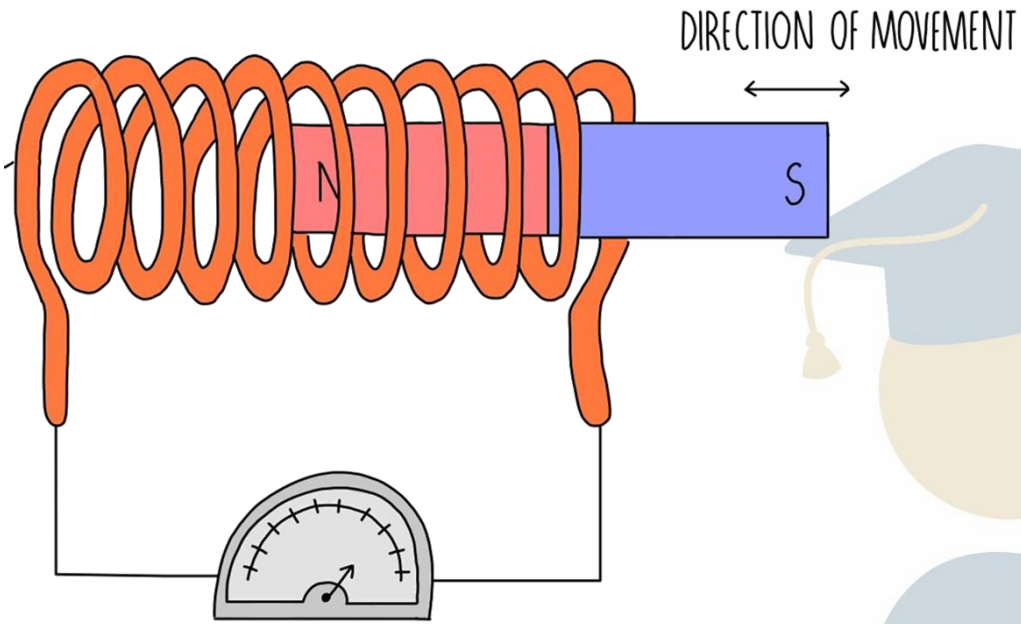
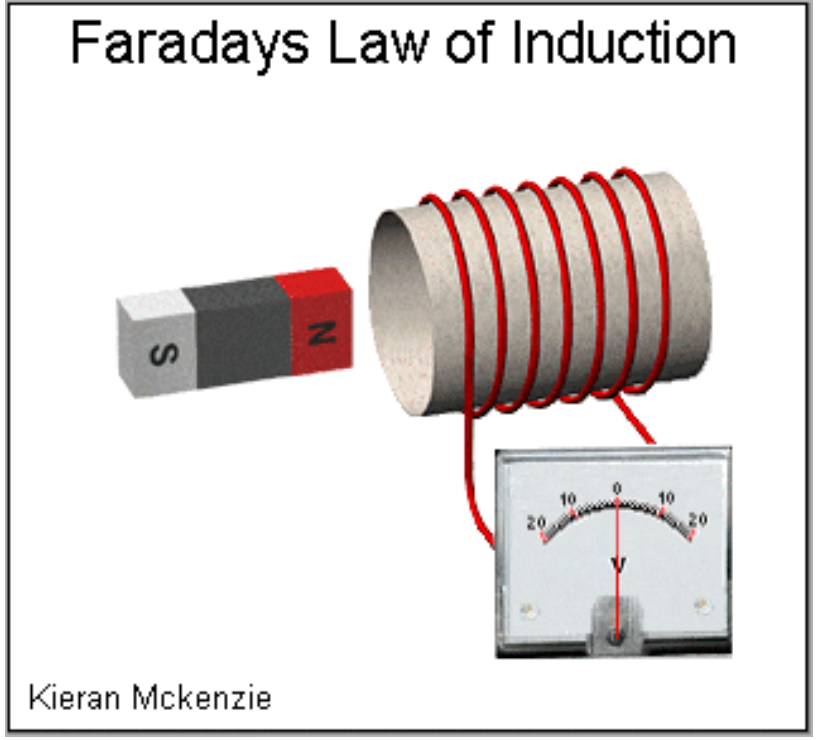



