CURRENTS, OHM’S LAW

7.1a

For everyday currents in home electronics and wires, which answer is the order of magnitude of the average velocity of the electrons along the wire?

A. km/s
B. m/s
C. mm/s
D. μm/s
E. nm/s

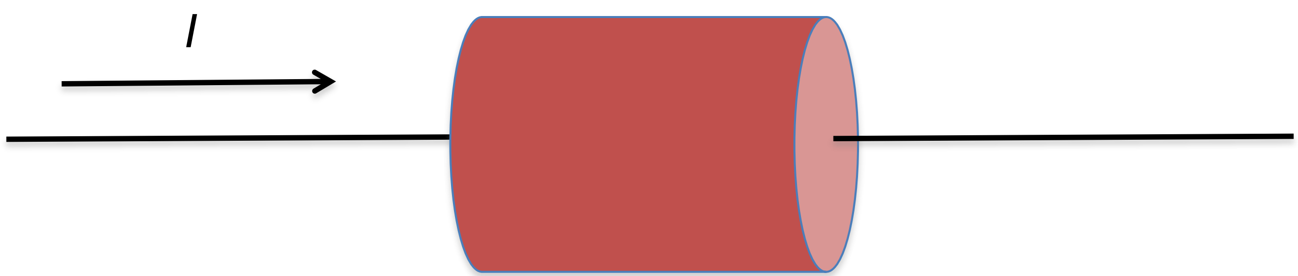
7.1b

For everyday currents in home electronics and wires, which answer is the order of magnitude of the instantaneous speed of the electrons in the wire?

A. km/s
B. m/s
C. mm/s
D. μm/s
E. nm/s

7.2

An electric current *I* flows along a copper wire (low resistivity) into a resistor made of carbon (high resistivity) then back into another copper wire.
In which material is the electric field largest?



A. In the copper wire
B. In the carbon resistor
C. It's the same in both copper and carbon
D. It depends on the sizes of the copper and carbon

7.3

An steady electric current *I* flows around a circuit containing a battery of voltage *V* and a resistor *R*. Which of the following statements about $\oint \vec{E} \cdot d\vec{l}$ is true?

A. It is zero around the circuit because it's an electrostatic field
B. It is non-zero around the circuit because it's not an electrostatic field
C. It is zero around the circuit because of the electric field is not time dependent
D. It is non-zero around the circuit because there is no electric field in the battery, only in the rest of the circuit
E. None of the above

5.10 Which of the following is a statement of charge conservation?

A) $\frac{\partial \rho}{\partial t} = -\int \vec{\mathbf{J}} \bullet d\vec{\mathbf{l}}$

B) $\frac{\partial \rho}{\partial t} = -\iint \vec{\mathbf{J}} \bullet d\vec{\mathbf{A}}$

C) $\frac{\partial \rho}{\partial t} = -\iiint (\nabla \bullet \vec{\mathbf{J}})\, d\tau$

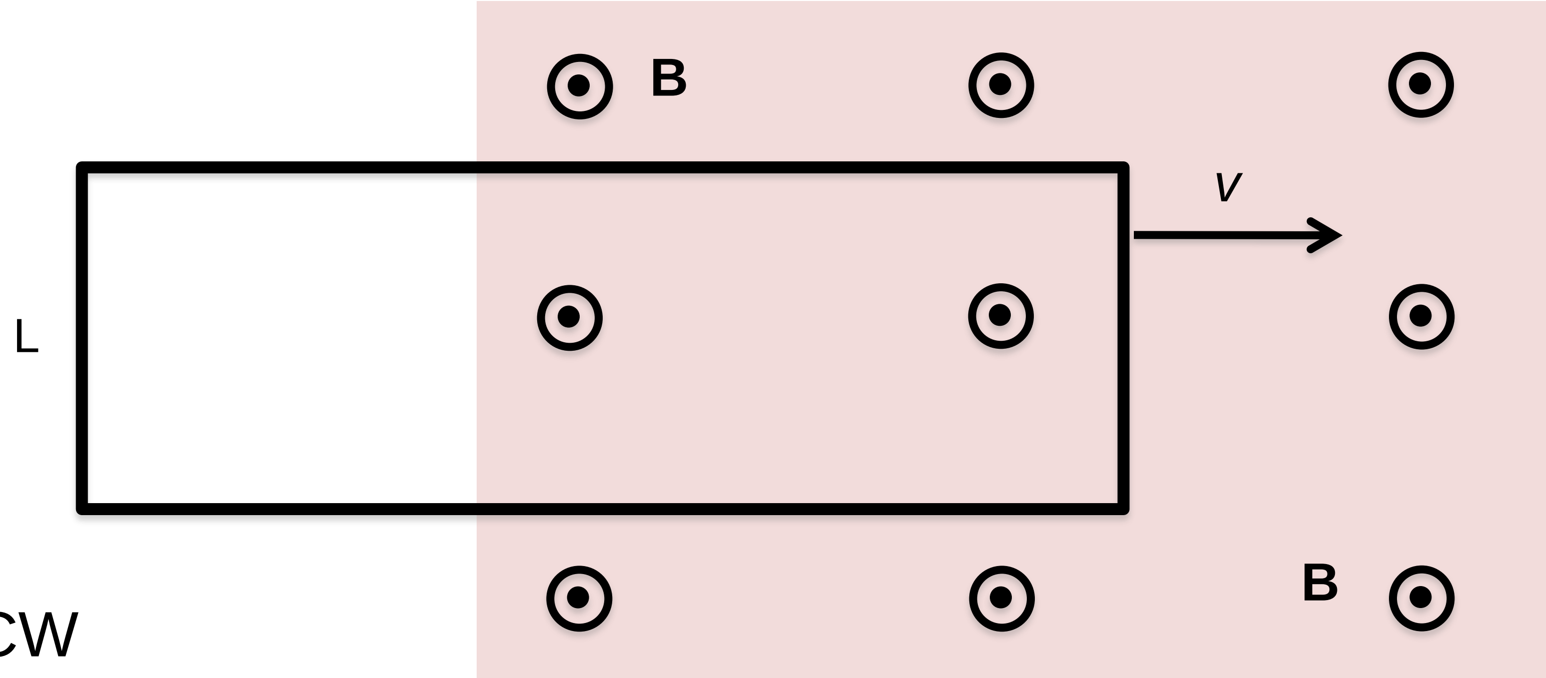
D) $\frac{\partial \rho}{\partial t} = -\nabla \bullet \vec{\mathbf{J}}$

