Quiz Average **6.3** **Quiz High Score** **10**

PH 202 **Quiz # 05 (10 pts)** **Name** **Solution**

An object has a mass $2.76 \text{ x } 10^{-3}$ kg and a charge -16.2 mC experiences a magnetic force of $7.95 \text{ x } 10^{-3}$ N $(\widehat{\text{Down}})$ when it enters a magnetic field given by $\vec{B} = 9.43 \text{ x } 10^{-4}$ T $(\widehat{\text{East}})$. What is the object's velocity when it entered the magnetic field?

A. $\mathbf{5.20 \text{ x } 10^{2}\ ^{m}/_{s}\ (\widehat{South})}$

B. $5.20 \text{ x } 10^{2}\ ^{m}/_{s}\ (\widehat{\text{North}})$

C. $2.16 \text{ x } 10^{3}\ ^{m}/_{s}\ (\widehat{\text{South}})$

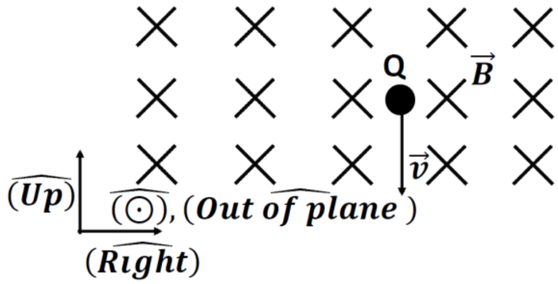
D. $2.16 \text{ x } 10^{3}\ ^{m}/_{s}\ (\widehat{\text{North}})$

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

Using the right-hand rule, we need a direction for velocity such that when crossed with $(\widehat{\mathbf{East}})$ gives $(\widehat{Up})$, because the negative charge will flip the force to $(\widehat{Down})$. So, our choices are $(\widehat{\mathbf{North}})$ or $(\widehat{South})$. $(\widehat{North})$ x $(\widehat{\mathbf{East}})$ is $(\widehat{\mathbf{Down}})$ so the velocity must be in the $(\widehat{South})$ direction since a negative charge does reverse direction. Now determine the magnitude. Solve for v

$$v = \frac{F_B}{QB} = \frac{7.95 \text{ x } 10^{-3}\ N}{(16.2 \text{ x } 10^{-3}\ C)(9.43 \text{ x } 10^{-4}\ T)} = \frac{7.95 \text{ x } 10^{-3}\ N}{1.53 \text{ x } 10^{-5}\ C\ T} = 5.20 \text{ x } 10^{2}\ ^{m}/_{s}$$

So, the correct answer is A !



As shown to the left an object has a charge of $+4.27\ \mu C$ and a mass of 9.94×10^{-12} kg. It is traveling with an initial velocity of $8.72 \times 10^{4}\ {}^{m}/_{s}\ (\widehat{Down})$ in a magnetic field given by $\vec{B} = 1.56 \times 10^{3}\ T\ (\widehat{\otimes})$ (into plane of paper). What is the magnetic force acting on the object due to these conditions?

A. $5.81 \times 10^{2}\ N\ (\widehat{Left})$

B. $\mathbf{5.81 \times 10^{2}\ N\ (\widehat{Right})}$

C. $6.66 \times 10^{-3}\ N\ (\widehat{Left})$

D. $6.66 \times 10^{-3}\ N\ (\widehat{Right})$

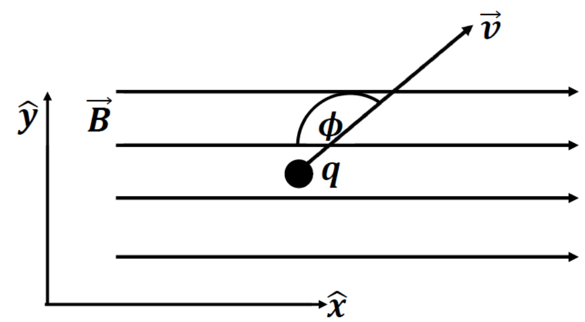
$$\vec{F_B} = Q\vec{v} \times \vec{B} = (+4.27 \times 10^{-6}\ C)\left[\left(8.72 \times 10^{4}\ {}^{m}/_{s}\ (\widehat{Down})\right) \times \left(1.56 \times 10^{3}\ T\ (\widehat{\otimes})\right)\right]$$

$$\vec{F_B} = (+4.27 \times 10^{-6}\ C)(8.72 \times 10^{4}\ {}^{m}/_{s})(1.56 \times 10^{3}\ T)\left[(\widehat{Down}) \times (\widehat{\otimes})\right]$$

$$\vec{F_B} = (+5.81 \times 10^{2}\ N)(\widehat{Right}) = 5.81 \times 10^{2}\ N\ (\widehat{Right})$$

So, the correct answer is B !

