1 A wire loop with an area of 0.0050 m^2 is oriented perpendicular to a uniform magnetic field of 1.3 T. What is the magnetic flux through the loop?

2 A 0.20 m wide and 0.60 m long rectangular loop of wire is oriented perpendicular to a uniform magnetic field of 0.30 T. What is the magnetic flux through the loop?

3 The magnetic flux through a rectangular loop, with an area of 0.0080 m^2 is 0.40 Wb. How strong is the magnetic field?

4 A loop of wire, 4.2 cm in diameter, is oriented perpendicular to a uniform magnetic field of 0.60 T. What is the magnetic flux in the loop?

5 A 0.40 m wide and 0.80 m long rectangular loop of wire is oriented perpendicular to a uniform magnetic field of 0.50 T. What is the magnetic flux through the loop?

6 The magnetic flux through a loop of wire, 15 cm in diameter, is 3.0 Wb. What is the strength of the magnetic field?

7 The magnetic flux through a loop of wire changes from zero to 12 Wb in 0.30 s. What is the induced emf in the loop?

8 What is the rate of change of magnetic flux through a coil of wire with 100 turns if the induced emf is 12 V?

9 The magnetic flux through a coil of wire changes uniformly from 2.0 Wb to 4.8 Wb in 0.20 s and induces an emf of 14 V. How many loops are in the coil?

10 A wire loop with a radius of 9.0 cm is initially parallel to a uniform magnetic field 2.6 T. The loop's orientation is then changed so that it is perpendicular to the field in 0.12 s. What is the induced emf in the loop?

11 A circular loop is made of a flexible wire. The loop is perpendicular to a uniform magnetic field with a magnitude of 3.5 T. The area of the loop is changed from 0.0050 m^2 to 0.0080 m^2 in 0.15 s. What is the induced emf in the loop?

12 The magnetic flux through a coil of wire with 100 turns changes from 5.0 Wb to 45 Wb in 0.25 s? What is the induced emf in the coil?

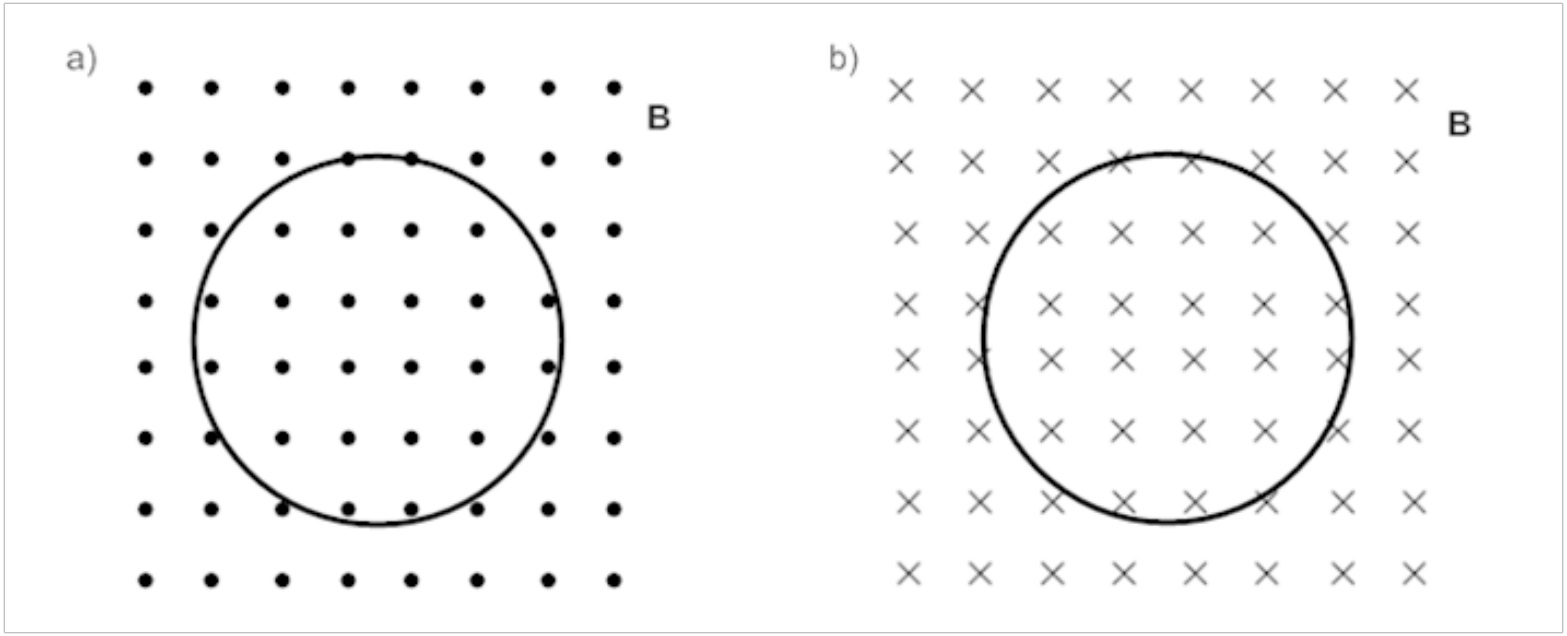
13 A coil with 200 turns is oriented perpendicular to a changing magnetic field. An induced emf of 30.0 V is caused by the change in magnetic field. What is the rate of change of magnetic flux through the coil?

14 The magnetic flux through a coil of wire changes uniformly from 5.2×10^{-2} Wb to zero in 0.13 s and induces an emf of 4.0 V. How many loops are in the coil?

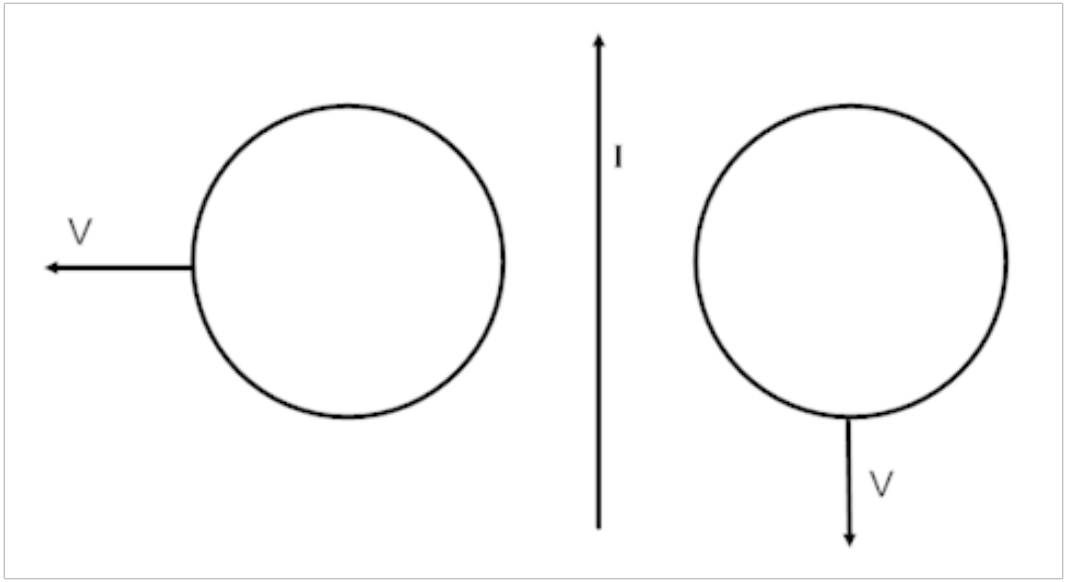
15 A rectangular loop of wire with an area of 0.048 m^2 is perpendicular to a magnetic field. The magnitude of the field changes uniformly from 0.24 T to 1.67 T in 0.25 s. What is the induced emf in the loop?

16 A rectangular loop is made of a flexible wire. The loop is perpendicular to a uniform magnetic field with a magnitude of 4.5 T. The area of the loop is changed from 0.010 m^2 to 0.0080 m^2 in 0.15 s. What is the induced emf in the loop?

