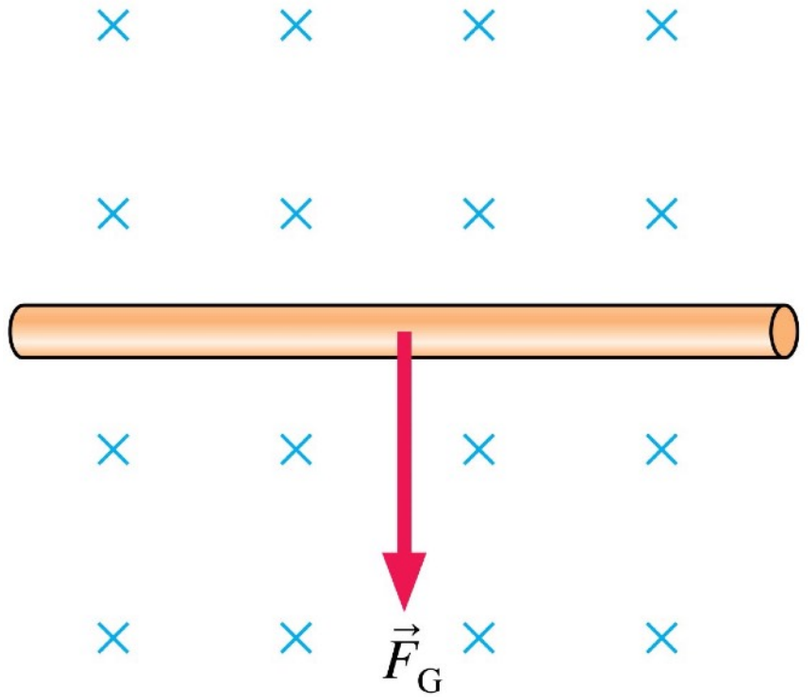


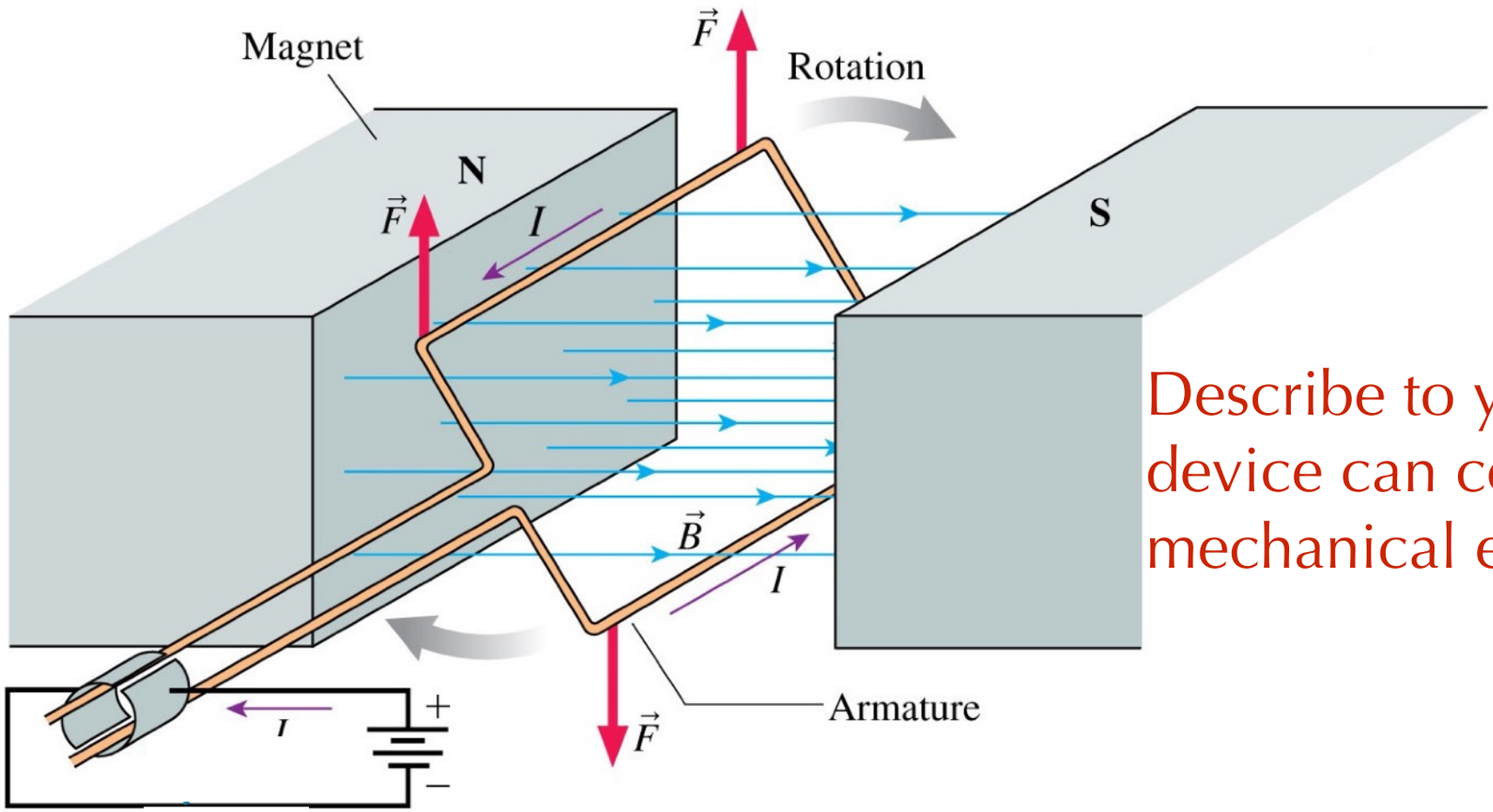
Question #11

The horizontal wire can be levitated – held up against the force of gravity – if the current in the wire is

A. Left to right.