A magnetic field is determined to be $\vec{B} = 9.13 \times 10^{-2}\ \mathrm{T}\ (\widehat{+x})$. A charge $q = -7.54\ \mathrm{mC}$ has a velocity given by $\vec{v} = 6.57 \times 10^{5}\ {}^{m}/_{s}$ @ $130°$ above $(\widehat{-x})$. What is the magnitude and direction of the magnetic force acting on the charge?



A. $452.\ N\ (\widehat{\otimes})$

B. $346.\ N\ (\widehat{\otimes})$

C. $\mathbf{346.\ N}\ (\widehat{\odot})$

D. $452.\ N\ (\widehat{\odot})$

$$\vec{F_B} = q\vec{v} \times \vec{B}$$

Using right hand rule, $\vec{v} \times \vec{B}$ gives a direction into the page $(\widehat{\otimes})$,but the negative charge flips that and the force will point out of the page $(\widehat{\odot})$!

$$\left|\vec{F_B}\right| = \left|q\vec{v} \times \vec{B}\right| = qvB\ \sin(\theta)$$

The angle given in the picture is not θ, which is the angle between $\vec{v}$ and $\vec{B}$. The relationship for θ is

$$\theta = 180° - \phi = 180° - 130° = 50°$$

$$\left|\vec{F_B}\right| = (7.54 \times 10^{-3}\ C)(6.57 \times 10^{5}\ {}^{m}/_{s})\ (9.13 \times 10^{-2}\ T)\ \sin(50°)$$

$$\left|\vec{F_B}\right| = (4.523 \times 10^{2}\ N)\ \sin(50°) = 346.\ N$$

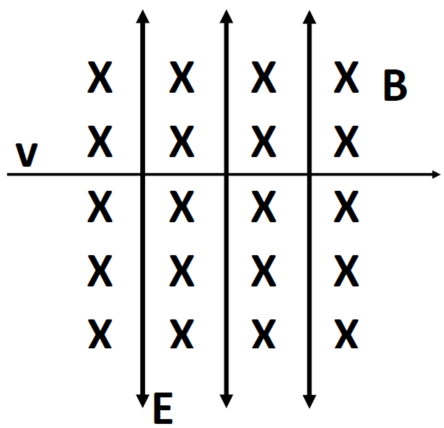
So, the correct answer is C !

An object is making circular paths in a magnetic field which has a field strength given by $\vec{B} = 787.\text{ T}\ (\widehat{\text{West}})$. The object has a mass of 5.24×10^{-3} kg. It has a charge of $Q = +3.41$ mC. The radius of the circular path is 0.171 m. Its speed is $87.6\ ^{\text{m}}/_{\text{s}}$. How much work is the magnetic force doing as the object travels a distance of 4.30 m along the circular path?

A. 54.7 J **B.** $3380.\text{ J}$ **C.** $1010.\text{ J}$ **D.** $\mathbf{0.00\ J}$

The object is traveling along a circular path as the magnetic force is directed towards the center of the circle. Since the displacement is along the circle, the angle between the force and displacement is 90°. Therefore, the work done is Zero!

So, the correct answer is D !



An object that has a mass $m = 7.56 \times 10^{-14}$ kg and a charge of $q = -37.9\ \mu\text{C}$ is moving with a velocity $\vec{v} = 1750.0\ ^{\text{m}}/_{\text{s}}\ (\widehat{\text{Right}})$ as shown on the left. It enters a region of space, which has both a magnetic field $\vec{B} = 137.0\text{ T}\ (\widehat{\otimes})$ and electric field, which could be going either $(\widehat{\text{Up}})$ or $(\widehat{\text{Down}})$. What is the magnitude and direction of the electric field so that the object experiences no net force from the electric and magnetic fields acting on it as it travels through this region of space?

A. $1.28 \times 10^{1}\ ^{\text{N}}/_{\text{C}}\ (\widehat{\text{Up}})$ **C.** $1.28 \times 10^{1}\ ^{\text{N}}/_{\text{C}}\ (\widehat{\text{Down}})$

B. $2.40 \times 10^{5}\ ^{\text{N}}/_{\text{C}}\ (\widehat{\text{Up}})$ **D.** $\mathbf{2.40 \times 10^{5}\ ^{N}/_{C}\ (\widehat{Down})}$

$$\overrightarrow{F_{Net}} = \overrightarrow{F_E} + \overrightarrow{F_B} = q\vec{E} + q\vec{v} \times \vec{B} = 0$$

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

$$\vec{E} = -\vec{v} \times \vec{B} = -\left(1750.0\ ^{m}/_{s}\ (\widehat{Right})\right) \times \left(137.0\ T\ (\widehat{\otimes})\right)$$

$$\vec{E} = -2.40 \times 10^{5}\ ^{N}/_{C}\left((\widehat{Right}) \times (\widehat{\otimes})\right) = -2.40 \times 10^{5}\ ^{N}/_{C}\ (\widehat{Up}) = 2.40 \times 10^{5}\ ^{N}/_{C}\ (\widehat{Down})$$

So, the correct answer is D !