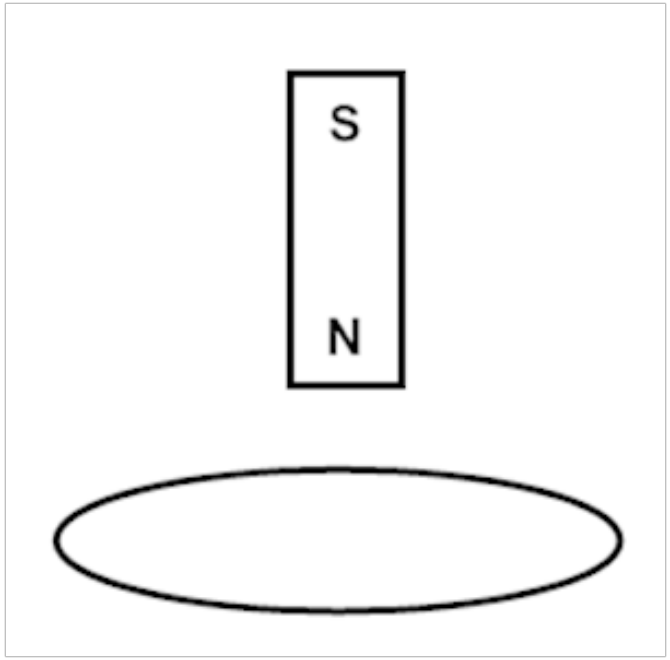
17 A loop is placed in a uniform magnetic field. Determine the direction of the induced current in the loop, when a) the original field, **B**, increases, b) the original field, **B,** decreases.



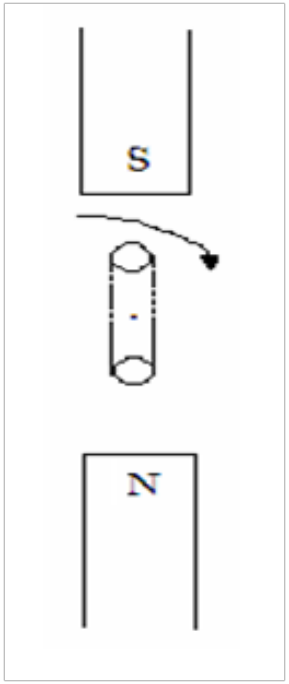
18 Two loops of wire are moving in the vicinity of a very long wire carrying a steady current. Find the direction of the induced current in each loop.



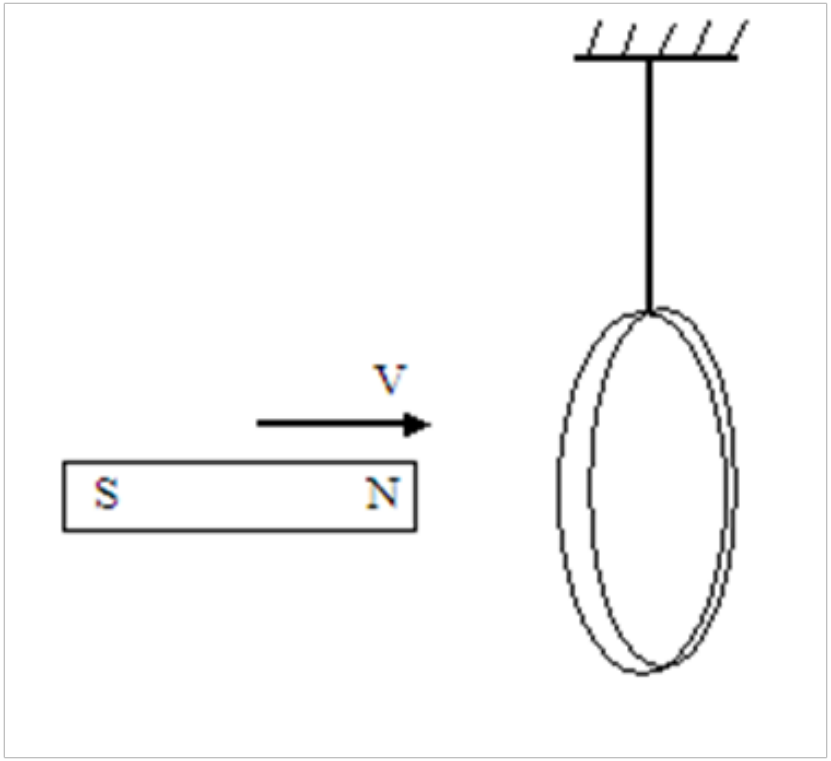
19 A circular loop lies on a horizontal table. A student holds a bar magnet with the north pole pointing down. Find the direction of the induced current when a) the bar magnet is stationary; b) the bar magnet is dropped into the loop.



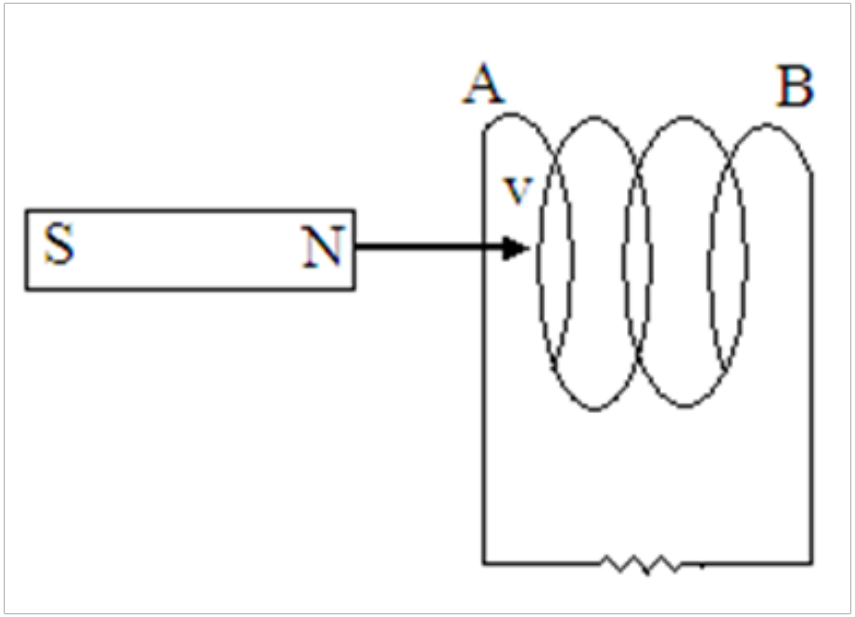
20 A rectangular loop of wire, whose axis is oriented horizontally, is rotating a quarter turn in clockwise direction, as shown above. What is the induced current in the loop as it rotates from a vertical to horizontal orientation?



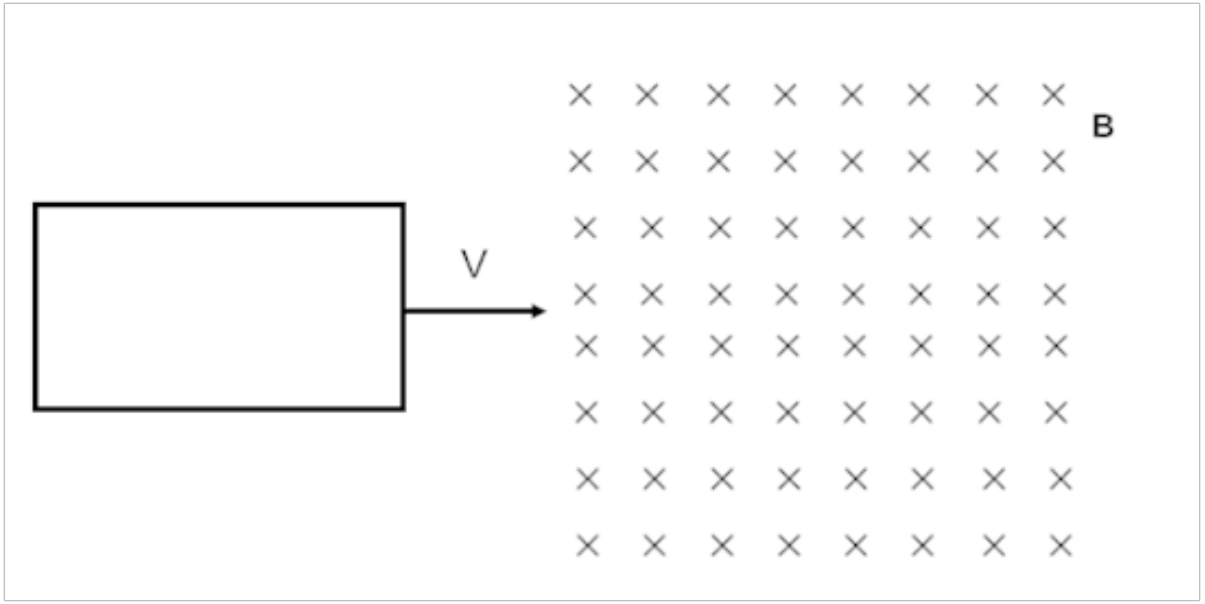
21 A permanent magnet is pushed into a stationary ring that is suspended from a vertical string. What happens to the ring? How can we use Lenz's Law to explain this experiment?