B. Right to left.
C. It can't be done with this magnetic field.



A simple electric motor

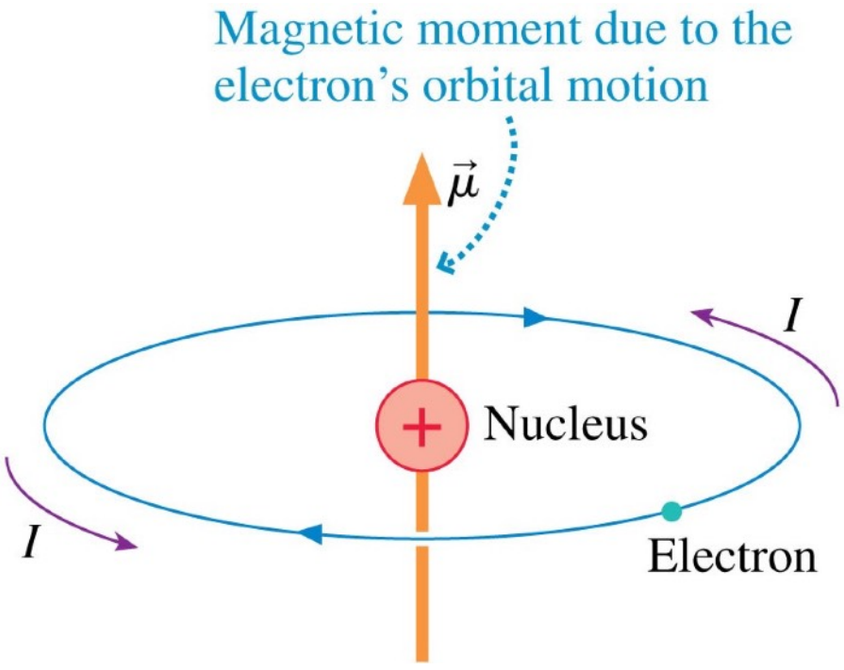


Describe to your neighbor how this device can convert electrical energy into mechanical energy.