E) Not sure/can't remember

MOTIONAL EMF

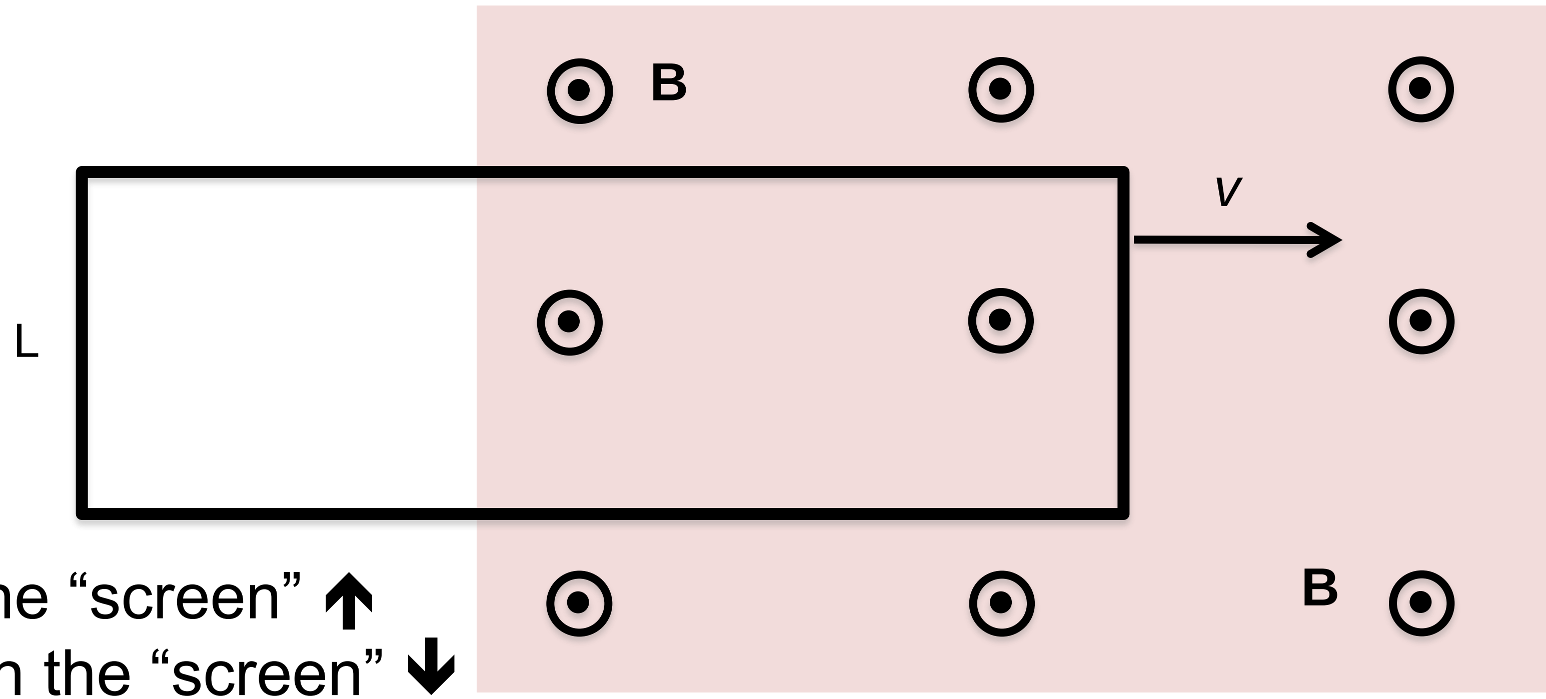
7.4

One end of rectangular metal loop enters a region of constant uniform magnetic field **B** with speed *v*, as shown.
In which direction does the current flow?



A. CW
B. CCW
C. Depends on the length of the sides
D. Depends on the resistivity of the metal

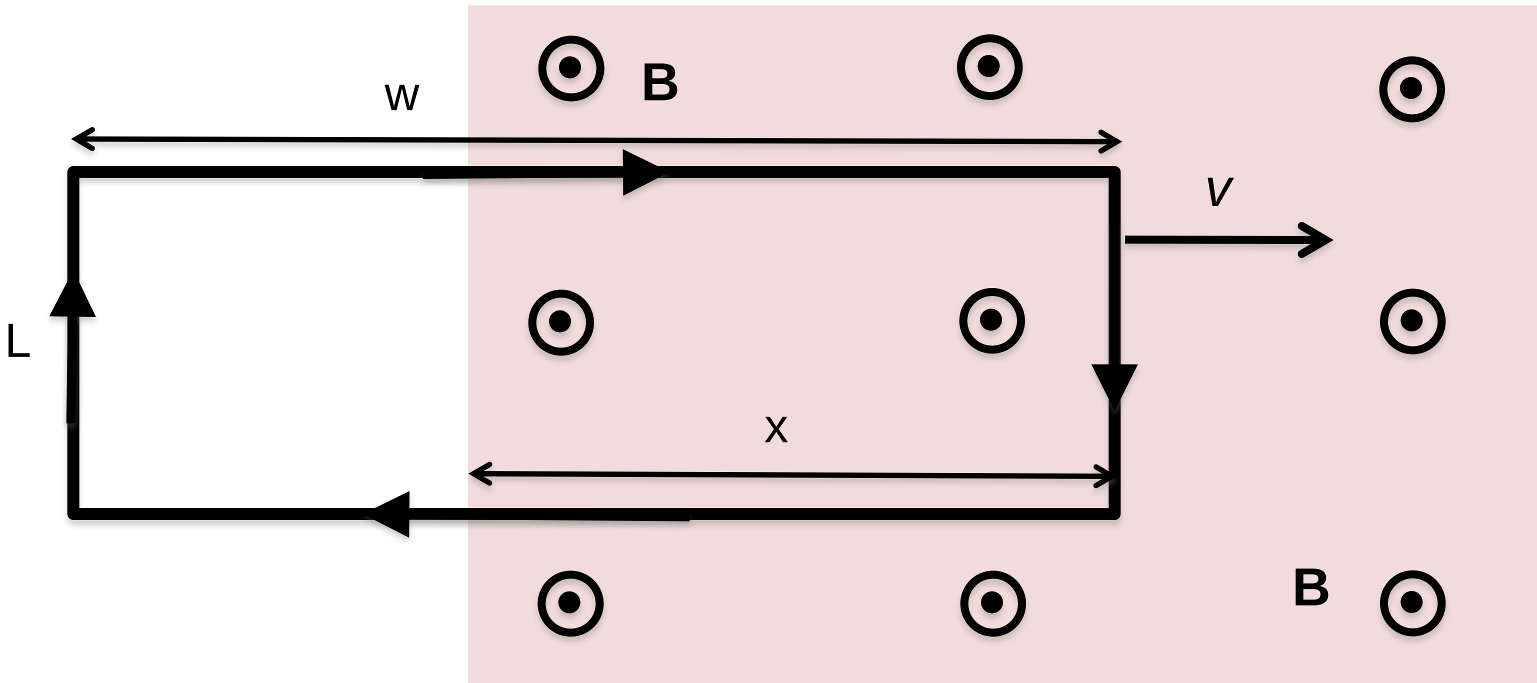
One end of rectangular metal loop enters a region of constant uniform magnetic field **B,** with constant speed *v,* as shown. What direction is the net force on the loop?