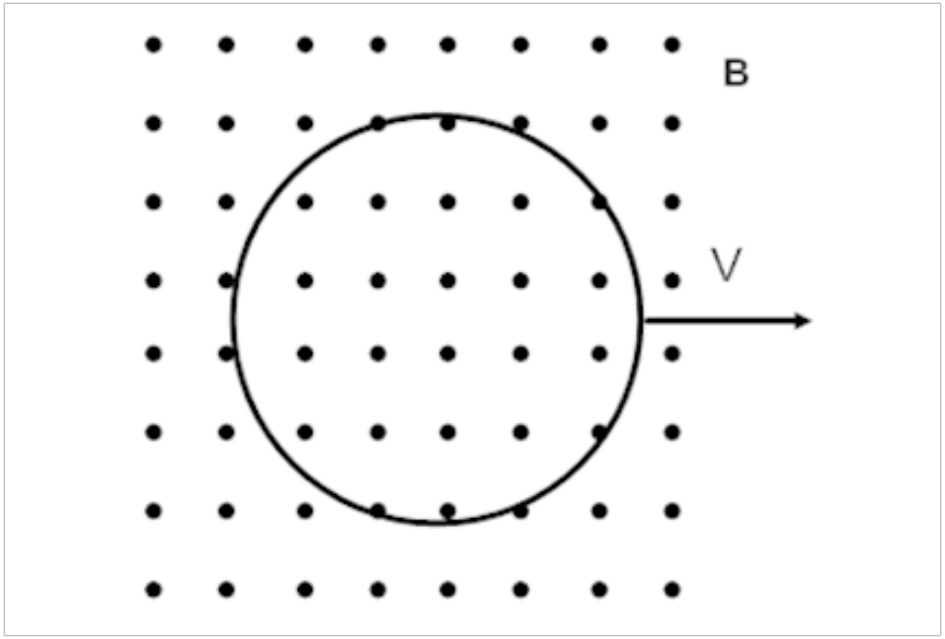
22 A bar magnet is pushed into a coil. Is $V_B - V_A$ positive, negative or zero?



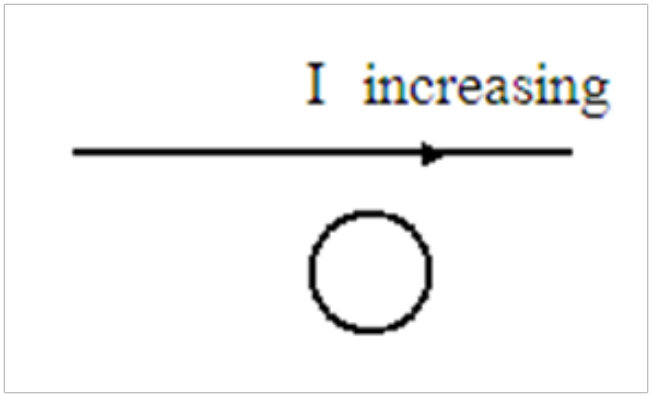
23 A rectangular loop is pushed into a uniform magnetic field. Find the direction of the induced current.



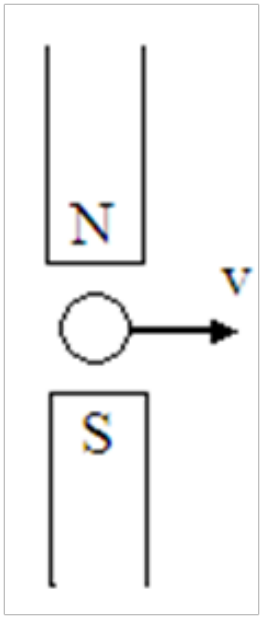
24 A circular loop is removed from a uniform magnetic field. Find the direction of the induced current in the loop.



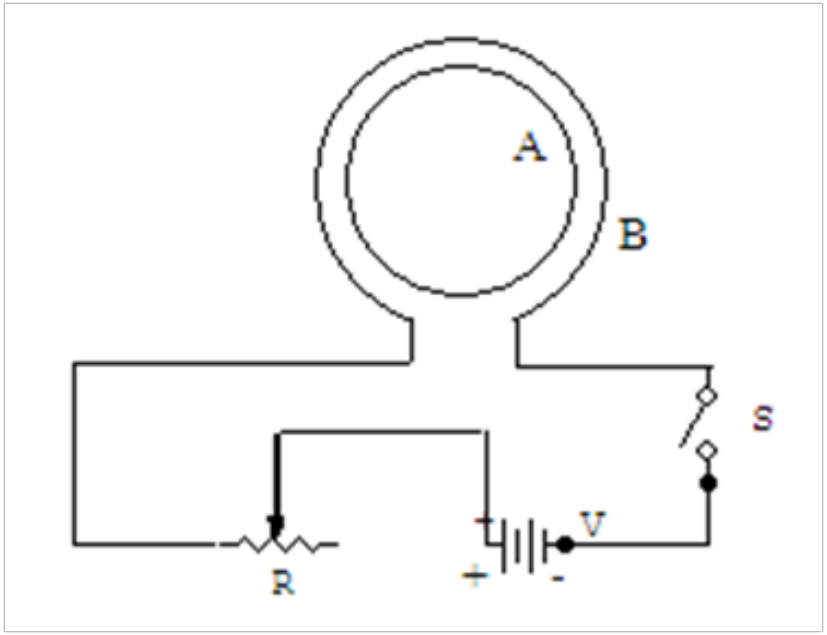
25 A loop of wire is placed stationary near a straight wire with an increasing current. What is the direction of the induced current in the loop?



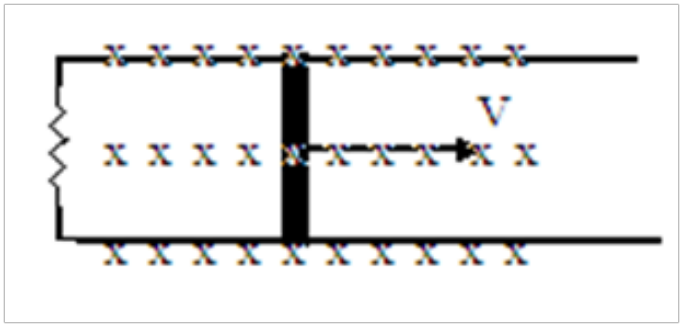
26 A straight wire is moving to the right between two magnets facing each other. What is the direction of the induced current in the wire?



27 Two coaxial rings are connected to a circuit shown above. Ring B is connected in series to a battery, switch and rheostat. After the switch is closed a steady current flows through the circuit. Find the direction of the induced current in ring A when a) the rheostat rider is moved to the right (R increases, so I decreases); b) the rheostat rider is moved to the left (I increases).



28 A constant force is applied to a metal rod that is placed on two parallel conducting rails. The rod then slides to the right at a constant speed, perpendicular to a constant magnetic field. Find the direction of the induced current in the resistor.



29 A 15 cm wire moves at a constant speed of 16 $^{m}/_{s}$ perpendicular to a uniform magnetic field of 0.80 T. What is the induced emf in the wire?

30 When a 36 cm wire moves at constant speed in a 3.4 T magnetic field the induced emf is 16 V. What is the speed of the wire?

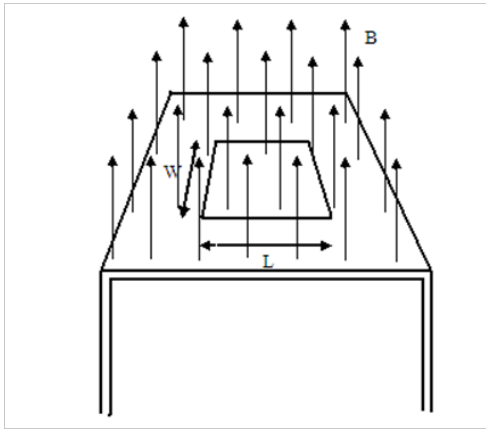
31 How strong must a magnetic field be in order to induce a 6.0 V emf in a 0.32 m wire that is moving at a constant speed of 17 $^{m}/_{s,}$ perpendicular to the field?

