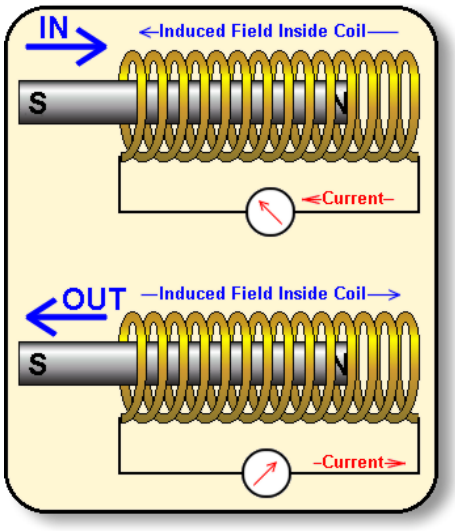
Name: _____ Phys 12

6.6 Electromagnetic Induction part 1

If a moving electric charge can produce a magnetic field, can changing a magnetic field produce an electric field (current)? Michael Faraday was the first scientist to try this out.



When a magnet was moved in and out of the solenoid, what did you see?

A current was produced

When the magnet was moved in the other direction, the direction of the current _____reversed_____.

Was there a current when the magnet was moving through the solenoid at constant speed?

Not as much deflection

Through these experiments, Michael Faraday came up with his law of electromagnetic induction.

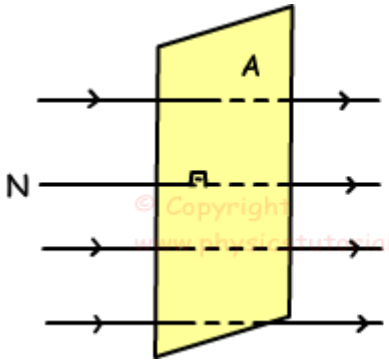
Faraday's Law: A change in the magnetic field around a coil of wire will produce an EMF in the coil, thus generating an electric current.

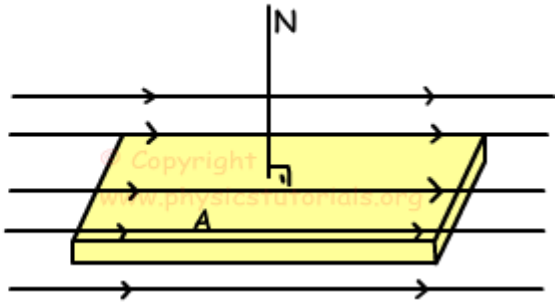
Lenz's Law helps us predict the direction of the current based on the motion of the magnet through the solenoid.

Lenz's Law states that the current induced in the circuit produces a magnetic field that opposes the change in magnetic field or **magnetic flux**.

Recall, **magnetic flux:** is the # of field lines that pass through a cross sectional area.

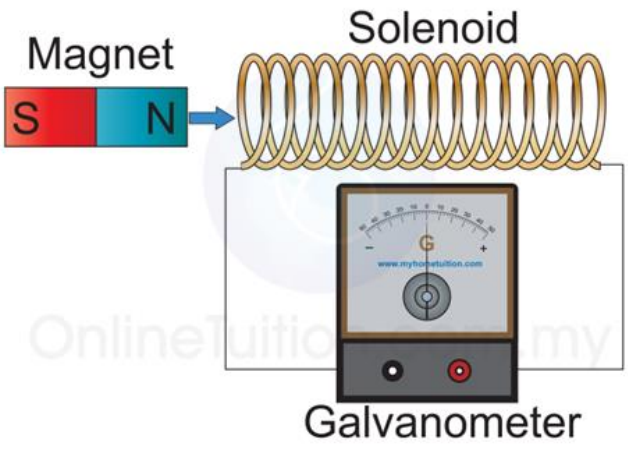
For a solenoid, that would be circle enclosed by the loops.