A. Up the “screen” ↑
B. Down the “screen” ↓
C. To the right →
D. To the left ←
E. The net force is zero

7.6

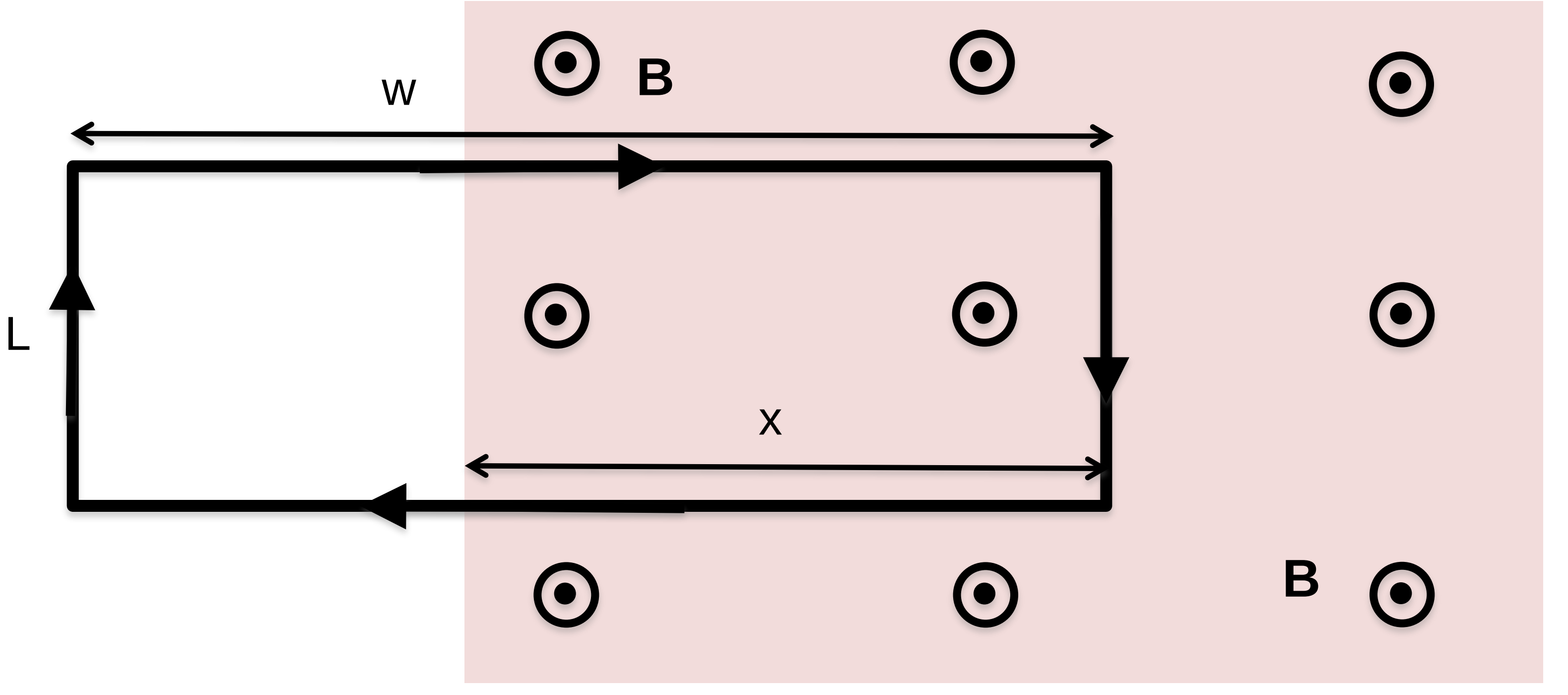
One end of rectangular metal loop enters a region of constant uniform magnetic field **B,** with constant speed *v,* as shown. What is the flux through the loop at the instant shown?



