PHYS 102: General Physics II KOÇ UNIVERSITY Spring Semester 2017

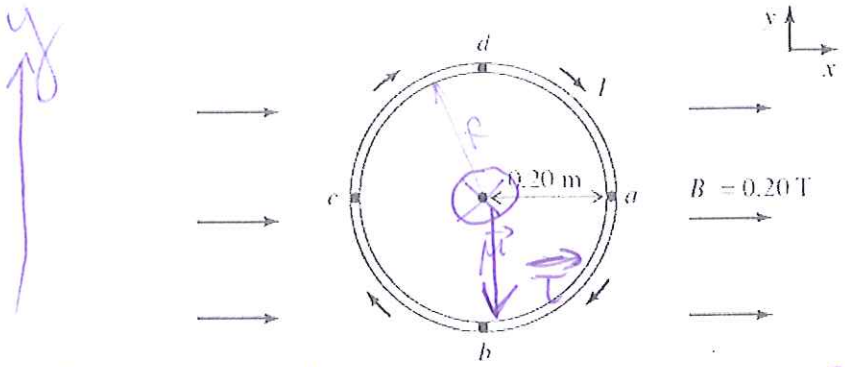
College of Sciences

Section 1 Quiz 7 03 April 2017

Closed book. No calculators are to be used for this quiz.
Quiz duration: 15 minutes

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

A rigid circular loop has a radius of 0.20 m and is in the *xy*-plane. A clockwise current I=5.0 A is carried by the loop, as shown. A uniform external magnetic field, B = 0.20 T in the positive x-direction, is present. Calculate the magnitude and the direction of the torque on the loop. Shortly after this instance, which of the points a,b,c,d will be moving towards you? Assume $\pi \simeq 3$.



Magnetic moment: $|\vec{\mu}| = IS = I\pi R^2$ into the page.

Torque: $\vec{\tau} = \vec{\mu} \times \vec{B}$

$\tau = \mu B = I\pi R^2 B = 5 \cdot 3 \cdot 0.2^2 \cdot 0.2 = 0.12 \, N.m$

(direction is downwards; -y direction)

The point (a) will be moving towards us.

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Section 2 Quiz 7 03 April 2017

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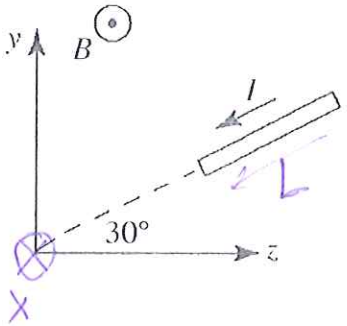
Name: **Student ID:** **Signature:**

A wire segment 1.2 m long carries a current $I = 2.0$ A, and is oriented as shown in the figure. The $+x$-axis points directly into the page. A uniform magnetic field of magnitude B=0.50 T pointing toward the $-x$ direction is present as shown. Find the magnetic force vector on the wire segment. ($sin(30^o) = 0.50, cos(30^o) \simeq 0.86$.)



$\vec{B} = -B_0 \hat{i}$, $B_0 = 0.50\,T$

Force: $\vec{F} = I\vec{L} \times \vec{B}$

where $\vec{L} = -L\sin 30^\circ \hat{j} - L\cos 30^\circ \hat{k}$

$\Rightarrow \vec{F} = -I B_0 L (\sin 30^\circ \hat{i} \times \hat{j} + \cos 30^\circ \hat{i} \times \hat{k}) =$

$= 2 \cdot 0.5 \cdot 1.2 (-0.5 \hat{k} + 0.86 \hat{j})$

$\boxed{\vec{F} = 1.2(-0.5\hat{k} + 0.86\hat{j})\ N}$

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Section 3 **Quiz 7** **03 April 2017**

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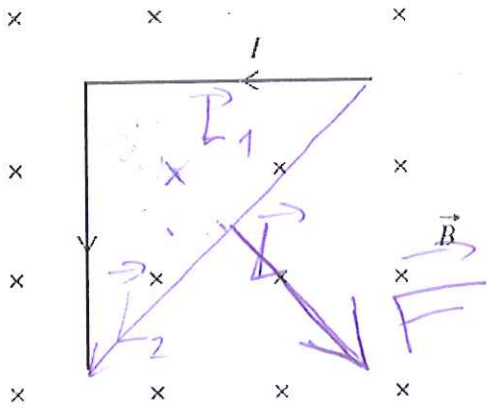
Quiz duration: 15 minutes

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

An L-shaped metal wire is made of two equal-length segments that are perpendicular to each other and carry a current I=4.0 A as shown in the figure. The wire has a total length of 6.0 m, and it is in an external magnetic field with magnitude B=0.2 T that is oriented perpendicular to the plane of the wire, as shown. What is the magnitude of the net magnetic force that the field exerts on the wire? (You may assume $\sqrt{2} \simeq 1.4$.). Indicate the direction of the net force with an arrow on the figure.

Let $\vec{L}_1$ & $\vec{L}_2$ be as shown in figure.

$\vec{F} = I\vec{L} \times \vec{B}$!

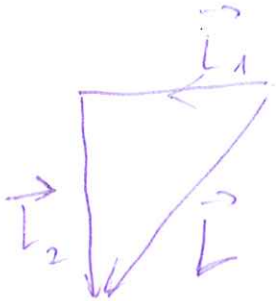


Total Magnetic force, $\vec{F} = (I\vec{L}_1 \times \vec{B} + I\vec{L}_2 \times \vec{B}) =$

$= I\vec{B} \times (\vec{L}_1 + \vec{L}_2) = I\vec{L} \times \vec{B}$

$\Rightarrow F = IBL = IBL_1\sqrt{2} = 4 \cdot 0.2 \cdot 6 \cdot \sqrt{2} = 3.36$ T

$F = 3.36$ T



PHYS 102:General PhysicsII **KOÇ UNIVERSITY** **Spring Semester 2017**

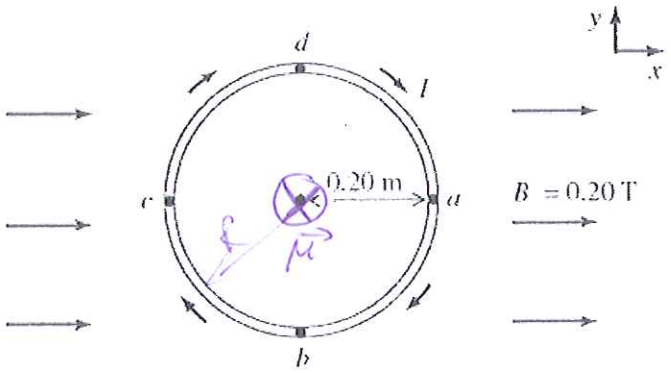
College of Sciences

Section 4 **Quiz 7** **03 April 2017**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 15 minutes

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

A rigid circular loop has a radius of 0.20 m and is in the *xy*-plane. A clockwise current I=5.0 A is carried by the loop, as shown. A uniform external magnetic field, B = 0.20 T in the positive x-direction, is present. Calculate the (magnetic) potential energy of the loop. Assume $\pi \simeq 3$.



$|\vec{\mu}| = I \cdot S = \pi I R^2 = 5 \cdot 3 \cdot 0.2^2 = 0.6\ A \cdot m^2$

Potential energy $U = -\vec{\mu} \cdot \vec{B}$

Since $\vec{\mu} \perp \vec{B} \Rightarrow \boxed{U = -\vec{\mu} \cdot \vec{B} = 0}$