To determine the direction of the current in your solenoid (or any coil of wire), we will use the **2nd Right Hand Rule.** (Thumb: North; Fingers: Current)

Ex. Find the direction of the current in the following example:



Magnetic field increases towards the:

Current was to produce magnetic field countering the above direction:

$\vec{B}$ field increasing towards the right
∴ need $\vec{B}$ field to the left.

Therefore, using the 2nd Right Hand Rule will yield a current going:

clockwise around circuit

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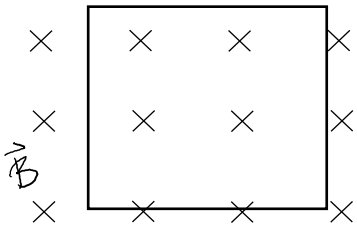
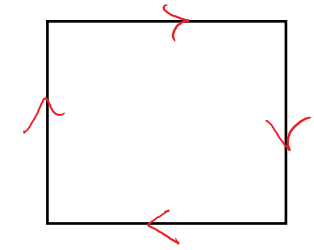
Below are examples where you're given an initial state then a final state. Determine in which direction is the magnetic field changing to help you deduce the direction of the current. The first example is done for you.

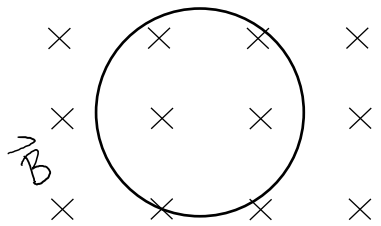
Initial Final

1) 

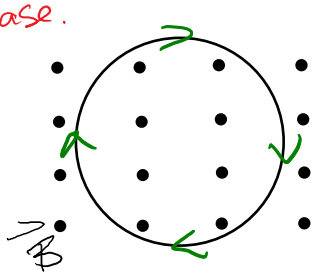
$\vec{B}$ field decreases going into page ∴ need induced current producing $\vec{B}$-field going into page to counter this decrease.

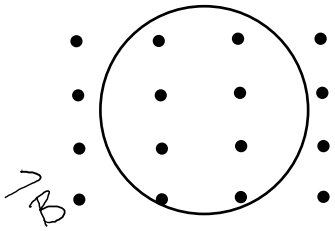
2nd RHR



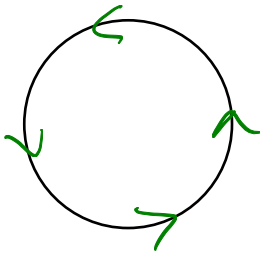
2) 

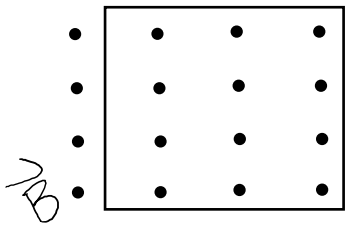
$\vec{B}$ field increasing out of page ∴ need $\vec{B}$ field into page

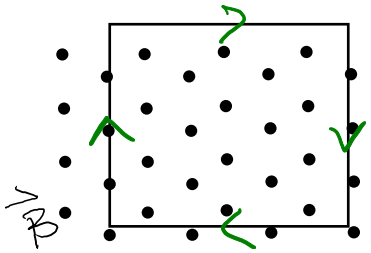


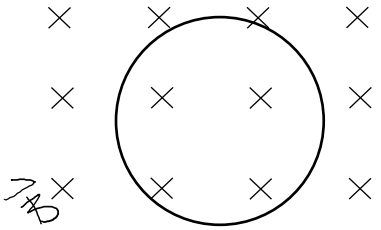
3) 

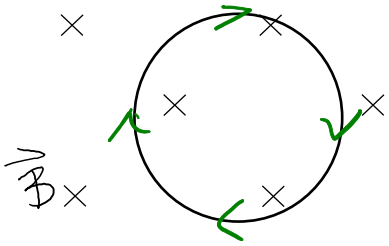
$\vec{B}$ field decreasing out of page ∴ need $\vec{B}$ field out of page



4) 



5) 



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