A. LwB
B. -LwB
C. LxB
D. -LxB
E. 0

7.7

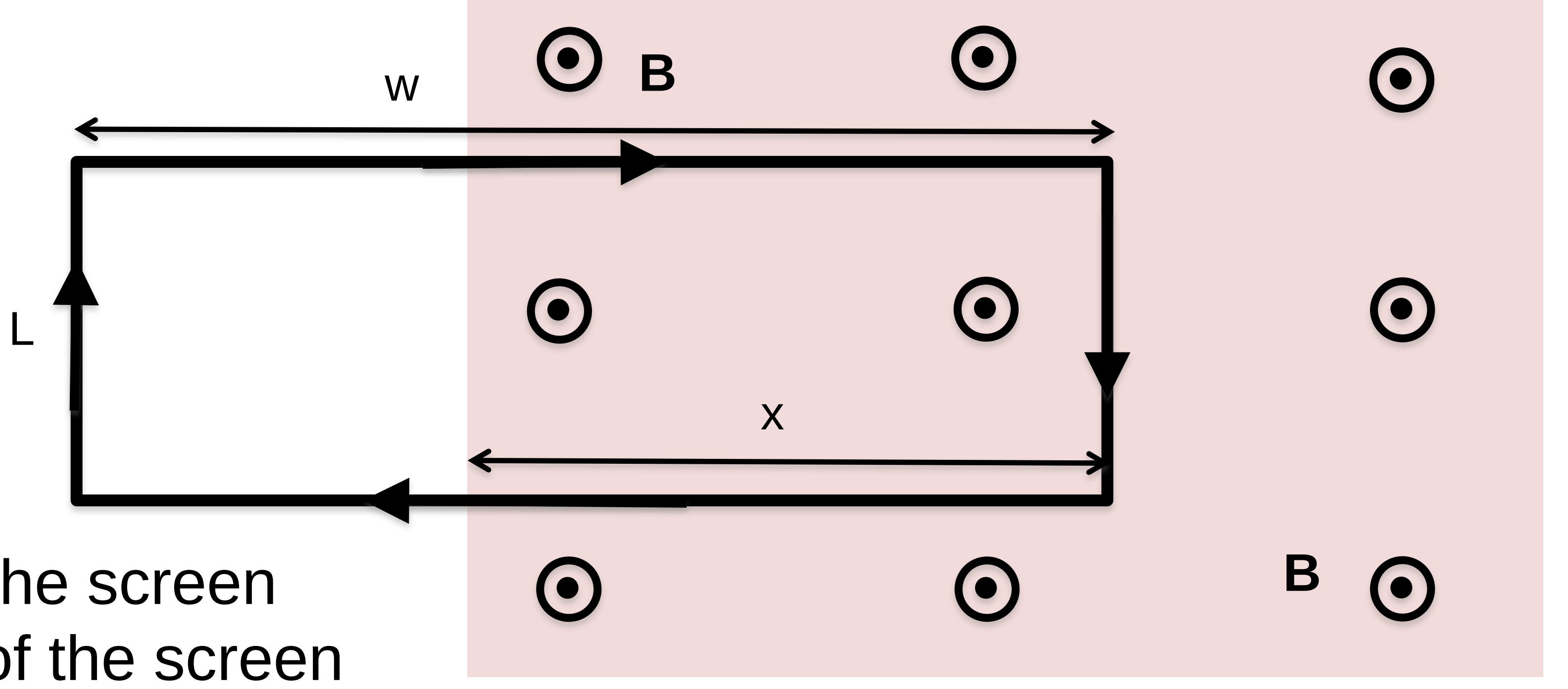
One end of stationary rectangular metal loop is in a region of uniform magnetic field **B**, which has magnitude B increasing with time as $B=B_0+kt$. What is the emf around the loop?



A. Lxk
B. -Lxk
C. LxB_0
D. $-LxB_0$
E. 0

7.8

