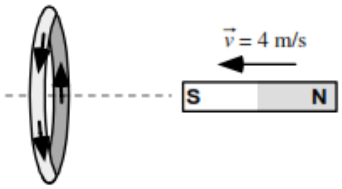
AP Physics 2 – Magnetic Induction

D3-SCT31: Moving Magnet and Circular Loop—Force

Three students are comparing the forces on a permanent magnet and a current-carrying circular loop of wire. The mass of the magnet is much larger than the mass of the loop.



Amador: *"The coil will push or pull on the magnet just as hard as the magnet pushes or pulls on the coil."*

Barbara: *"I think the magnet has to push harder on the coil than the coil pushes on the magnet because the magnet is more massive than the wire."*

Charlene: *"I think the magnet will push or pull on the coil but the coil will not push or pull on the magnet at all because the coil is not a magnet."*

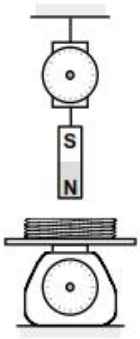
With which of these students do you agree?

Amador _____ Barbara _____ Charlene _____ None of them _____

Explain your reasoning.

D3-QRT32: Suspended Permanent Magnet and Circular Coil—Scale Reading

A small, permanent magnet is suspended by a spring balance above the center of a circular coil of wire that is sitting on a balance. A large current is now introduced into the coil, causing the magnet to be attracted to the coil.



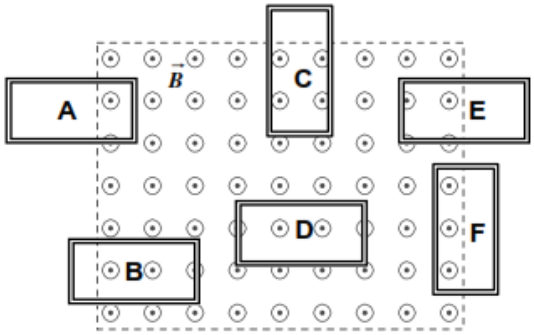
(a) Will the reading on the upper spring balance *increase*, *decrease*, or *stay the same*?
Explain your reasoning.

(b) Will the reading on the balance supporting the coil *increase*, *decrease*, or *stay the same*?
Explain your reasoning.

(c) Compare the sizes of the changes that will be observed in parts (a) and (b).
Explain your reasoning.

D3-RT38: Moving Rectangular Loops in Uniform Magnetic Fields—Current

Six identical rectangular wire loops are moving to the right at the same constant speed. There is a uniform magnetic field coming out of the page in the region enclosed by the dashed line. The rectangular loops are all 5 cm by 10 cm.



Rank the magnitude of the induced current in the rectangular loops at the instant shown. Assume there is no effect or interaction between the loops.

						OR			
							☐	☐	☐
1 Greatest	2	3	4	5	6 Least		All the same	All zero	Cannot determine

Explain your reasoning.

D3-SCT39: Moving Rectangular Loops in Uniform Magnetic Fields—Current

Three students are discussing a rectangular wire loop moving at a constant speed as it enters a region in which there is a uniform magnetic field perpendicular to the plane of the loop. The sides of the rectangular wire loop are perpendicular or parallel to the leading edge of the magnetic field.

Allison: *"The current will increase as more of the loop gets into the field since there will be more magnetic flux inside the loop."*

Blanca: *"I think the current in the wire loop will start out big and then decrease as the loop moves into the field region since less of the loop will be outside of the field."*

Chithra: *"No, the current in the wire loop will be constant from the time the loop starts into the field region until it is fully into the field region. Then the current will go to zero."*

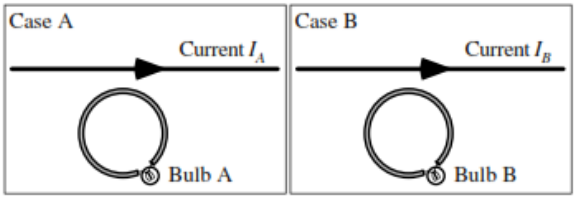
With which of these students do you agree?

Allison _____ Blanca _____ Chithra _____ None of these students _____

Explain your reasoning.

D3-SCT41: Changing Current in Long Wire—Bulb Brightness in Nearby Loop

A circular loop of wire with a small bulb in it is placed beside a long straight current-carrying wire. In both cases below, these loops are the same distance away from the current-carrying wire. Bulb A is brighter than Bulb B. The wire loops, bulbs, and long straight wires are identical for the two situations.



Three students discussing this arrangement contend:

Adela: *"Bulb A is brighter than Bulb B because the long wire next to the brighter bulb has a larger current in it."*

Bryce: *"No, Bulb A is brighter than Bulb B because the current in the long wire next to it is increasing at a faster rate than the current in the other wire."*

Consuelo: *"We don't know that. The current in the long wire must be changing at a faster rate, but it could also be decreasing."*

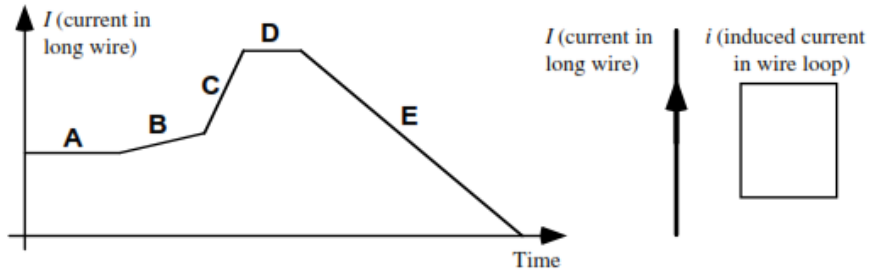
With which of these students do you agree?

Adela _____ Bryce _____ Consuelo _____ None of these students _____

Explain your reasoning.

D3-RT42: Current in Wire Time Graph—Induced Current in Nearby Loop

The current in a long wire changes with time as indicated in the graph below. A square wire loop is placed near the wire as shown in the diagram.



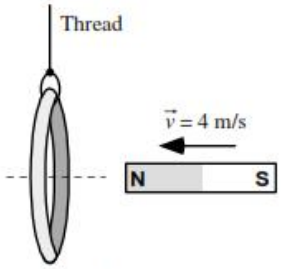
Rank the magnitude of the induced current *i* in the square loop for the labeled time intervals.

						OR			
							☐	☐	☐
1 Greatest	2	3	4	5	6 Least		All the same	All zero	Cannot determine

Explain your reasoning.

D3-QRT44: Wire Loops and Moving Magnets—Motion of the System

A circular loop of wire is suspended from a thread so that it hangs freely. A permanent bar magnet is moved toward the center of the wire loop as shown.



Describe how each of the following changes affects this system.

(a) The magnet is moved toward the loop at twice the speed.
Explain your reasoning.

(b) A small gap is cut in the wire loop.
Explain your reasoning.

(c) The south pole of the magnet is on the side of the magnet closer to the loop.
Explain your reasoning.

(d) The strength of the magnet is increased.
Explain your reasoning.

(e) The magnet is moving away from the loop at the same speed.
Explain your reasoning.