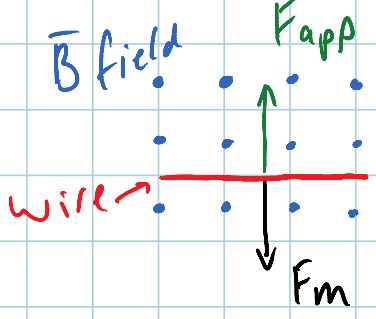
Lenz's Law

Wednesday, June 05, 2013
10:41 AM

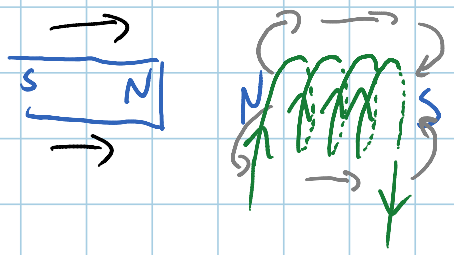
Current Direction: The induced current flows in the wire in a direction that's results in a magnetic field or force, that is equal to but opposite to direction of the applied field or force

$F_m = -F_{app}$

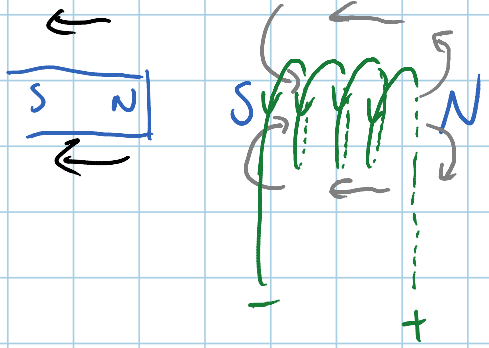


Current flows to the right
Electrons flow to the left
left side becomes negatively charge
right side becomes positively charged

Solenoid : bar magnet



For a solenoid, the induced current produces a magnetic field that opposes the motion of the bar magnet.



Lenz Law

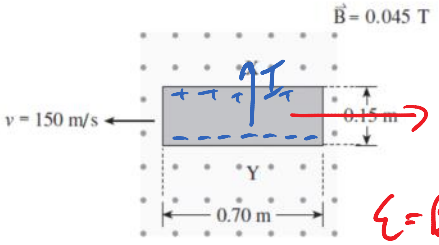
PHYSICS 12

NAME: _____

Lenz's Law

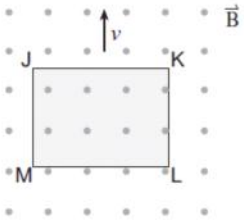
1. A solid conductor travels at 150 m/s across a uniform 0.045 T magnetic field. Which side is positively charged and what is the emf across this block?

	POSITIVE SIDE	EMF
A.	X ✓	1.0 V
B.	X ✓	4.7 V
C.	Y	1.0 V
D.	Y	4.7 V



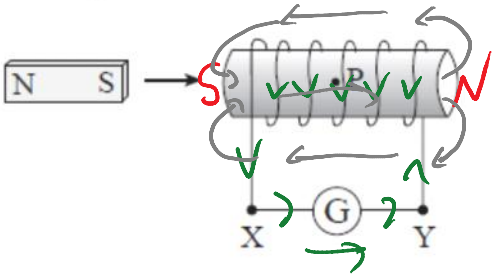
2. A metal block moves with a constant speed in a uniform magnetic field. Which side of the block is positive?

A. JK
B. KL
C. LM
D. MJ



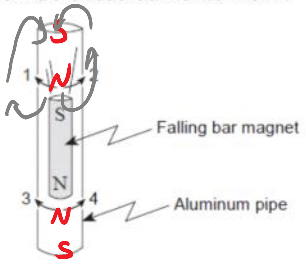
3. A bar magnet is moving toward a solenoid. What is the direction of the current through the galvanometer and what is the direction of the magnetic field produced by this current at location P inside the solenoid?

	DIRECTION OF THE CURRENT THROUGH THE GALVANOMETER	DIRECTION OF THE MAGNETIC FIELD AT P
A.	From X to Y ✓	Right ✓
B.	From X to Y ✓	Left
C.	From Y to X	Right
D.	From Y to X	Left



4. The diagram shows a bar magnet falling through an aluminum pipe. Electric currents are induced in the pipe immediately above and below the falling magnet. In which direction do these currents flow?

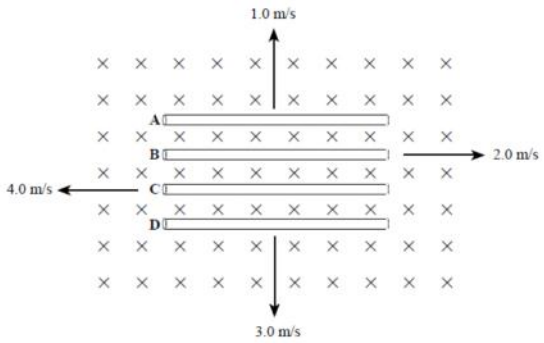
	ABOVE THE MAGNET	BELOW THE MAGNET
A.	1	3
B.	1 ✓	4 ✓
C.	2	3
D.	2	4



5. A square coil is perpendicular to a uniform magnetic field. Which one of the following would **increase** the magnetic flux through the coil?
   A. Decreasing the area of the coil.
   B. Increasing the number of loops in the coil.
   C. Removing the coil from the magnetic field.
   D. Increasing the strength of the magnetic field.