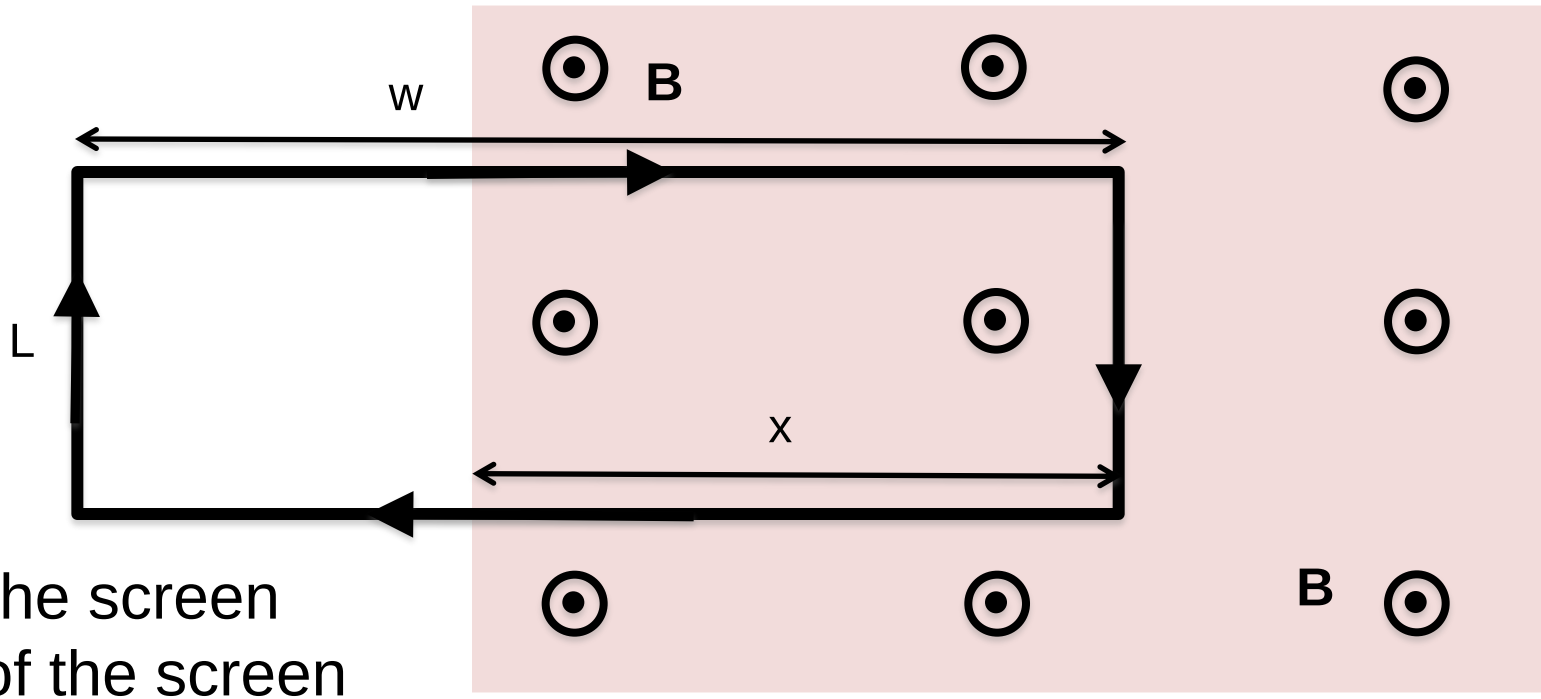
One end of stationary rectangular metal loop is in a region of uniform magnetic field **B**, which has magnitude B increasing with time as $B=B_0+kt$. What is the direction of the field $\mathbf{B}_{\mathbf{ind}}$ created by the induced current in the loop, in the plane region inside the loop?



