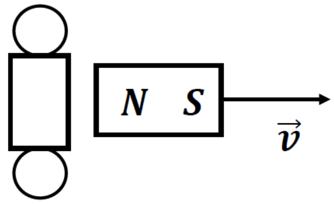
Quiz Average 6.6 **Quiz High Score** 10

PH 202 **Quiz # 07 (10 pts)** **Name** **Solution**

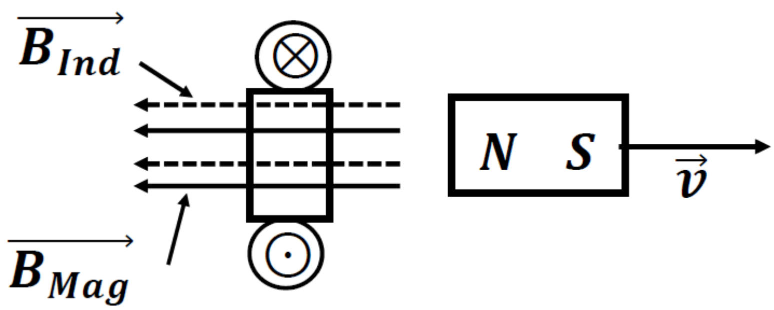


A simple bar magnet as shown above is being pulled away from a coil. The coil is pictured above as the rectangle to represent the cross-sectional area of the opening inside the coil of wire. The two circles above and below are the wires going around the open area. The coil is being cut in half by the paper. Half lies in front of the paper and half lies behind the paper. The magnet is being pulled from the opening of the coil. Will there be a current induced in the coil due to the bar magnet's motion? If so will the current at the top of the coil be coming out of the paper, or going into the paper?

A. No Current will be induced

B. At the top, current will come out of the paper

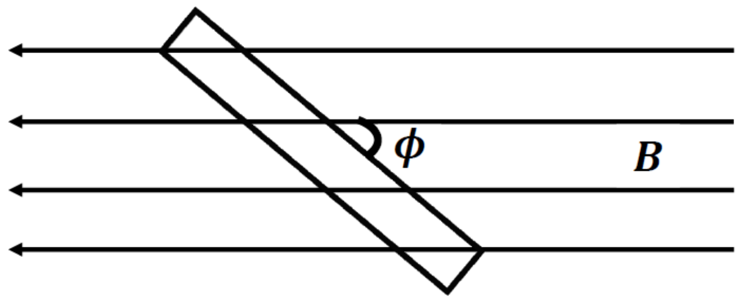
C. At the top, current will go into the paper



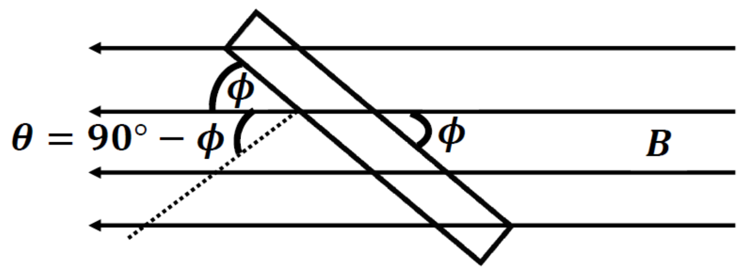
Because of the bar magnet, the magnetic field in the coil is initially pointing from the North pole or to the left. With the bar magnet, moving away from the coil, the field strength is decreasing. The magnetic flux is therefore decreasing. To oppose the change in magnetic flux, the induced magnetic field must go to the left to strengthen the decreasing magnetic flux. To create an induced magnetic field to the left, the current must go into the paper at the top of the coil!

So, the correct answer is C !

A circular coil is shown from the side in the figure below. The coil is going into and out of the plane of the screen (paper) as shown. The area of the coil is $6.37 \text{ x } 10^{-2}\text{m}^2$. The number of turns of wire for the coil is 1548. The strength of the magnetic field is 5.86 T. The angle shown, $\phi = 29.6°$, is between the area face of the coil and the magnetic field $\vec{B}$. What is the magnetic flux passing through the coil?



A.	$\mathbf{1.84 \text{ x } 10^{-1} \text{ T m}^2}$	**C.**	$5.78 \text{ x } 10^{2} \text{ T m}^2$
B.	$3.25 \text{ x } 10^{-1} \text{ T m}^2$	**D.**	$2.85 \text{ x } 10^{2} \text{ T m}^2$



Magnetic Flux is given by:

$$\Phi_B = \vec{B} \cdot \vec{A} = BA\cos(\theta) = BA\cos(90° - \phi)$$

ϕ is not the angle the flux, so we have to get θ which is related to ϕ as shown in the diagram.

$$\Phi_B = BA\cos(90° - \phi) = (5.86\ T)(6.37 \text{ x } 10^{-2} m^2)\cos(90° - 29.6°)$$

$$\Phi_B = (5.86\ T)(6.37 \text{ x } 10^{-2} m^2)\cos(90° - 29.6°) = (0.3733\ \ T\,m^2)\cos(60.4°)$$

$$\Phi_B = (0.3733\ \ T\,m^2)\cos(60.4°) = 1.844 \text{ x } 10^{-1}\ T\,m^2$$

So, the correct answer is A !