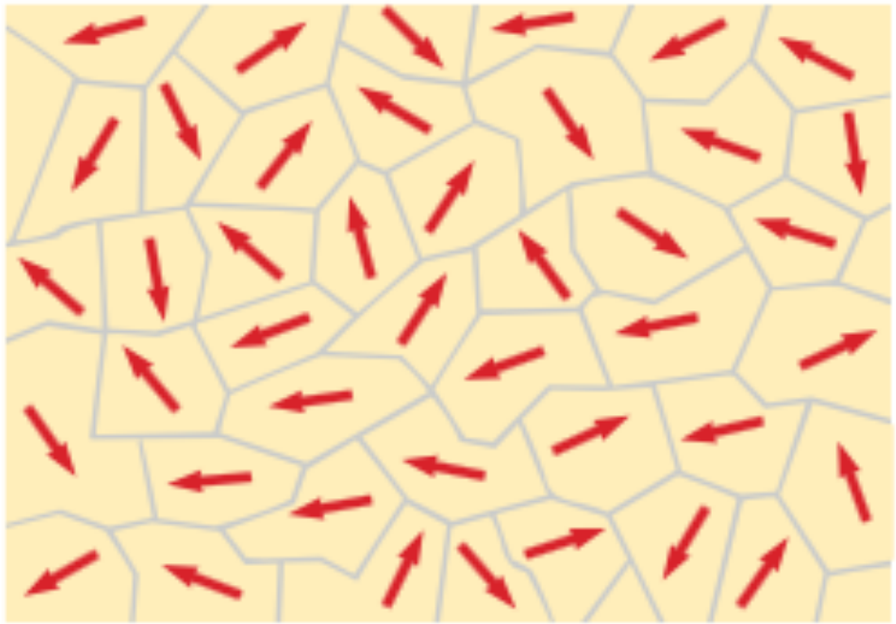
motor animation

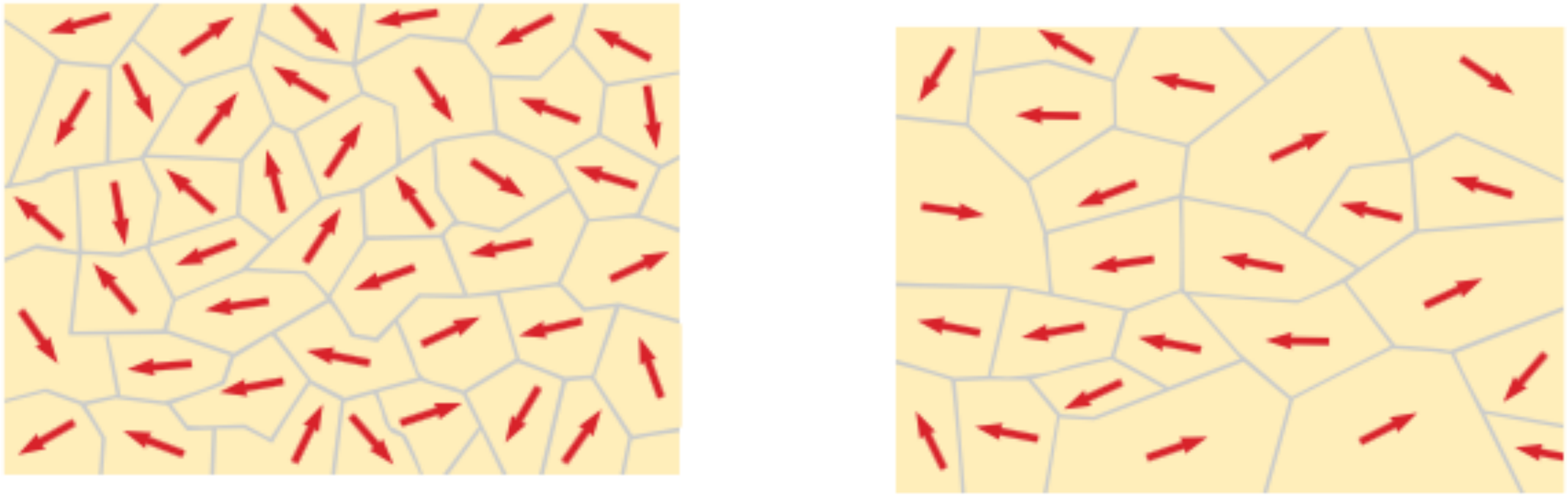
speaker

Two reasons materials exhibit magnetic properties