A. Into the screen
B. Out of the screen
C. To the left
D. To the right
E. Not enough information

7.9

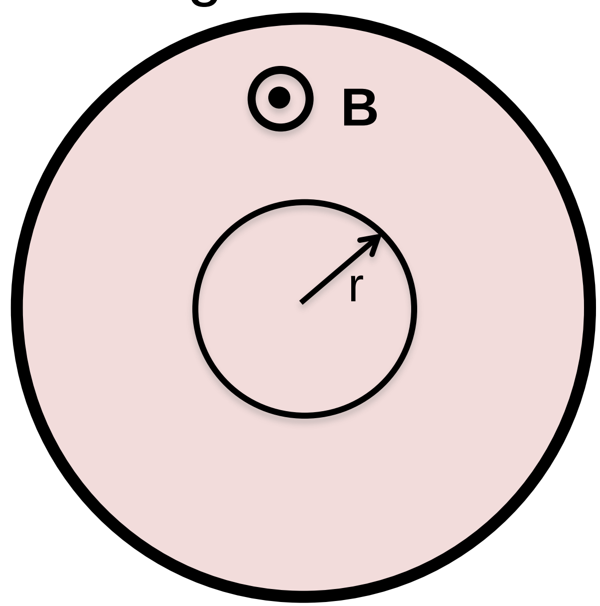
One end of stationary rectangular metal loop is in a region of uniform magnetic field **B**, which has magnitude B *decreasing* with time as $B=B_0-kt$. What is the direction of the field $\mathbf{B}_{\mathbf{ind}}$ created by the induced current in the loop, in the plane region inside the loop?