32 A 48 cm wire moves at a constant speed of 25 $^{m}/_{s}$ perpendicular to a uniform magnetic field of 2.2 T. What is the induced emf in the wire?

33 A 1.4 m straight wire moves at constant speed in a 4.9 T magnetic field. What is the speed of the wire if the induced emf is 24 V?

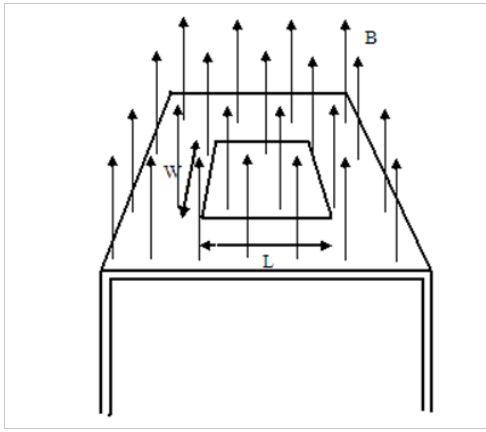
34 How strong must a magnetic field be in order to induce a 5.0 V emf in a 0.12 m wire moving at a constant speed of 15 $^{m}/_{s,}$ perpendicular to the field?

General Problems



1. A 0.14 m wide and 0.28 m long wire coil containing 10 loops lies on a horizontal table top (see the figure above). An upward magnetic field crosses the table top and the field magnitude increases from zero to the maximum value of 2.6 T in 0.30 s.

a. What is the maximum magnetic flux through the coil?
b. What is the induced emf in the coil?
c. If the net resistance of the coil is 0.60 Ω what is the magnitude of the induced current in the coil?
d. What is the direction of the induced current in the coil?
e. What is the rate of thermal energy produced by the coil?



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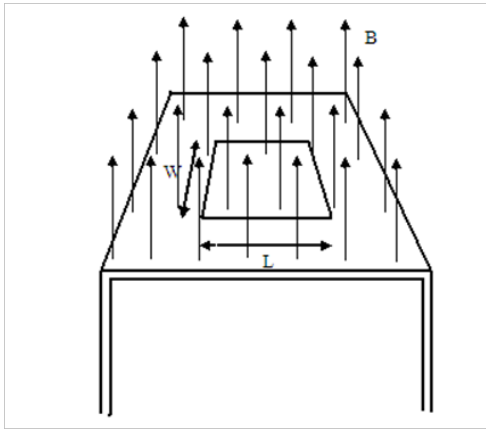

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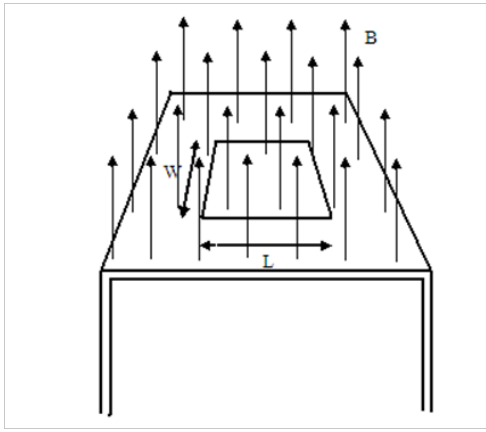

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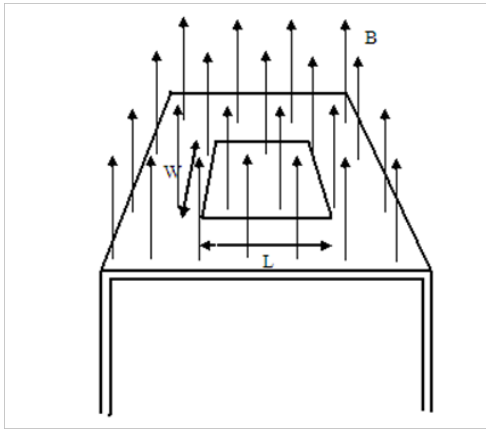

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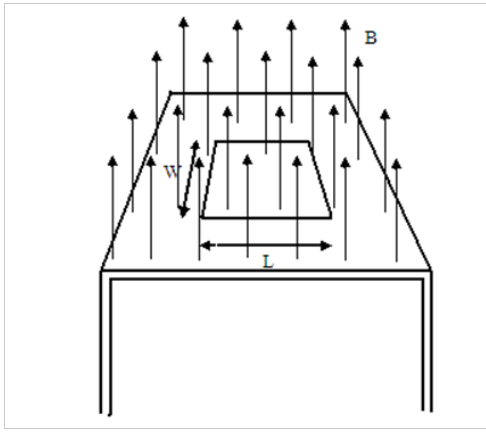

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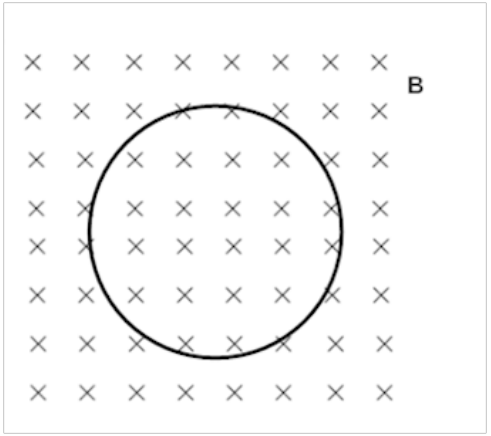
e. What is the rate of thermal energy produced by the coil?



2. A circular coil with a radius of 25 cm has 20 turns. The coil is oriented perpendicularly to a magnetic field whose initial magnitude is 3.2 T. Suddenly, the magnetic field vanishes in 0.40 s.

a. What is the initial magnetic flux in the coil?
b. What is the induced emf in the coil?
c. If the net resistance of the coil is 6.8 Ω, what is the magnitude of the induced current in the coil?
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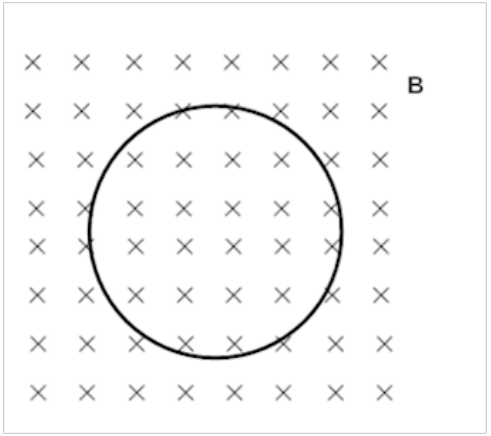

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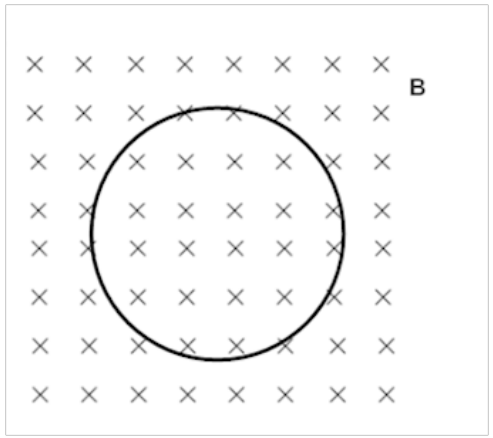

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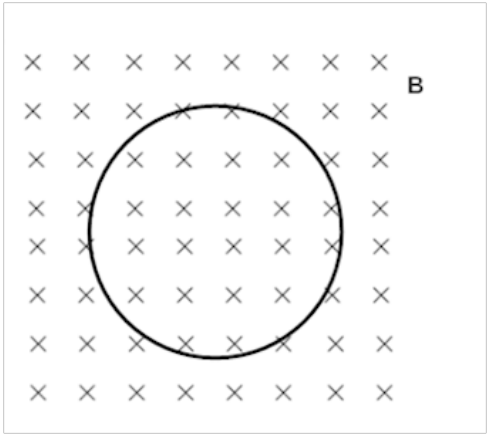