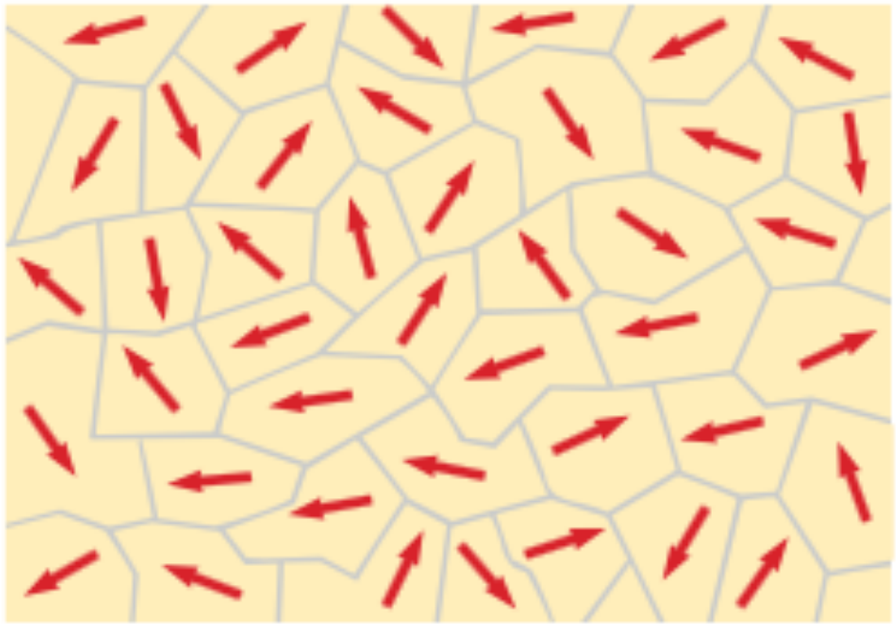


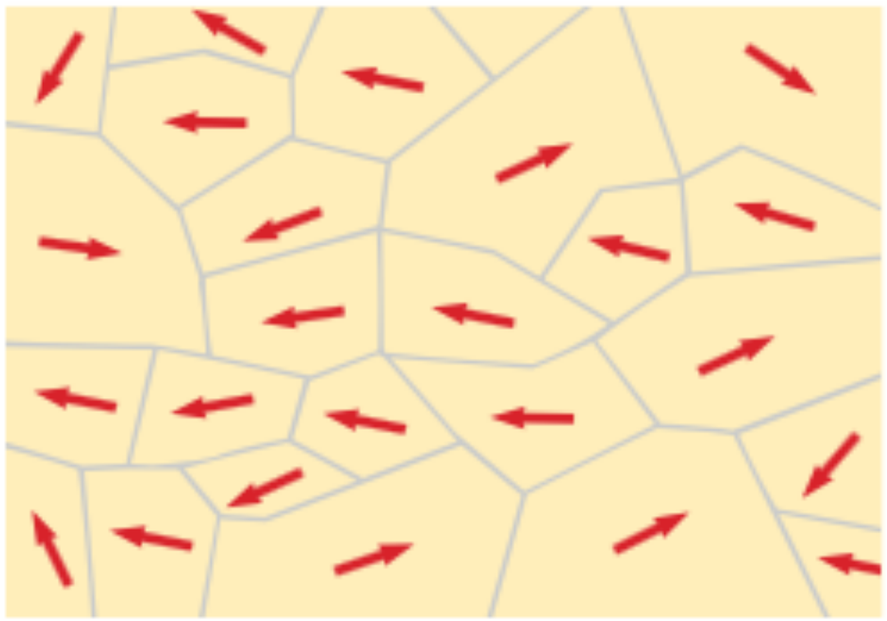
The arrow represents the inherent magnetic moment of the electron.