A. Into the screen
B. Out of the screen
C. To the left
D. To the right
E. Not enough information

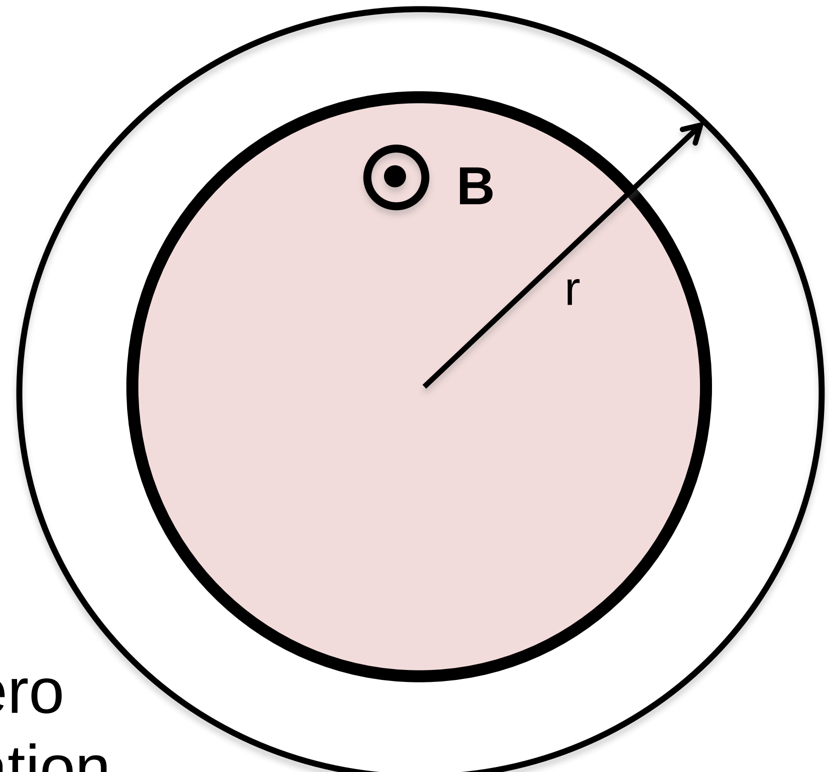
7.10

The current in an infinite solenoid with uniform magnetic field **B** inside is increasing so that the magnitude B in increasing with time as $B=B_0+kt$. A small circular loop of radius r is placed coaxially inside the solenoid as shown. Without calculating anything,
determine the direction of the field $\mathbf{B}_{\mathbf{ind}}$ created by the induced current in the loop, in the plane region inside the loop?



A. Into the screen
B. Out of the screen
C. CW
D. CCW
E. Not enough information

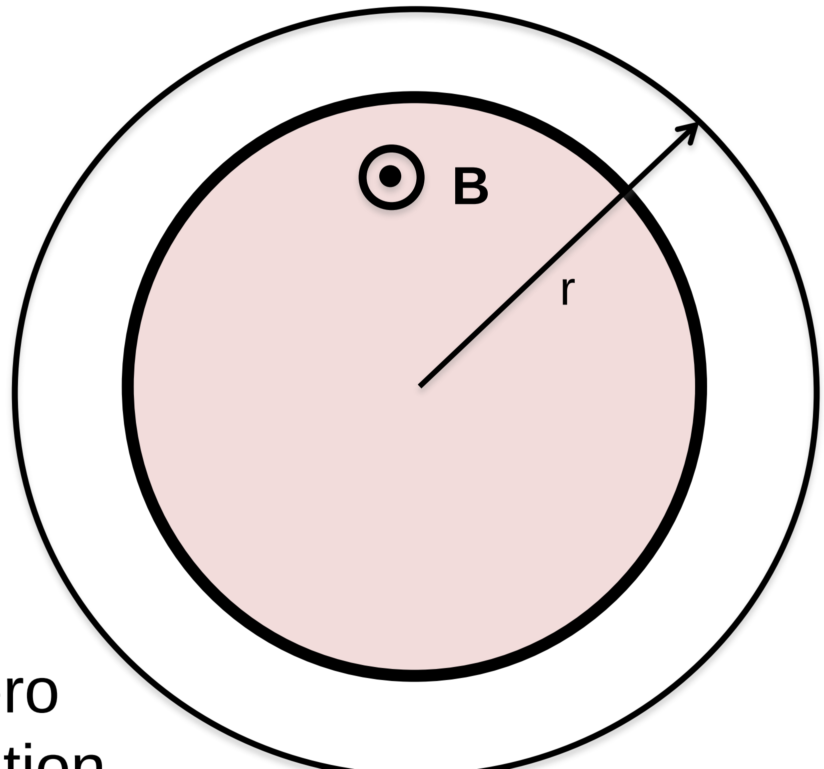
The current in an infinite solenoid with uniform magnetic field **B** inside is increasing so that the magnitude B in increasing with time as $B=B_0+kt$. A circular loop of radius r is placed coaxially outside the solenoid as shown. In what direction is the induced **E** field around the loop?