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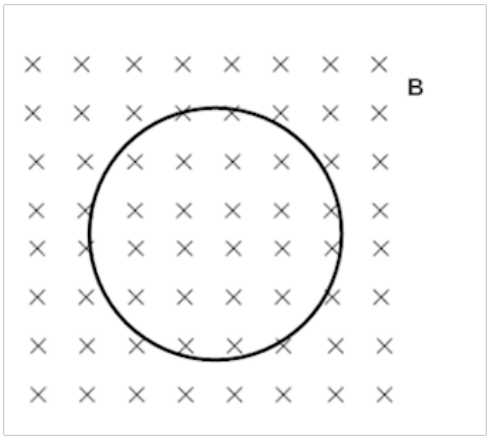

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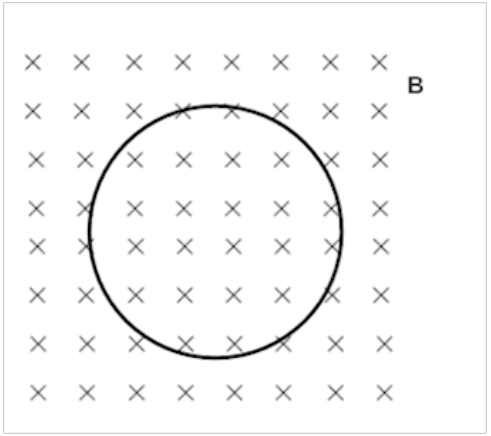

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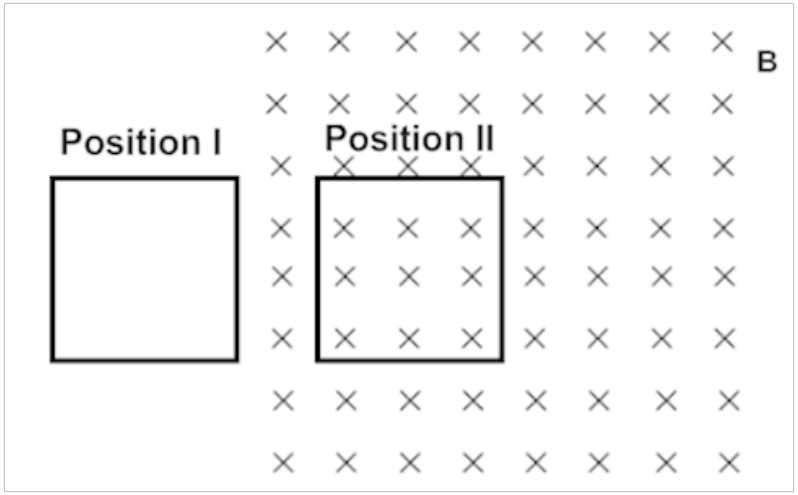
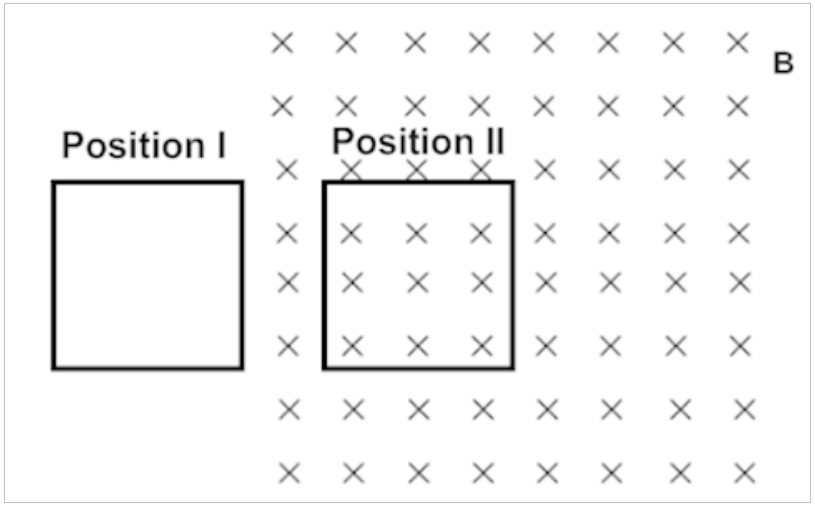


3. A square loop of wire, 0.20 m on each side has a resistance of 0.35 Ω. The loop is moved at constant speed in 0.40 s from position I where a magnetic field is zero to position II where a magnetic field is 0.90 T.

a. What is the induced emf in the loop during this period of time?
b. What is the direction of the induced current in the loop?
c. What is the magnitude of the induced current in the loop?
d. What is the power dissipated in the loop?
e. How much force is required to move the coil from position I to position II?



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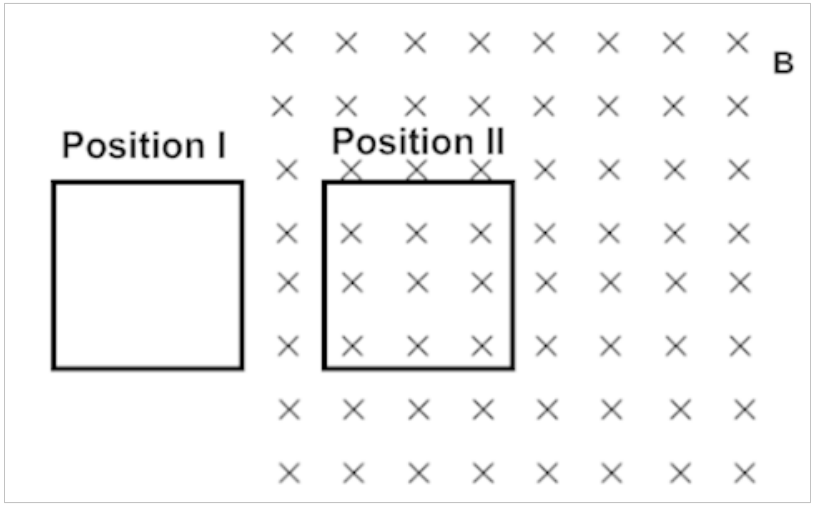

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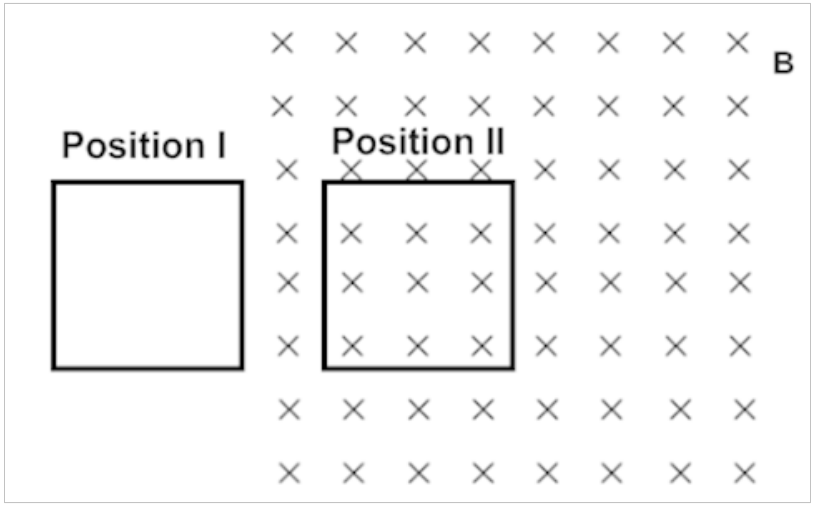

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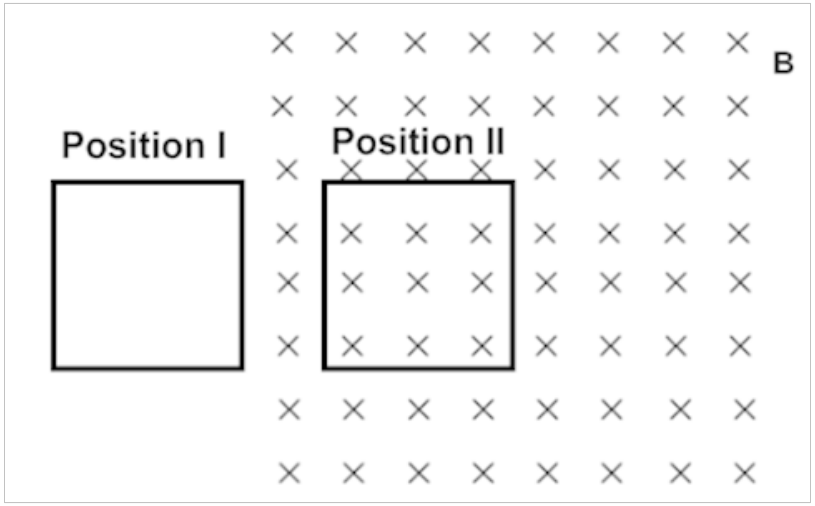