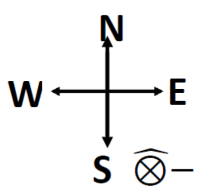
A Lear Jet model 60XR has a wingspan of 13.34 m. It is flying due West at an altitude of $1348.$ m with a cruising speed of $216.4\ {}^{m}/_{s}$. The vertical component of the Earth's magnetic field is given by $\overrightarrow{B_{Vertical}} = 8.87 \text{ x } 10^{-5}\ T\ (\widehat{Down})$. What is the potential difference between the northern most tip of one wing to the southern most tip of the other wing? Which one is more positive?

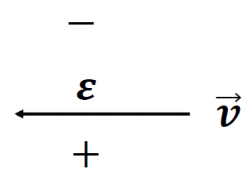
A. 0.256 V, Northern Tip is Positive

B. **0.256 V, Southern Tip is Positive**

C. 25.9 V, Northern Tip is Positive

D. 25.9 V, Southern Tip is Positive





$\widehat{\otimes}$ – ***Into Ground*** $(\widehat{\boldsymbol{Down}})$

$\widehat{\odot}$ – ***Out of Ground*** $(\widehat{\boldsymbol{Up}})$

The magnetic force can be written as

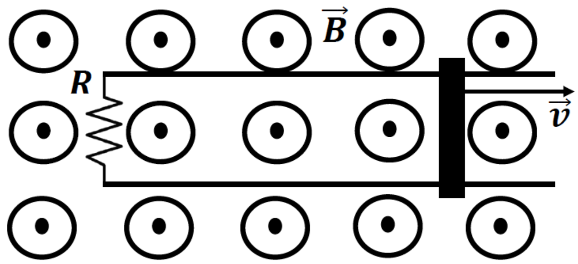
$$\overrightarrow{F_B} = Q\vec{v} \text{ x } \vec{B}$$

So, velocity is pointing West and the magnetic field is Down, so the cross product gives the force acting on a positive charge is pointing South! So, the Southernmost tip is more positive!

$$\varepsilon = BLv = (8.87 \text{ x } 10^{-5}\ T)(13.34\ m)(216.4\ {}^{m}/_{s}) = 0.256\ V$$

So, the correct answer is B !

As shown below a conductive bar $(\mathrm{L} = 0.854\ \mathrm{m})$ is sliding along conductive rails at a speed of $7.68\ ^{\mathrm{m}}/_{\mathrm{s}}\ (\widehat{\mathrm{Right}})$. The magnetic field is coming out of the page with a field strength of $\vec{\mathrm{B}} = 513.\mathrm{T}\ \widehat{\odot}$. The resistor has a value of $490.\Omega$. What is the magnitude and direction of the current induced in the resistor?



A. 0.146 A Down in Resistor

B. 6.87 A Down in Resistor

C. 0.146 A Up in Resistor

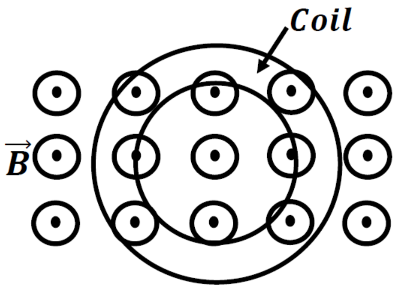
D. **6.87 A Up in Resistor**

$$\boldsymbol{i = \frac{\varepsilon}{R} = \frac{BLv}{R} = \frac{(513.T)(0.854\ m)(7.68\ ^{m}/_{s})}{490.\Omega} = \frac{3365.V}{490.\Omega} = 6.87\ A}$$

For the current direction, $\overrightarrow{F_B} = Q\vec{v}\ x\ \vec{B} = QvB(\widehat{Right}\ x\ \widehat{\odot}) = QvB\ \widehat{Down}$ So positive charges are pushed to the bottom of the rod and the current then will go clockwise! Alternatively, the Magnetic flux is increasing since the area is increasing. To oppose the change, need the induced Magnetic field going into the paper which requires a clockwise current to create that magnetic field.

A clockwise current is going through the resistor upwards!

So, the correct answer is D !



A circular coil is shown on the left. The coil has 1040 turns of wire around it. It has an area of $0.137\ \mathrm{m}^2$. A magnetic field is coming from the behind the page through the coil as indicated. The magnetic field strength is changed from $400.\ \mathrm{T}$ to $625.\ \mathrm{T}$. This results in an emf of 951.3 V being induced across the coil. How much time passed while the magnetic field was decreasing?

A. **33.7 s** **B.** 0.0324 s **C.** 59.9 s **D.** 93.6 s

$$\varepsilon = -N\frac{\Delta\Phi_B}{\Delta t} = -N\frac{\Delta(BA\ \cos(0°))}{\Delta t} = -NA\frac{\Delta B}{\Delta t}$$

The minus sign can be dropped as it is for directions which we are not interested in for this problem. Solving for time:

$$\Delta t = NA\frac{\Delta B}{\varepsilon} = \frac{(1040)(0.137\ m^2)(625.T - 400.T)}{951.3\ V} = \frac{(142.5\ m^2)(225.T)}{951.3\ V}$$

$$\Delta t = \frac{3.206\ x\ 10^4\ Tm^2}{951.3\ V} = 33.7\ s$$

So, the correct answer is A !

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