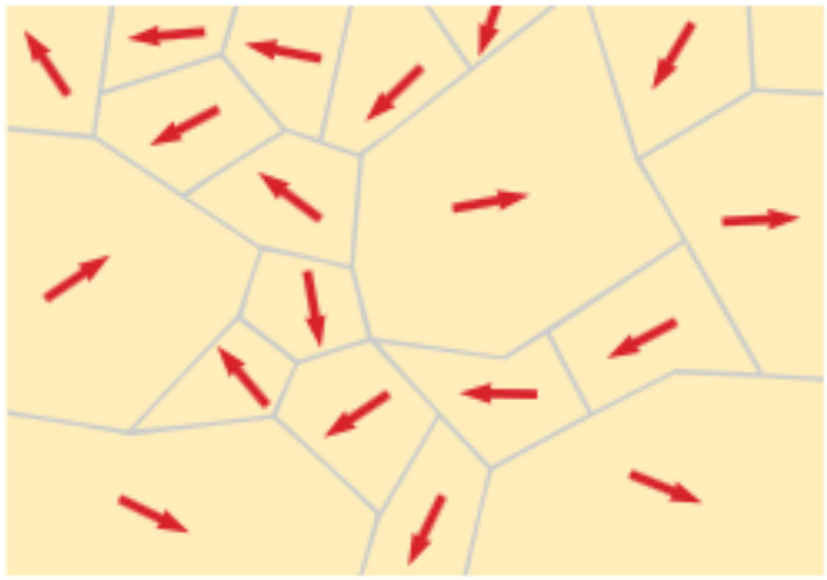


$\vec{\mathbf{B}}$





$\vec{\mathbf{B}}$



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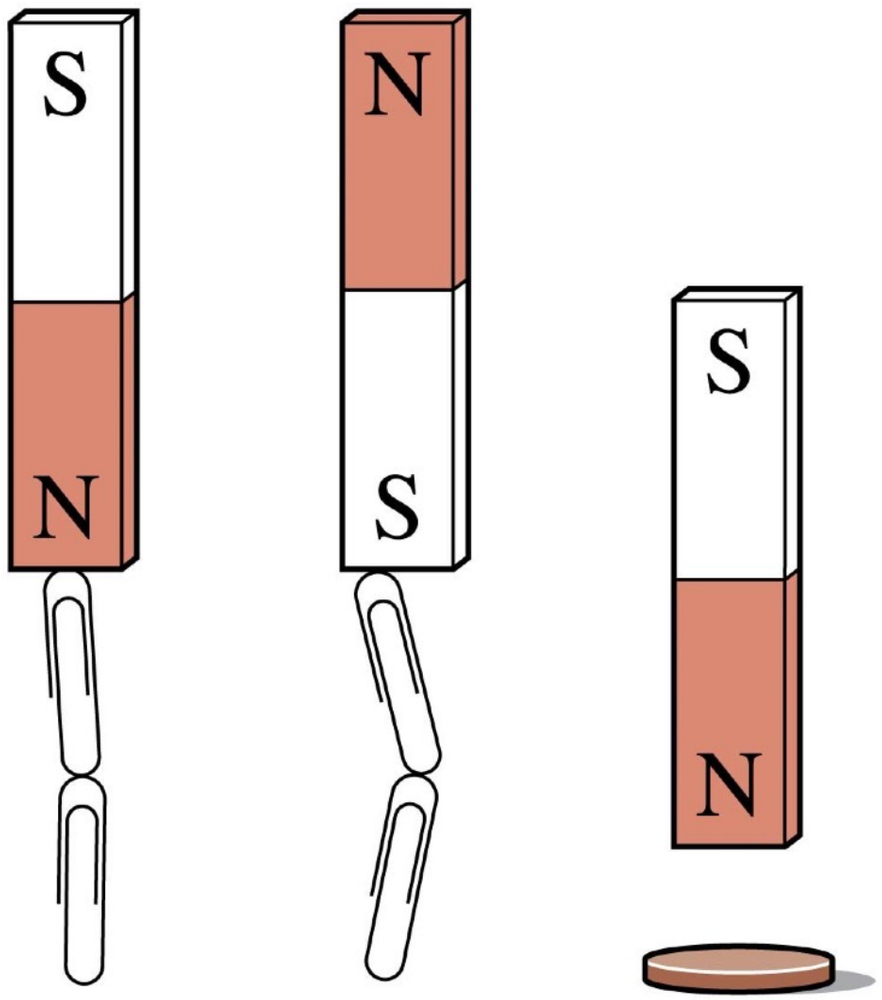


