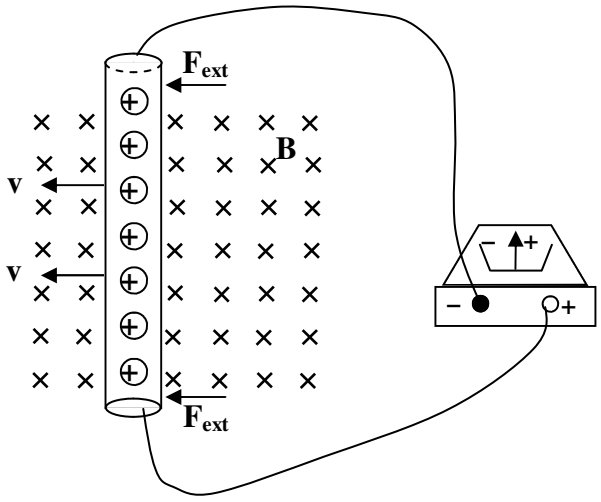
A-day: Due Mon., May 24
B-day: Due Tues, May 25

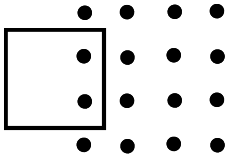
2009-10 PreAP Magnetism 4

Starting in your book on p.794

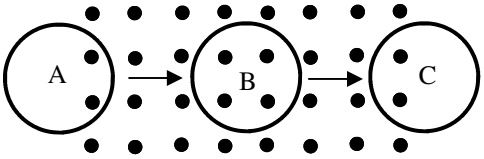
1. Define electromagnetic induction.



2. A wire is moved while inside a magnetic field, as shown at the right. Notice that the wire is NOT being moved by the magnetic force, but by an external force (by a person).
   A. What part of the RHR is the moving wire?
   B. Which direction will the magnetic force inside the wire?
   C. Which direction will the induced current flow inside the wire?
   D. If the wire is connected to a galvanometer as shown, will the galvanometer read positive or negative?
3. (*Bottom of p. 795*) When is the induced emf greatest: when the moving loop is perpendicular or parallel to the field?
4. (*Top of p.797)* Changing what causes induction?



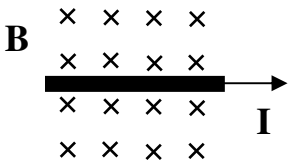
5. A square loop of wire is moving into a magnetic field.
   A. Which sides of the loop break magnetic field lines?
   B. Which sides of the loop will not experience a magnetic force?
   C. Remembering that the moving wire is the moving charge in the RHR, determine the direction of the induced current in the loop as it enters the field.



6. A circular loop of wire is move into, thru, and out of a magnetic field.
   A. When does the magnetic field strength change in the loop?
   B. When will there be no induced current?
   C. Use the RHR to determine the direction of $F_{magnetic}$ in each loop.

(p.804) Use the diagram at the bottom of the page to answer the following.

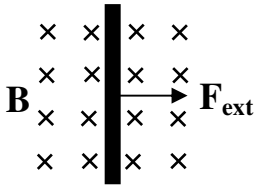
7. The loop of wire is turning in a magnetic field. In part A of the diagram notice that the wire loop is perpendicular to B.
   A. Is the loop breaking any field lines in part A?
   B. Is there any induced emf in part A?
   C. Is the loop breaking any field lines in part B?
   D. Is there any induced emf in part B?
   E. Using all of the pictures, does the magnitude of the emf change while the loop is rotated?
   F. Does the direction of the current change while it is rotated?
   G. What kind of current is being produced?
   H. How does the magnitude of the induced emf compare in pictures A and D?



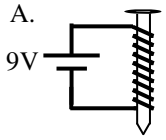
8. A battery causes the charges in the wire to move. The magnetic field is NOT from the wire (*it can't move itself*). If the charges move to the right, what direction will the wire be deflected (move)?

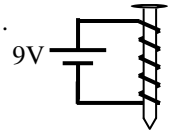
   In this case, the magnetic force (F_B) moves the wire. "I" is your thumb, "B" is your fingers, and your palm is the force (F_B).

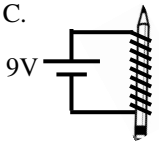
Q9

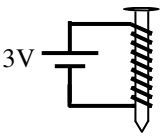


9. In this example the wire is pulled thru a magnetic field with an external force (*like my hands*) as shown at the left.
   A. Is the magnet moving the wire?
   So the moving wire is q for the right hand rule (your thumb).
   B. Find the direction of the force in the wire.
   This force (F_B) causes the charges to move in the wire, causing $I_{induced}$.

A. 

B. 

C. 

D. 

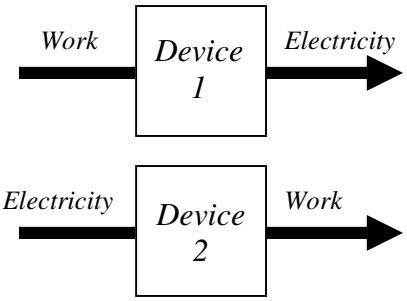
From the "Magnet" notes:

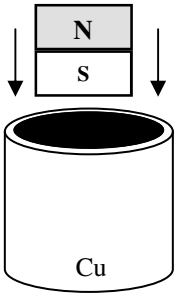
10. A. Which of the four electromagnets at the right is the strongest?