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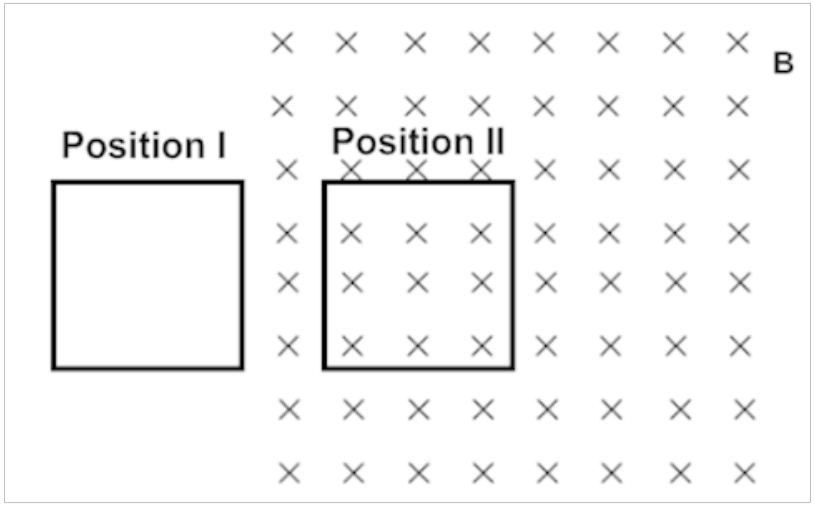

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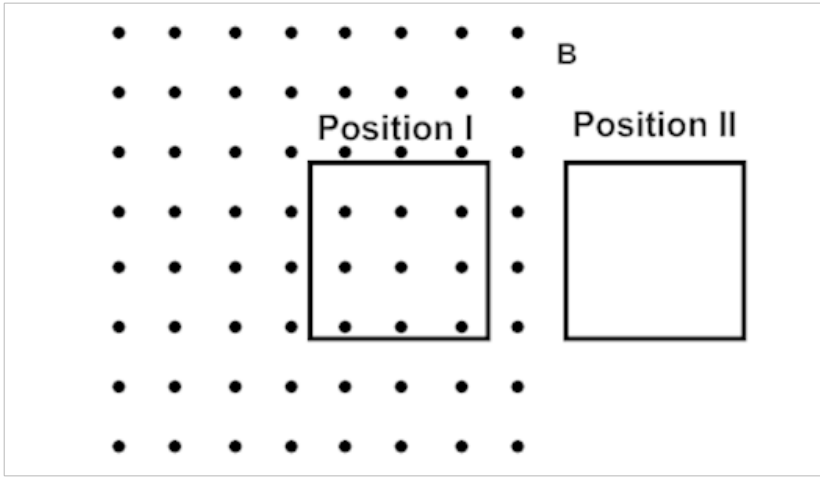

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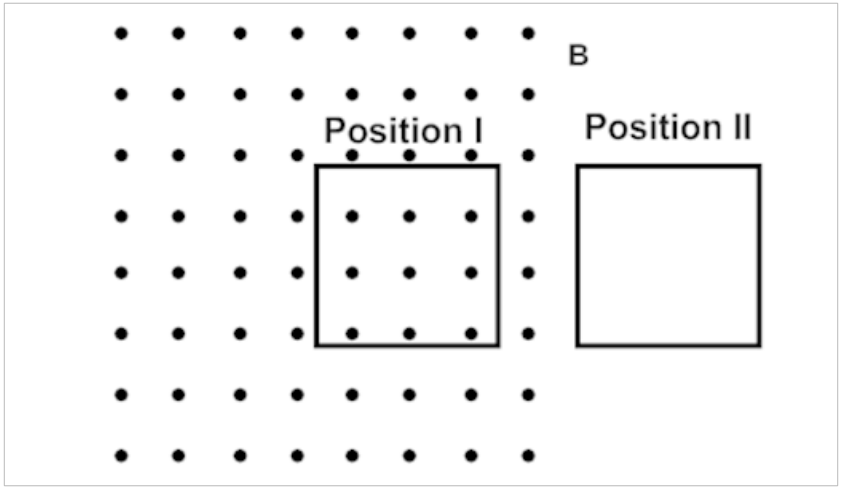

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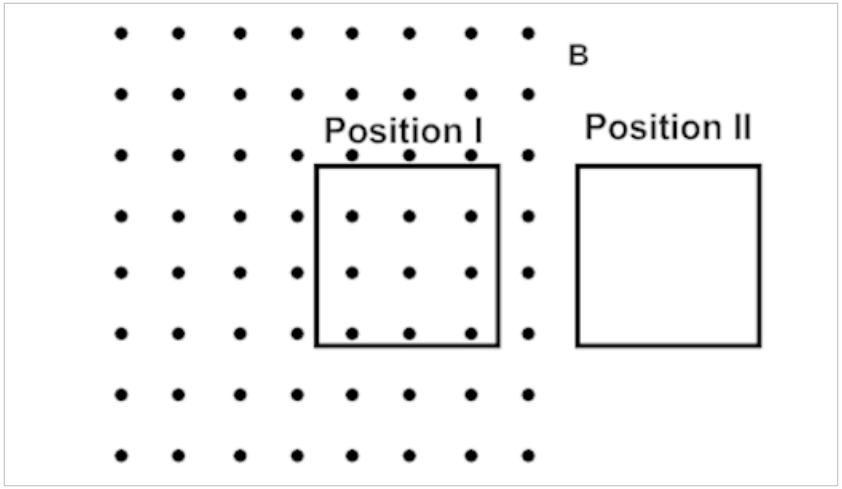

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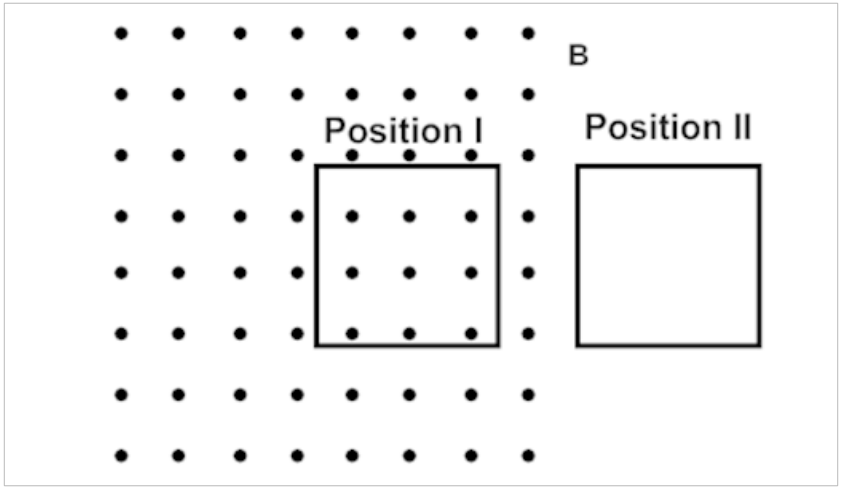

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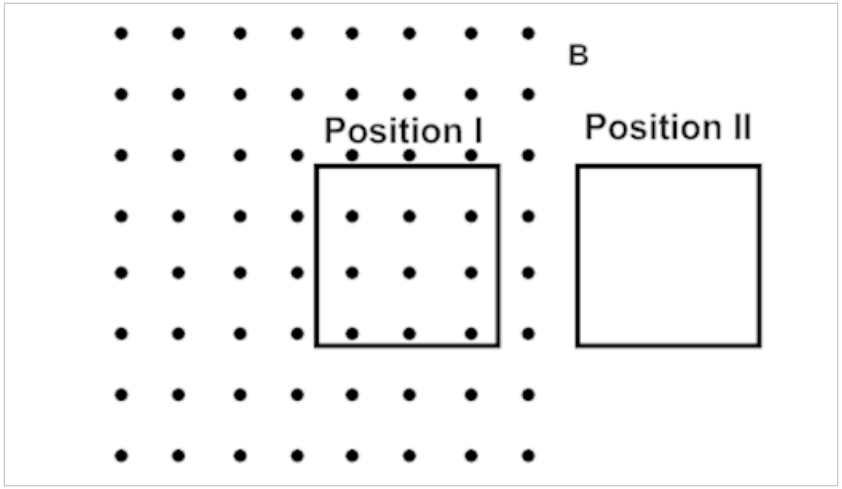