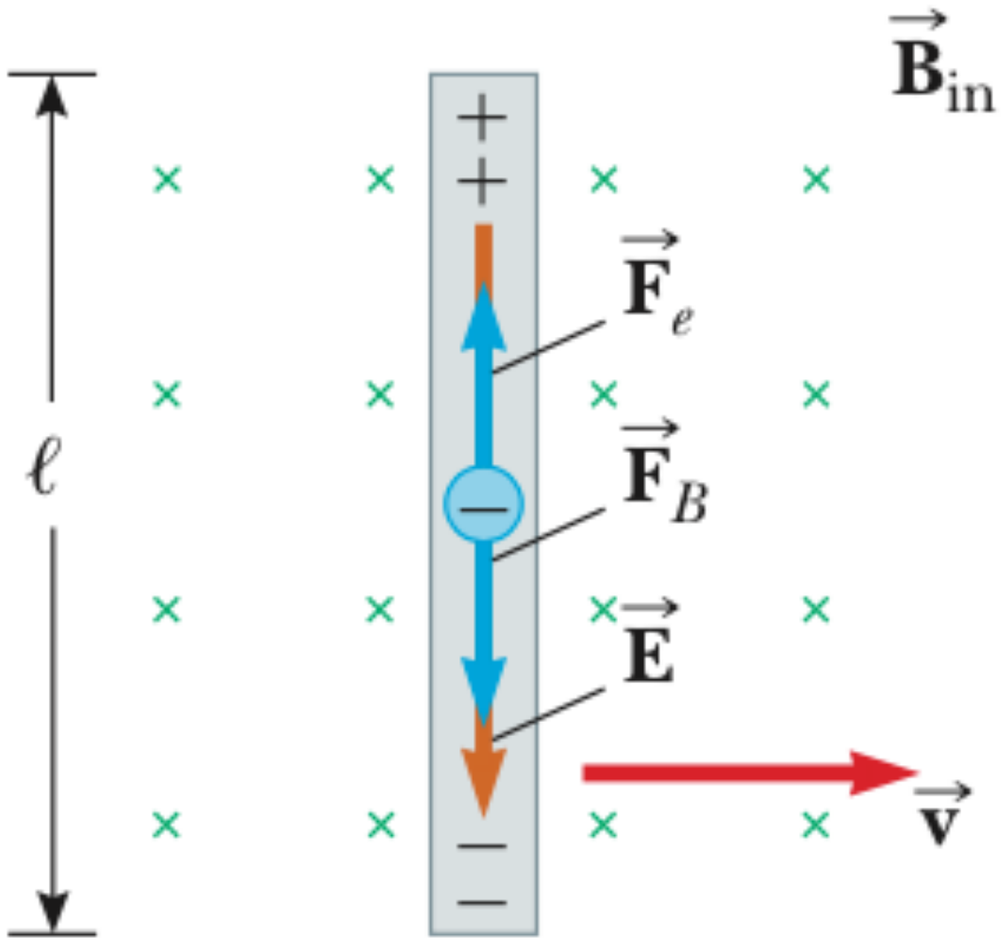
Now we know why magnets pick things up

Explain why each of these things happens to your neighbor.