# Physics – Grade 12 LS & GS

# Unit Two – Electricity

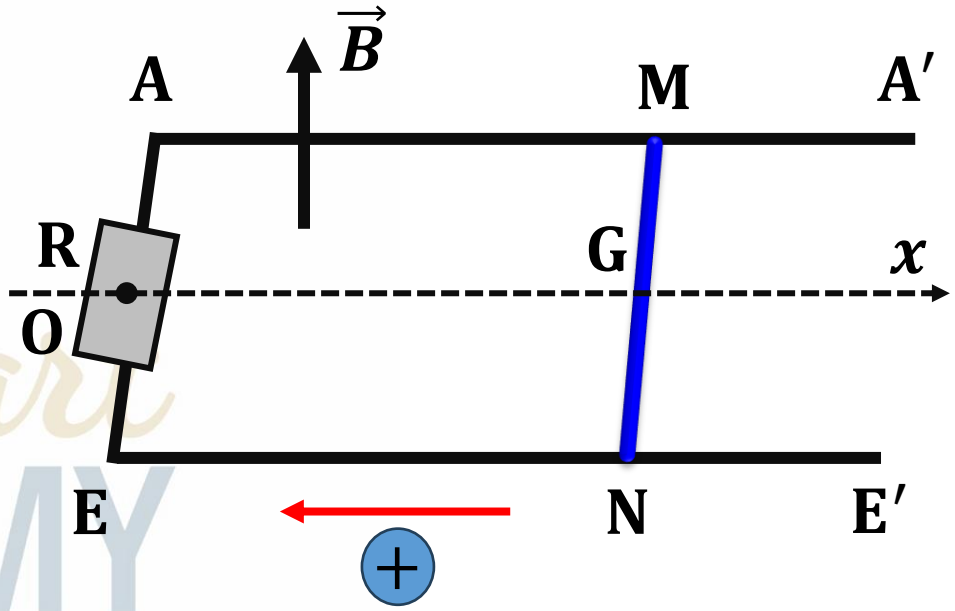
# Chapter8 – Electromagnetic Induction

# Quiz Electromagnetic induction

A metal rod MN, of length $l = 60cm$ and of negligible resistance, can move without friction on two horizontal parallel, rectilinear and very long rails, $AA'$ and $EE'$, of negligible resistances.

During its motion, the rod remains perpendicular to the rails.

A resistor of resistance $R = 100\Omega$ is connected to the two rails as shown in the adjacent figure.