    B. Why?

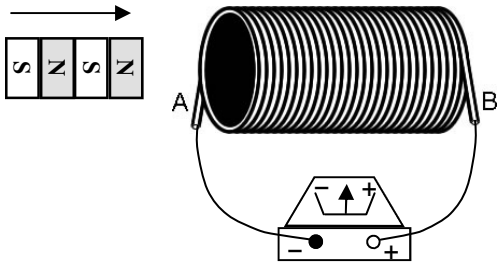
11. Motor, Generator, or Both?

A. ____ Creates electricity.
B. ____ Has loops of wire in it.
C. ____ Creates motion.
D. ____ Is turned by a force.
E. ____ Device 1 (at the right).
F. ____ Can make electricity.
G. ____ Used in a hydroelectric dam.
H. ____ Opens the windows in a car.
I. ____ Turns when electricity is applied .
J. ____ Device 2 (at the right).





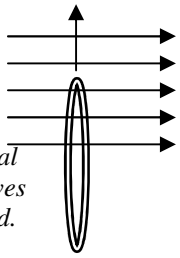
12. A magnet is dropped into a copper tube.
    A. Is the magnet attracted to the copper tube?
    You know that the magnet drops slowly thru the tube, so there must be a magnetic force opposing gravity.
    B. To keep the magnet from falling, which way must the induced magnet face?
    You should have chosen N faces down, so your thumb faces down with your fingers curled.
    C. To create this magnet which way is the induced current flowing in the tube (*as seen from above*)?

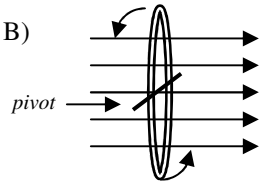


13. The north pole of a group of magnets is moved into a solenoid.
    A. When is there an induced current: when the magnets are moving into, moving out, or just sitting in the solenoid?
    So we know that current flows every time there is changing magnetic fields. This induced current wants to oppose any change of B.
    B. Since the induced current wants to oppose a change of magnetic field, which side of the solenoid will be its North?
    C. Looking from the left, will the induced current be moving clockwise or counterclockwise in the loops?
    D. Will the induced current cause the galvanometer to read positive or negative?

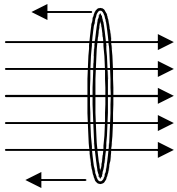
Remember: current is induced if there is a change of magnetic field in the loop of wire.

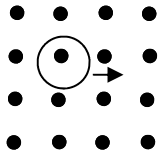
14. For each of the following instances, decide if there will be an induced current in the wire loop.

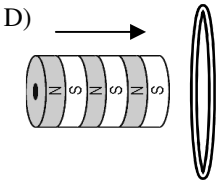
A) 
A vertical loop moves into field.

B) 

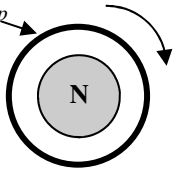
Spin the loop around the pivot.

C) 
Move the loop to the left.

D) 
Move the loop while completely inside the field.

D) 

Move the magnets into the loop

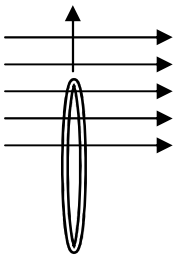
F) 

Spin the loop around a magnet

G)

You should have chosen: A, B, D, and G. For choices C, D, and F there is no change of B (mag field) inside the loop.

Now let's learn how to find the direction of the induced current.

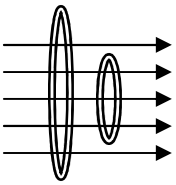


15. A. As the loop moves into the magnetic field, is B increasing or decreasing in the loop?

So $I_{induced}$ must oppose the change by making a north to the left.

B. As seen from the left, which direction must $I_{induced}$ be flowing in the loop?

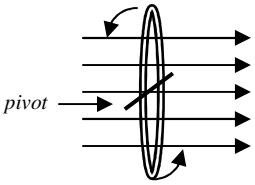
$I_{induced}$ will be CCW as seen from the left.



16. A. As the loop shrinks, does B (the magnetic field) inside the loop increase or decrease?

B. So the $I_{induced}$ opposes the change, making a magnetic field point left or right?

C. As seen from the left, give the direction of the induced current in the loop.



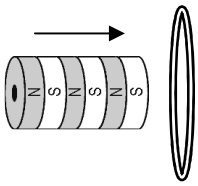
17. A wire loop is rotated CCW in a magnetic field.

A. When it is vertical, is the end of the loop moving parallel or perpendicular to the field?

B. Is the emf (induced voltage) a max or a min at this position?

C. As it turns CCW from vertical to horizontal, is B increasing or decreasing in the loop?

D. From the left, determine the direction of $I_{induced}$ in the loop.



18. A stack of magnets is moved into a wire loop.

A. To resist the magnet, the loop will make a magnet with the north pointing left or right?

B. From the left, which direction is $I_{induced}$ flowing in the loop?

19. The diagram at the left shows a loop of wire moving inside a horseshoe magnet. The loop rotates clockwise around the pivot.

A. Which direction does the magnetic field point?

B. When does the rotating loop cut more magnetic field lines, when it is horizontal or vertical?

C. When does the loop create a stronger emf (voltage), when horizontal or vertical?

D. Remembering that the wire is your thumb, which side will the induced current flow: out point T or point S? (*You can either use the right hand rule on either side of the loop OR the idea of changing magnetic field.*)

E. During an entire rotation (360º) will the moving loop produce AC or DC voltage (emf)?