PHYS 102: General Physics 2 **KOÇ UNIVERSITY** **Fall Semestre 2015**

College of Sciences

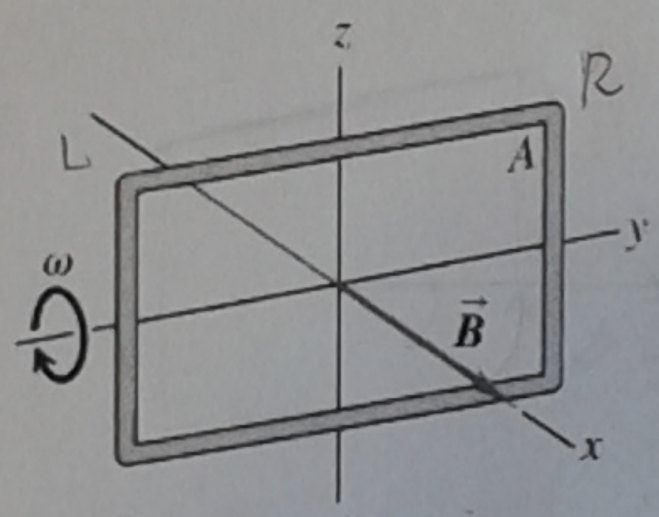
Section 3 **Quiz 10** **04 December 2015**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

Suppose the loop in the figure below is
a) rotated about the y-axis;
b) rotated about the x-axis;
c) rotated about an edge parallel to the z-axis.

What is the maximum induced emf in each case if $A = 600\ cm^2$, $\omega = 35.0 rad/s$, $B = 0.450T$?



a) $\mathcal{E} = -\frac{d\Phi_B}{dt} = -\frac{d}{dt}\left((B\hat{x})\cdot(A\hat{n})\right) = -\frac{d}{dt}(BA\cos\omega t) =$

$= BA\omega \sin\omega t$

$\Rightarrow \mathcal{E}_{max} = BA\omega = (0.45\,T)\cdot(600\cdot 10^{-4}\,m^2)\cdot(35\,rad/s) =$

$= 0.945\ Tm^2/s$ //

b) $\mathcal{E} = -\frac{d}{dt}\left((B\hat{x})\cdot(A\hat{n})\right) = -\frac{d}{dt}(BA\cos 0^\circ) = 0$ //

c) Let the loop to rotate about the right (R) edge parallel to the z-axis. This case is the same as in a)

$\mathcal{E} = -\frac{d}{dt}\left((B\hat{x})\cdot(A\hat{n})\right) = -\frac{d}{dt}(BA\cos\omega t) =$

$= BA\omega \sin\omega t$

$\mathcal{E}_{max} = BA\omega = 0.945\ Tm^2/s$ //

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Section 2 **Quiz 10** **04 December 2015**

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Quiz duration: 10 minutes

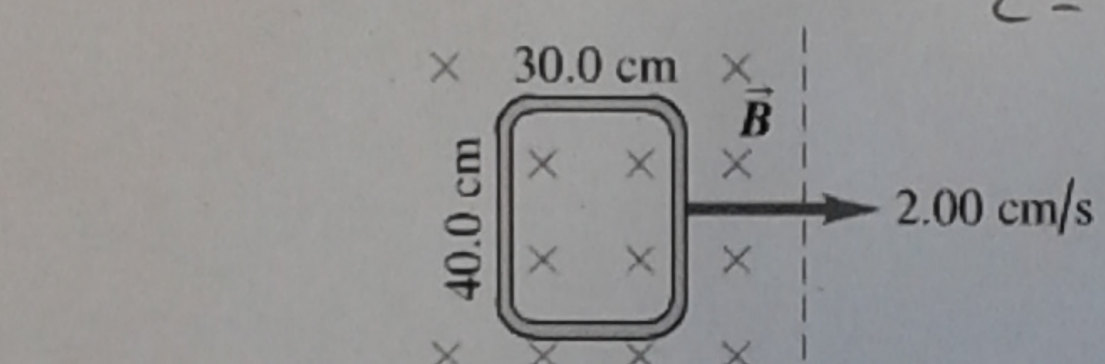
Name: **Student ID:** **Signature:**

A rectangle measuring 30.0 cm by 40.0 cm is located inside a region of a spatially uniform magnetic field of 1.25 T, with the field perpendicular to the plane of the coil as shown in the figure.The coil is pulled out at a steady rate of 2.00 cm/s traveling perpendicular to the field lines. The region of the field ends abruptly as shown. Find the emf induced in this coil when it is;

a) All inside the field;
b) Partly inside the field;
c) All outside the field.