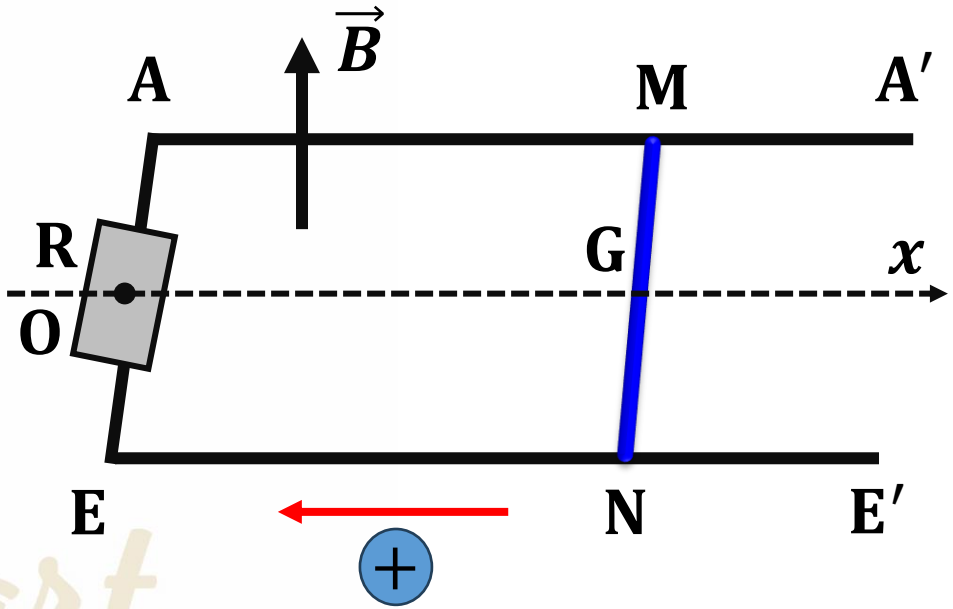
# Quiz Electromagnetic induction

**The set is placed in a uniform vertical ascending magnetic field $\vec{B}$ of intensity $B = 1.2T$.**

**At time $t_0 = 0$. the center of gravity G of the rod is at O.**

**A suitable device imposes on the rod a uniform translational motion, from left to right, of speed $v = 50cm/s$.**

**At an instant t, the abscissa of G is $x = \overline{OG}$.**

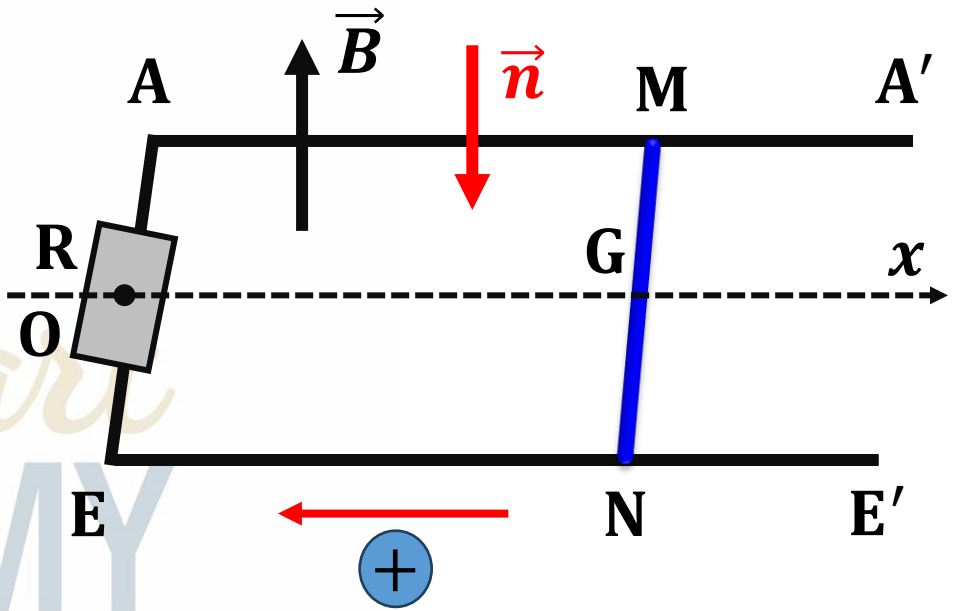


# Quiz Electromagnetic induction

1. **Determine the expression of the magnetic flux crosses the surface AMNE as a function of B, L, v and t, respecting the positive direction indicated on the figure.**

$$\emptyset = NBScos(\vec{n}, \vec{B})$$

$$\emptyset = 1 \times B \times (L \times x)cos(180)$$




**The speed is constant then:**

$$x = Vt + x_0 \Rightarrow x = Vt$$

$$\emptyset = -B \times (L \times Vt)$$

$$\emptyset = -BLVt$$

**2. Explain the appearance of an induced e.m.f between the terminals M and N of the rod and show that $e = 0.36V$.**

**The magnetic flux (∅) is variable, because of the rotation of the coil around the axis then:**

**The induced e.m.f "e" exist during the rotation of (C).**

$$e = -\frac{d\emptyset}{dt} \Rightarrow e = -\frac{d(-BLVt)}{dt} \Rightarrow e = +BLV$$

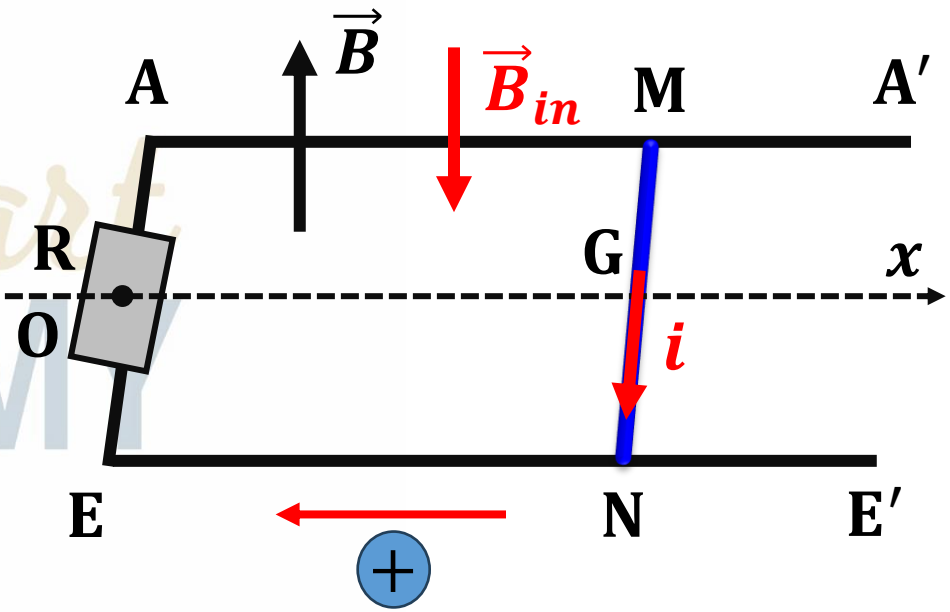
$$e = 1.2 \times 0.6 \times (50 \times 10^{-2}) \Rightarrow e = 0.36V$$

