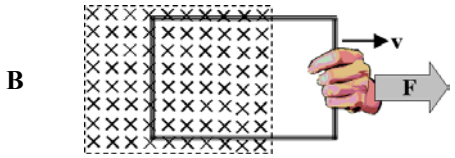
Newton's Second Law Mental Models: E&M, Induction

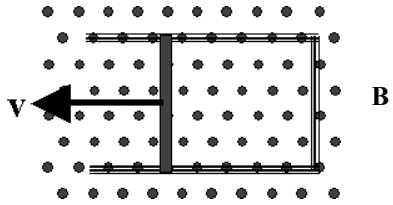


You pull a metallic loop, out of a region with a magnetic field **B**, with a force **F**, and at constant speed V. The magnetic field **B** points into the page (indicated by **X**). For the following questions (statements), indicate your choice by circling the corresponding letter, **a** to **d**.

Q1. The total magnetic force on the loop only due to the induced current is…
(a) in the direction opposite to **F** and with a magnitude less than **F**.
(b) in the direction opposite to **F** and with a magnitude equal to **F**.
(c) in the direction opposite to **F** and with a magnitude more than **F**
(d) None of the above.

Q2. A couple of seconds later you stop pulling. Then the loop will…
(a) slow to a stop and remain at rest.
(b) slow to a stop and then move in the opposite direction.
(c) move in the opposite direction as soon as you stop pulling.
(d) None of the above.

Q3. If the magnetic field is turned off, and you continue to pull with force **F**, the loop will…
(a) speed up.
(b) continue moving at constant speed.
(c) speed up for a while and then move at constant speed.
(d) None of the above.



A metallic rod moves at constant speed V along horizontal *frictionless* conducting rails, in a region where there is a uniform magnetic field **B** pointing out of the page (indicated by **dots**). For the following questions (statements), indicate your choice by circling the corresponding letter, **a** to **d**.

Q4. The force(s) on the rod is (are)…
(a) only the magnetic force due to the induced current.
(b) the magnetic force due to the induced current, and an equal and opposite external force.
(c) only a external force pulling the rod.
(d) None of the above.

Q5. A couple of seconds after the rod is moving the magnetic field is turned off. Then the rod will….
(a) slow to a stop.
(b) speed up.
(c) stop as the magnetic field is turned off.
(d) None of the above.

Q6. If now the rod moves at constant speed 2V (twice from the original set-up), but everything else in the set-up remains the same, What would be the magnetic force due to the induced current?
(a) the magnetic force due to the induced current would be less than in the original set up.
(b) the magnetic force due to the induced current would remain the same as well.
(c) the magnetic force due to the induced current would be more than in the original set-up.
(d) None of the above.