Induced emf :

$$\mathcal{E} = -\frac{d\Phi_B}{dt}$$

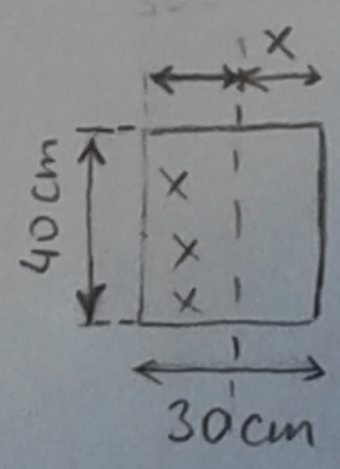


a) $\mathcal{E} = -\frac{d}{dt}(\vec{B}\cdot A\hat{n}) = -\frac{d}{dt}(BA) = 0$

where $B = \text{const.} = 1.25\ T$ and $A = 0.3m \cdot 0,4\ m =$

$= 0.12\ m^2 = \text{const.}$

b) Let



$A = 0.4 \cdot (0.3 - x)$

$B = \text{const} = 1.25\ T$

$$\mathcal{E} = -\frac{d}{dt}(BA) = -B\cdot\frac{dA}{dt} = -B\frac{d}{dt}\left(0.4\cdot(0.3-x)\right) =$$

$$= 0.4B\cdot\frac{dx}{dt} = 0.4\,Bv = 0.4\cdot 1.25\cdot 0.02 = 0.01\ Tm^2/s$$

c) The some as in b) for $x = 0.3\ m \Rightarrow \mathcal{E} = 0.01\ Tm^2/s$ //

PHYS 102: General Physics 2 **KOÇ UNIVERSITY** **Fall Semestre 2015**

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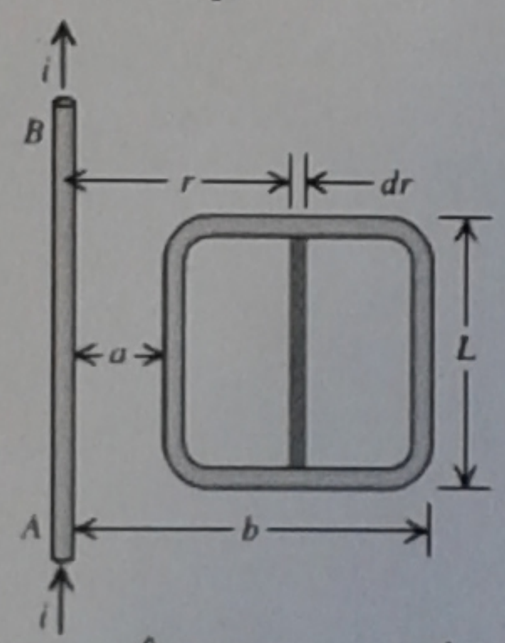
Section 1 **Quiz 10** **04 December 2015**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 10 minutes

Name: **Student ID:** **Signature:**

The current in the long, straight wire AB shown in the figure below is upward and is increasing steadily at a rate *di/dt*.

a) At an instant when the current is *i*, what are the magnitude and direction of the field $\vec{B}$ at a distance *r* to the right of the wire?
b) What is the flux $d\Phi_B$ through the narrow, shaded strip?
c) What is the total flux through the loop?
d) What is the induced emf in the loop?



a) From Ampère's law : $\oint_C \vec{B}\cdot d\vec{\ell} = \mu_0 I_{enc}$

where $I_{enc} = i(t) = \frac{di}{dt}t$ and $\frac{di}{dt} = \text{const.}$

$\Rightarrow B\cdot(2\pi r) = \mu_0 i \Rightarrow B = \frac{\mu_0 i}{2\pi r}$ //

The direction of $\vec{B}$ into into the plane $\otimes$ at "r".

b) $d\Phi_B = \vec{B}\cdot d\vec{S} = B\cdot(L\,dr) = \frac{\mu_0 i L}{2\pi r}dr \quad (\vec{B}\parallel\vec{S})$

c) $\Phi_B = \int_a^b \vec{B}\cdot d\vec{S} = \frac{\mu_0 i L}{2\pi}\int_a^b \frac{dr}{r} = \frac{\mu_0 i L}{2\pi}\ln(b/a)$ //

d) $\mathcal{E} = -\frac{d\Phi_B}{dt} = -\frac{\mu_0 L}{2\pi}\frac{di}{dt}\ln(b/a)$ //