**3. An induced current $i$ passes through the circuit. State Lenz's law and determine the direction of this current.**

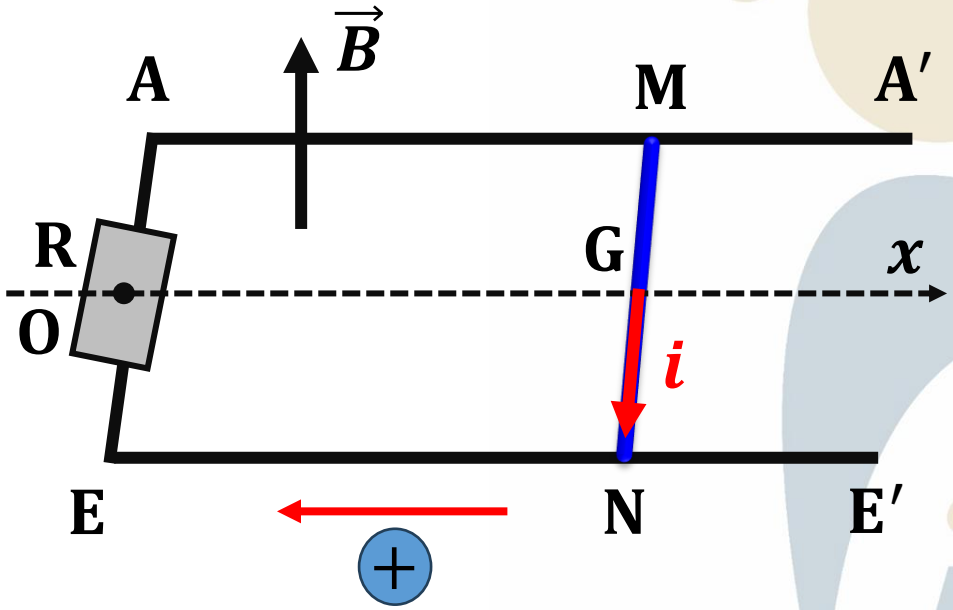
**Lenz's law: The induced current $i$ generates an induced magnetic field $\vec{B}_{in}$ that opposes by a changing magnetic field $\vec{B}$ since the magnetic flux is variable.**

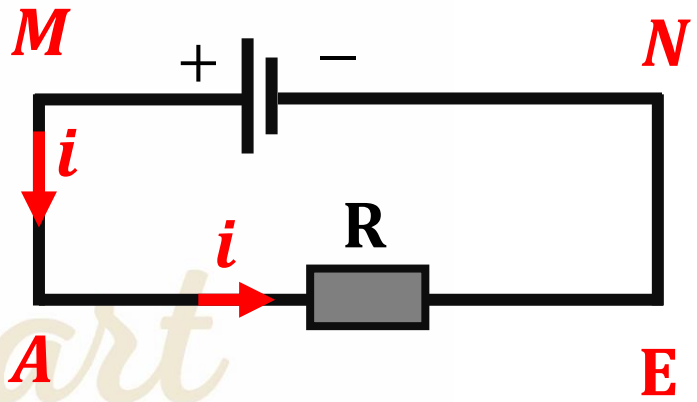
**The area (S) increases then the flux increases so $\vec{B}_{in}$ is opposite to $\vec{B}$.**

**By R.H.R $i$ flow from M to N**



4. Make the diagram showing the equivalent generator between M and N specifying its positive terminal.



5. Calculate the intensity of the current flowing through the circuit.

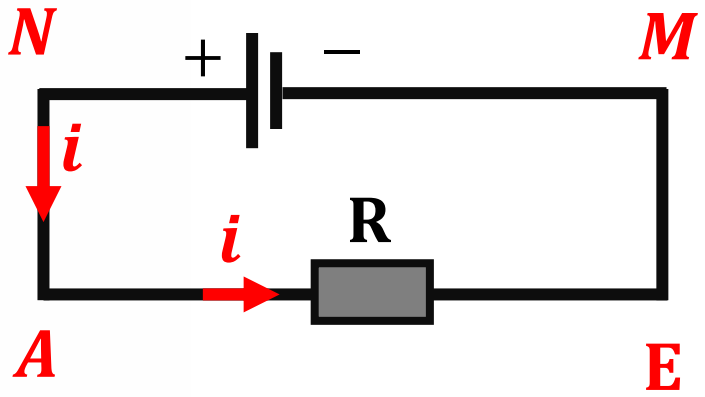
$$i = \frac{e}{R} \Rightarrow i = \frac{0.36}{100} \Rightarrow i = 3.6 \times 10^{-3} A$$

6. Calculate the voltage $u_{AE}$

$$u_{AE} = R \times I$$

$$u_{AE} = 100 \times 3.6 \times 10^{-3}$$

$$u_{AE} = 0.36V$$



# The End