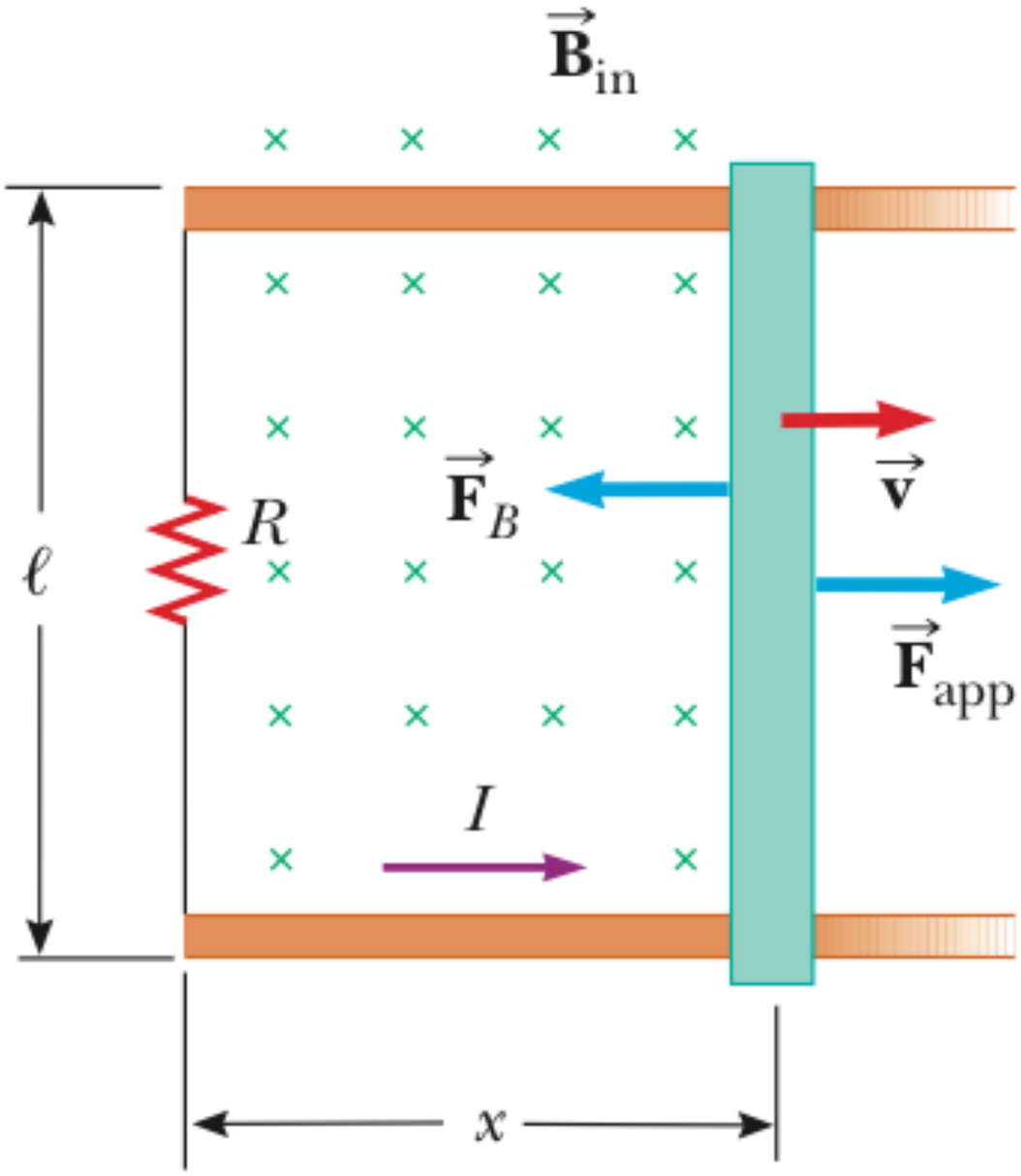
Question a scientist would ask?

If a current causes a magnetic field, could a magnet create an electric field?

Let's see!



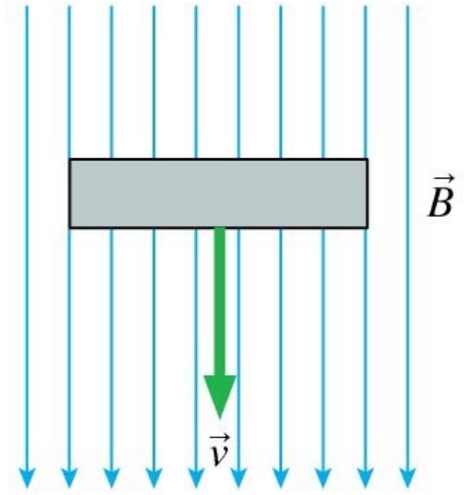
a) Write an expression for the electric force on the charge carriers.
b) Write an expression for the magnetic force on the charge carriers.
c) Set them equal and find the induced voltage across the



How much current flows through this circuit?

Question #12

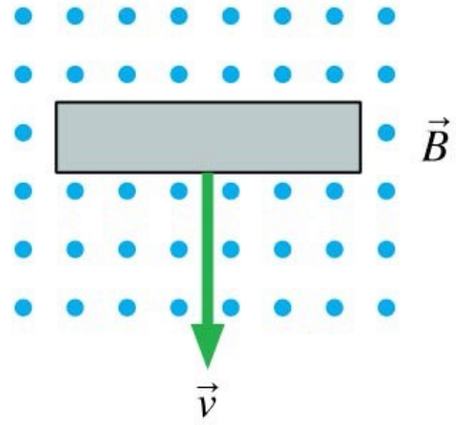
A metal bar moves through a magnetic field. The induced charges on the bar are



E B A C D

Question #13

A metal bar moves through a magnetic field. The induced charges on the bar are



E B D C A

Question #14

An induced current flows clockwise as the metal bar is pushed to the right. The magnetic field points

A. Up.
B. Into the screen.
C. Down.
D. Out of the screen.
E. To the right.