6. A coil of wire of area 1.5 x 10^{-3} m^2 consists of 40 loops. A magnetic field is perpendicular to the face of the coil. In a period of 0.20 s the strength of the magnetic field decreases from 0.060 T to 0.050 T in the same direction. What is the average emf induced in the coil during this time?
   A. 7.5 x 10^{-5} V
   B. 1.5 x 10^{-3} V
   C. 3.0 x 10^{-3} V
   D. 3.3 x 10^{-2} V

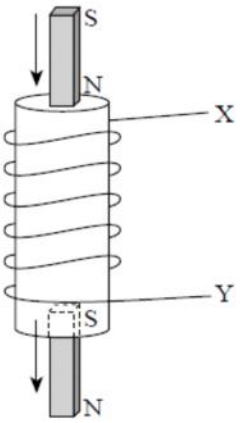
7. Four conductors of equal length are each moved through a uniform magnetic field in different directions and with different speeds, as shown. While the four conductors are being moved through the field, in which conductor will the largest potential difference be induced?
   A. Conductor A
   B. Conductor B
   C. Conductor C
   D. Conductor D



8. A 75-turn square coil of wire, 0.12 m on a side, is in a 4.5 ×10^{-2} T magnetic field. The field is perpendicular to the coil. If the coil of wire is removed from the field in 0.10 s, what average emf is induced in the coil?
   A. 6.5 ×10^{-3} V
   B. 1.2 ×10^{-1} V
   C. 2.4 ×10^{-1} V
   D. 4.9 ×10^{-1} V

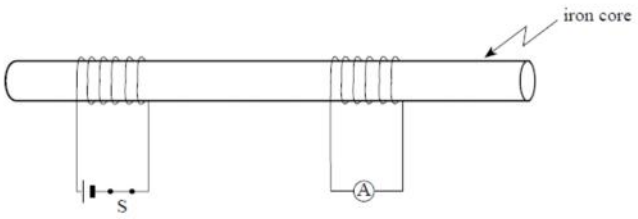
9. A bar magnet is dropped through a solenoid, as shown. What is the direction of the induced current in the solenoid as the magnet enters the top (i) and as the magnet leaves the bottom (ii)?

	(i) Enters Top	(ii) Leaves Bottom
A.	From X to Y	From X to Y
B.	From X to Y	From Y to X
C.	From Y to X	From Y to X
D.	From Y to X	From X to Y

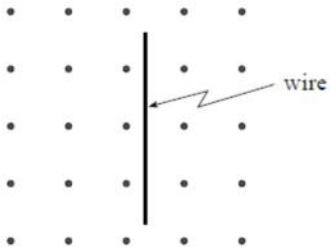


10. Which of the following is a statement of Lenz's law?
    A. The number of magnetic lines perpendicular to the surface area enclosed by a circuit is equal to the flux.
    B. An induced current in a closed conducting loop will appear in such a direction that it opposes the change that created it.
    C. An emf is produced between the ends of a straight wire when the wire is moving perpendicularly through a uniform magnetic field.
    D. The average emf induced in a circuit is proportional to the rate of change of the magnetic flux through that circuit.

11. In the following diagram, ammeter A shows a current
    A. while switch S remains closed.
    B. while switch S remains opened.
    C. only while switch S is being closed.
    D. while switch S is being opened or being closed.



12. A wire is in a magnetic field as shown. In which direction could the wire be moved to induce an emf across the length of the wire?
    A. to the left
    B. up the page
    C. into the page
    D. down the page



13. An emf is induced in a coil if the magnetic flux through the coil is
    A. zero.
    B. changing.
    C. constant and large.
    D. constant and small.

14. A coil of wire contains 55 loops. The coil is rotated such that the flux changes from 2.0×10^{-4} Wb to 8.0×10^{-4} Wb in 1.5×10^{-2} s. What is the average induced emf?
    A. 1.1 V
    B. 1.8 V
    C. 2.2 V
    D. 3.7 V

15. A coil of 150 turns and an area of 2.0×10^{-4} m^2 is placed in a 1.00 T magnetic field as shown in Diagram I. If this field changes to 0.45 T in 0.060 s, what is the average emf induced in the coil and in what direction does the induced current flow?

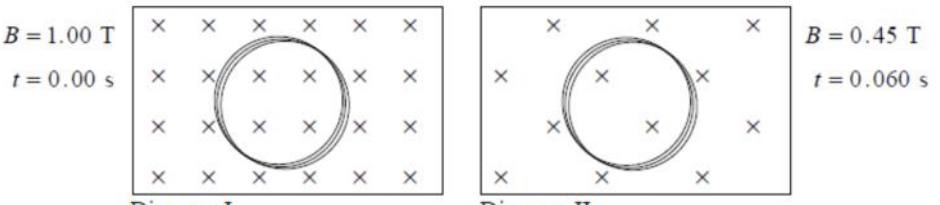


Diagram I Diagram II

	Induced Emf (V)	Current Direction
A.	0.28	Clockwise
B.	0.28	Counterclockwise
C.	0.36	Clockwise
D.	0.36	Counterclockwise

Answers:

1. **A**
2. **B**
3. **A**
4. **B**
5. **D**
6. **C**
7. **D**
8. **D**
9. **B**
10. **B**
11. **D**
12. **A**
13. **B**
14. **C**
15. **A**