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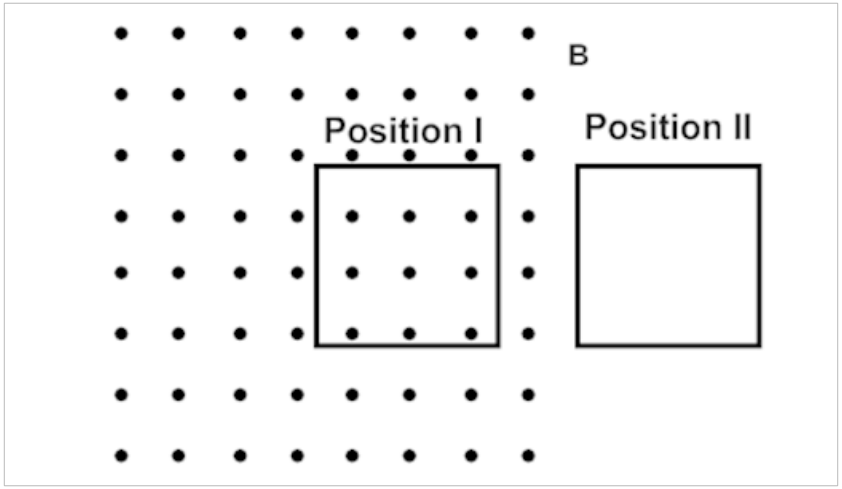
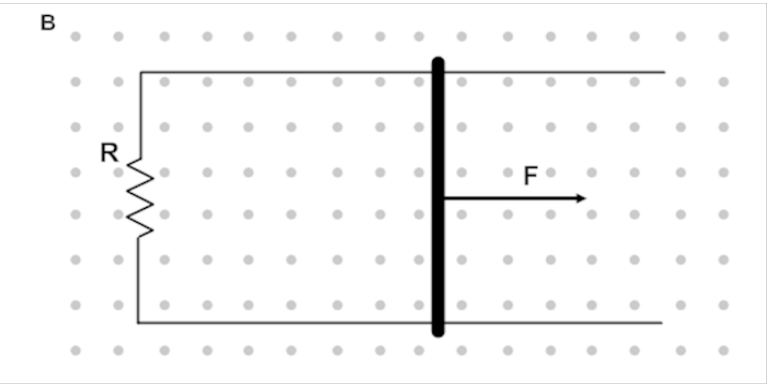


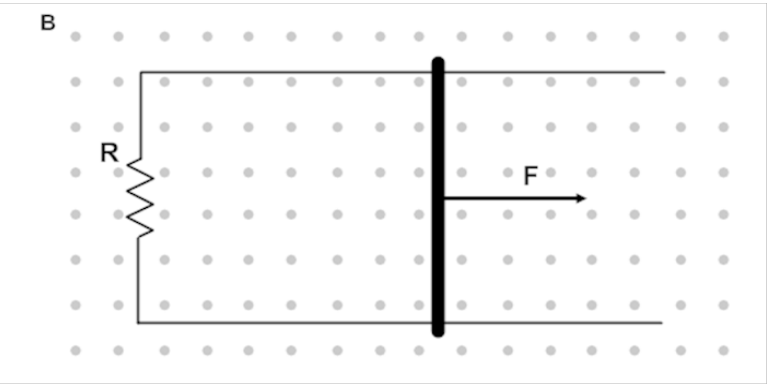
4. A square loop of wire, 0.40 m on each side has a resistance of 0.14 Ω. The loop is moved at constant speed in 0.20 s from position I where a magnetic field is 1.3 T to position II where the magnitude of the magnetic field is zero.

e. How much force is required to move the coil from position I to position II?



5. A conducting rod with a length of 0.45 m makes a contact with two conducting and parallel rails. The rails are connected to a 2.5 Ω resistor; ignore the resistance of the rod and rails. A constant force F moves the rod at a constant speed 4.2 m/s to the right with no friction between the rod and rails. The apparatus is placed in a uniform magnetic field 1.8 T that is perpendicular to the rails and the rod.

a. What is the induced emf in the loop during this period of time?
b. What is the direction of the induced current in the loop?
c. What is the magnitude of the induced current in the loop?
d. What is the power dissipated in the loop?
e. How much force is required to move the coil from position I to position II?



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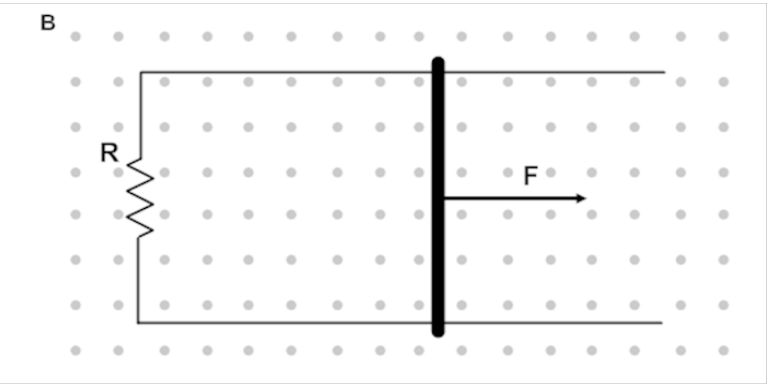

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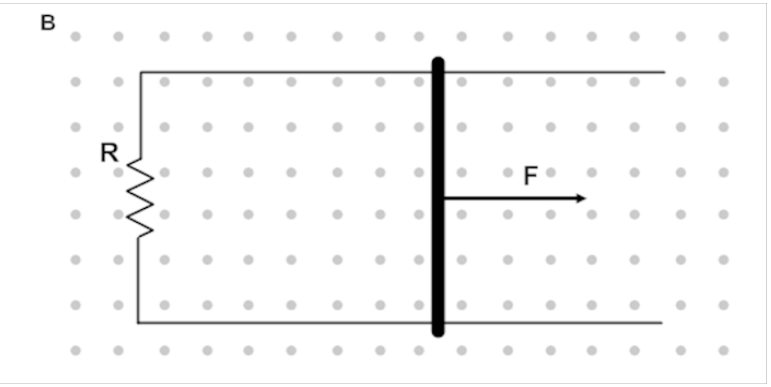
b. What is the direction of the induced current in the loop?



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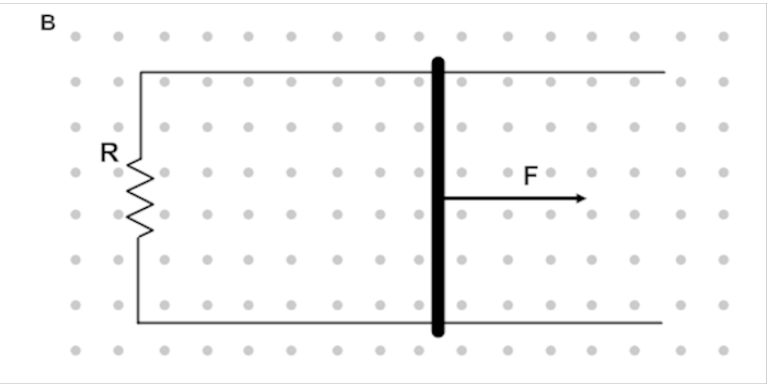
c. What is the magnitude of the induced current in the loop?



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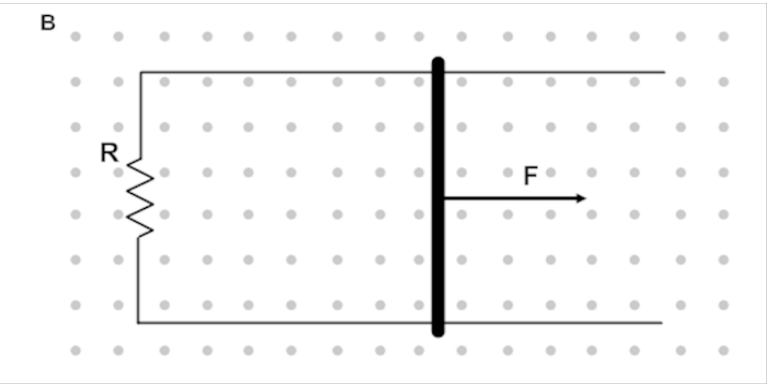
d. What is the power dissipated in the loop?