A. CW
B. CCW
C. The induced E is zero
D. Not enough information

7.12

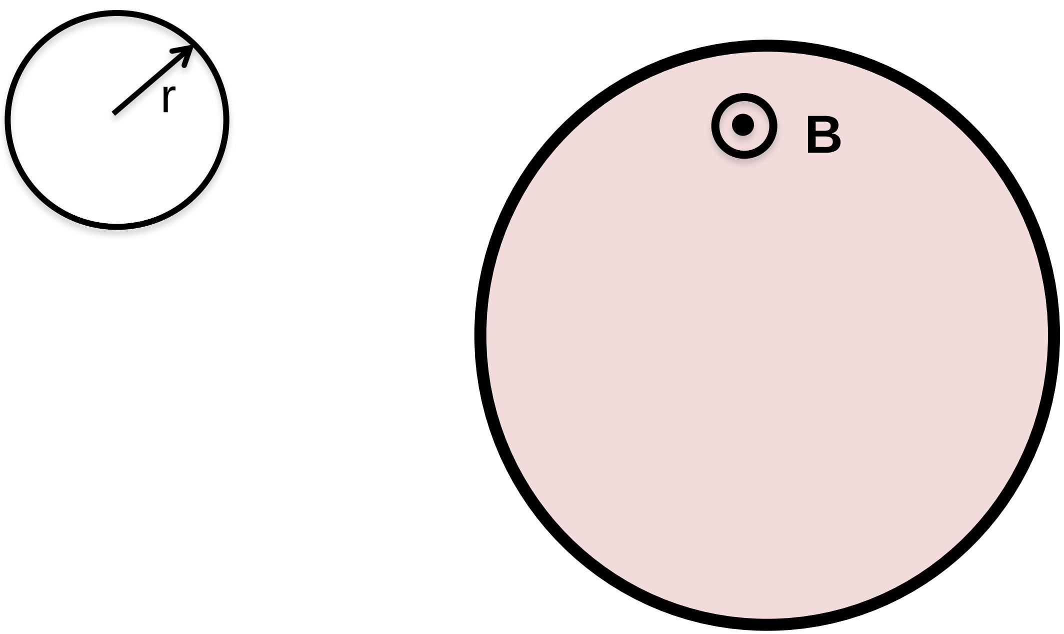
The current in an infinite solenoid with uniform magnetic field **B** inside is increasing so that the magnitude B in increasing with time as $B=B_0+kt$. A circular loop of radius r is placed coaxially outside the solenoid as shown. Without calculating anything, determine the direction of the field $\mathbf{B_{ind}}$ created by the induced current in the loop, in the plane region inside the loop?



A. Into the screen
B. Out of the screen
C. The induced B is zero
D. Not enough information

7.13

The current in an infinite solenoid with uniform magnetic field **B** inside is increasing so that the magnitude B in increasing with time as $B=B_0+kt$. A small circular loop of radius r is placed outside the solenoid as shown. What is the emf around the small loop?



A. $k\pi r^2$
B. $-k\pi r^2$
C. Zero
D. Nonzero, but need more information for value
E. Not enough information to tell if zero or non-zero

7.1 Consider two situations:

1) loop moves right at velocity V(loop), and

2) magnet moves left, V(mag).

Assuming |V(loop)| = |V(mag)|, what will the ammeter read in each case?

(Call CW current positive)

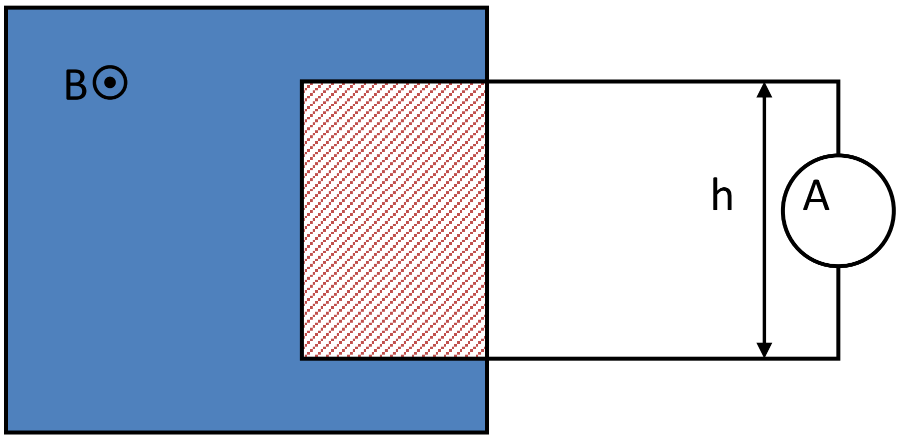
A) $I_1 > 0, I_2 = 0$

B) $I_1 < 0, I_2 = 0$

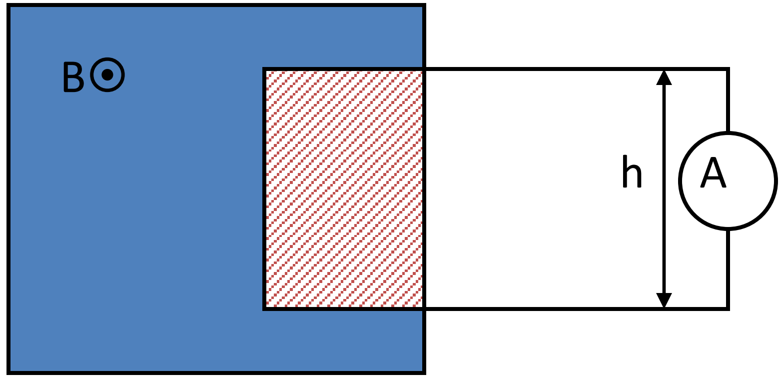
C) $I_1 = I_2$

D) $I_1 = -I_2$

E) $I_1 = 0, I_2 = 0$ (special case)



7.1
b



Ans: C) $I_1 = I_2$

The same result! But different physical situations are physically:

A) the same
B) equivalent
C) different