PHYS 102: General Physics 2 KOÇ UNIVERSITY Spring Semester 2010

College of Sciences

Section 1 Quiz 6 15 April 2010

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

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

A particle with charge q moves with a velocity of $\vec{v} = (2\hat{\text{i}} - 4\hat{\text{j}} + \hat{\text{k}})\,\text{m/s}$ in a region in which the magnetic field is $\vec{B} = (\hat{\text{i}} + 2\hat{\text{j}} - 3\hat{\text{k}})\text{T}$. Determine the magnetic force on this particle.

$$\vec{F} = q\,\vec{v} \times \vec{B}$$

$$= q\,(2\hat{i} - 4\hat{j} + \hat{k}) \times (\hat{i} + 2\hat{j} - 3\hat{k})$$

$$= 4k + 6\hat{j} + 4\hat{k} + 12\hat{i} + \hat{j} - 2\hat{i}$$

$$\vec{F} = (10\hat{i} + 7\hat{j} + 8\hat{k})\ N$$

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Section 2 **Quiz 6** **15 April 2010**

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Quiz duration: 10 minutes

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

A particle with initial velocity $\vec{v}_0 = 4\times10^3\,\hat{\imath}$ (m/s) and charge $q = 4\times10^{-9}$ C enters a region of uniform electric and magnetic fields. The magnetic field in the region is $\vec{B} = -0.3\hat{\jmath}$ (T) and the gravitational force is negligible. If the particle passes through the region undeflected, calculate the electric field vector in the region.

$$q\vec{E} = -q(\vec{v}\times\vec{B}) \Rightarrow \vec{E} = -(\vec{v}\times\vec{B})$$

$$\vec{E} = -4\times10^3(-0.3)\,\hat{\imath}\times\hat{\jmath}$$

$$\vec{E} = 1.2\times10^3\,\hat{k}\ \text{N/C}$$

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Section 3 **Quiz 6** **15 April 2010**

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Quiz duration: 10 minutes

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

A wire carries a steady current of I=1.6A. A straight section of the wire, with a length of 1 m. along the x-axis lies within a uniform magnetic field of $\vec{B} = 1.6\hat{k}$ (T) .If the current flows in +x direction, calculate the magnetic force vector on the wire.

$$d\vec{F} = I\,d\vec{l} \times \vec{B} = I\,dx\,\hat{i} \times B\,\hat{k}$$

$$= (1.6)\cdot(1.6)\,dx\,\underbrace{\hat{i}\times\hat{k}}_{-\hat{j}}$$

$$= -2.56\,dx\,\hat{j} \qquad dx = 1\,m$$

$$\vec{F} = -2.56\,\hat{j}\ N.$$

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Section 4 **Quiz 6** **15 April 2010**

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Quiz duration: 10 minutes

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

Show that the work done by the magnetic force on a charged particle moving in a magnetic field is zero for any displacement of the particle.

$$W = \vec{F}_{mag.} \cdot d\vec{s} = (\vec{F}_{mag} \cdot \vec{v})dt = 0$$

Since $\vec{F}_{magnet} \perp \vec{v}$

$\cos 90° = 0$.

OR:

$$q(\vec{v} \times \vec{B}) \cdot \vec{v} = \frac{dW}{dt} = 0$$

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Section 5 **Quiz 6** **15 April 2010**

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

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

A magnetic force of $\vec{F} = (4\hat{i} - 3\hat{j})$ N acts on a particle with charge q moving in a uniform magnetic field of $\vec{B} = (2\hat{k})$ T. Determine the velocity vector of this particle.

$$\vec{F} = q(\vec{v} \times \vec{B})$$

$$4\hat{i} - 3\hat{j} = q(x\hat{i} + y\hat{j} + z\hat{k}) \times 2\hat{k}$$

$$4\hat{i} - 3\hat{j} = q(-2x\hat{j} + 2y\hat{i})$$

$$4 = 2yq, \quad y = \frac{2}{q}$$

$$-3 = 2xq, \quad x = \frac{3}{2q}$$

$$\Rightarrow \vec{v} = \left(\frac{3}{2}\hat{i} + 2\hat{j}\right) \text{ m/s}$$