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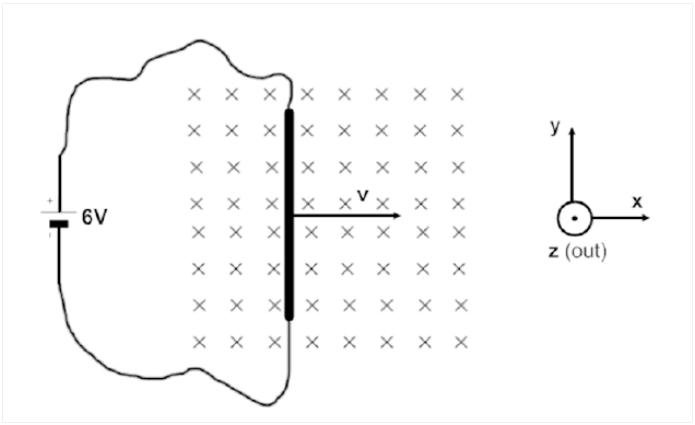
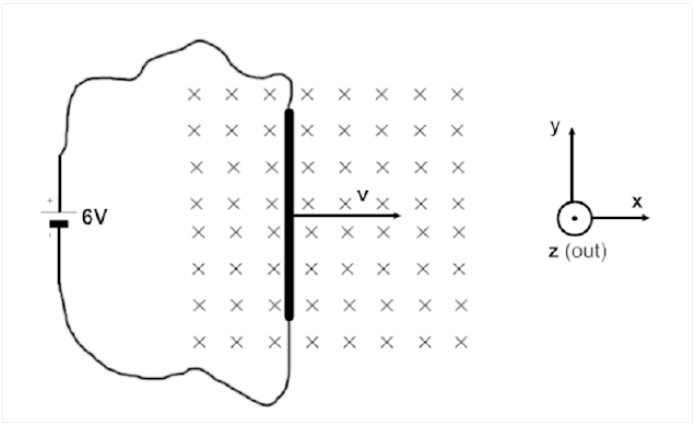
e. How much force is required to move the coil from position I to position II?



6. A 2.0 m conducting rod is connected to a 6.0 V battery by two very light wires. The rod is moved at a constant speed of 2.8 m/s in a perpendicular magnetic field with a magnitude of 1.1 T. The total resistance of the circuit is 2.5 Ω. Answer the following questions:

a. What is the induced emf in the rod while it is moving in the magnetic field?
b. What is the magnitude of the induced current in the rod?
c. What is the direction of the induced current in the rod with respect to the coordinate system shown on the diagram?
d. What is the magnitude of the current in the rod produced by the battery?
e. What is the magnitude of the net current in the rod?
f. What is the direction of the net current in the rod?



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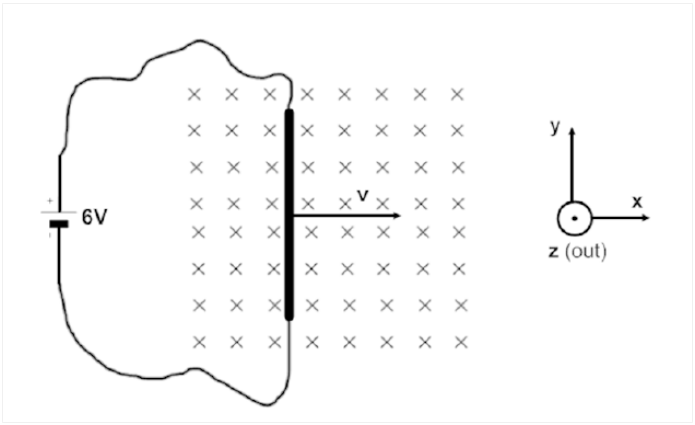

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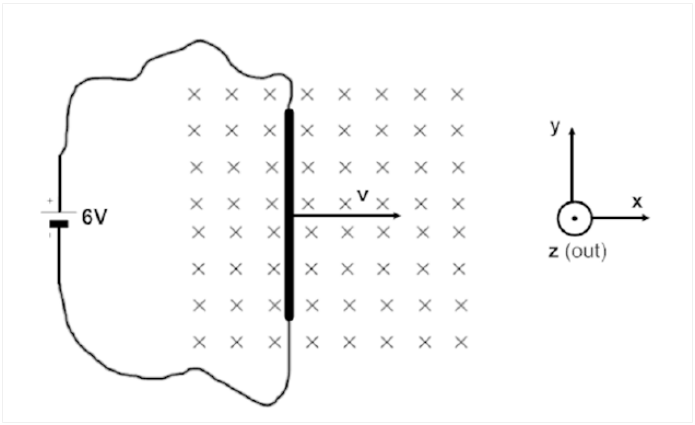

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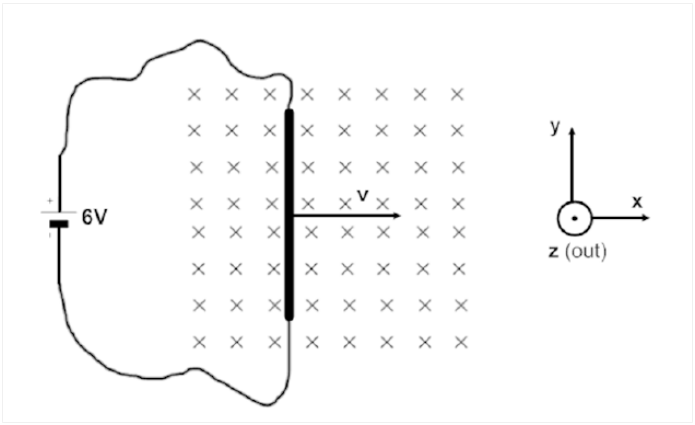
c. What is the direction of the induced current in the rod with respect to the coordinate system shown on the diagram?



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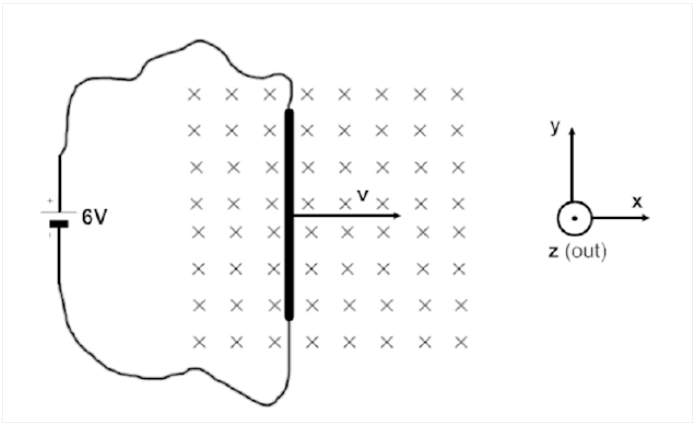
d. What is the magnitude of the current in the rod produced by the battery?



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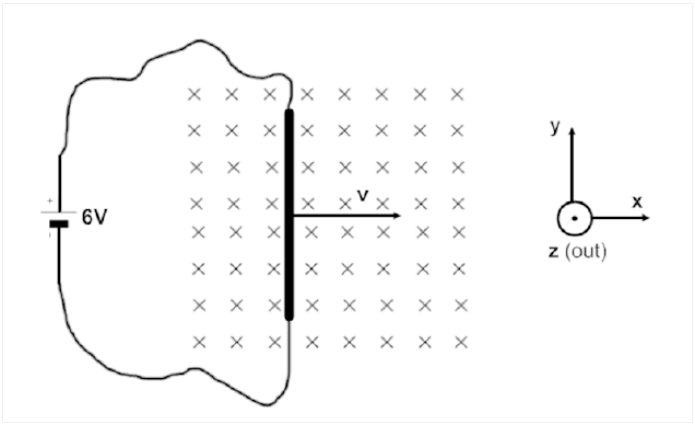
e. What is the magnitude of the net current in the rod?



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f. What is the direction of the net current in the rod?