Nishant Jindal



# DPP – 1

## SOLUTION

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**1.** $\frac{r_1}{r_2} = \frac{6}{5}$

$\frac{m_1}{m_2} = \frac{9}{4}$, $\frac{q_1}{q_2} = ?$

$r = \frac{mv}{q_B} = \frac{m}{q_B}\sqrt{\frac{2k}{m}}$

$r = \frac{1}{q_B}\sqrt{2mk}.$

$\frac{r_1}{r_2} = \sqrt{\frac{m_1}{m_2}} \times \frac{q_2}{q_1} \quad \Rightarrow \quad = \frac{6}{5} = \sqrt{\frac{9}{4}} \times \frac{q_2}{q_1}$

$\Rightarrow \frac{q_1}{q_2} = \frac{5}{4}$

$q_1 + q_2 = p + q = 9$

**2.** $\vec{B} = (2\hat{i} + 3\hat{j})T.$

$\vec{a} = (\alpha\hat{i} - 4\hat{j})m/s^2.$

$\vec{F} \perp \vec{B} \Rightarrow \vec{a} \perp \vec{B}$

$\vec{a} \cdot \vec{B} = 0$

$\Rightarrow 2\alpha - 12 = 0$

$\alpha = 6$

**3.**

| Proton, | deuteron | α-particle |
|---|---|---|
| $m_p$ | 2mp | $\simeq$ 4mp |
| $q = e$ | $q = e$ | $q^1 = 2e$ |

$r_p = \frac{\sqrt{2m_pk}}{eB}$ $r_d = \frac{2 \times 2m_pk}{eB}$

$r_\alpha = \frac{\sqrt{2 \times 4m_pk}}{2eB}$

$r_p : r_d : r_\alpha = 1 : \sqrt{2} : 1 = k : \frac{p}{\sqrt{2}} : 1$

$k = 1$ $p = 2$

$k + p = 3$

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**4.** (d) : Given : $v = 4 \times 10^5$ m/s, $\theta = 60°$, $m = 1.67 \times 10^{-27}$ kg,

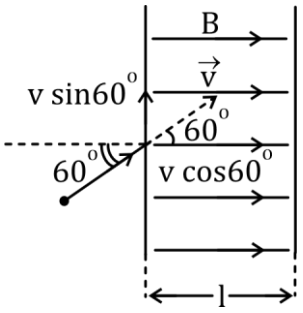
$q = 1.6 \times 10^{-19}$C, $B = 0.3$ T

Time of one revolution, $T = \frac{2\pi m}{qB}$

$l = (v\cos\ 60°) \times (10T) = \frac{10\pi mv}{qB}$

$\Rightarrow l = \frac{10\times3.14\times(1.67\times10^{-27})\times(4\times10^5)}{(1.6\times10^{-19})(0.3)}$

Here, $l = 0.4369$ m $\approx 0.444$ m




**5.** (b) : Given : $q = 1\mu C; \vec{v} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ m/s

$\vec{B} = (5\hat{i} + 3\hat{j} - 6\hat{k}) \times 10^{-3}$ T; $\vec{F}_M = \vec{F} \times 10^{-9}$ N

Magnetic force, $\vec{F}_M = q(\vec{v} \times \vec{B}); \vec{v} \times \vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 2 & 3 & 4 \\ 5 & 3 & -6 \end{vmatrix} \times 10^{-3}$

$= [\hat{i}(-18 - 12) - \hat{j}(-12 - 20) + \hat{k}(6 - 15)] \times 10^{-3}$

$= (-30\hat{j} + 32\hat{j} - 9\hat{k}) \times 10^{-3}$

$\therefore\ \vec{F}_M = 1 \times 10^{-6} \times 10^{-3}(-30\hat{i} + 32\hat{j} - 9\hat{k})$

$\vec{F}_M = (-30\hat{i} + 32\hat{j} - 9\hat{k}) \times 10^{-9}$ N

So, $\vec{F} = -30\hat{i} + 32\hat{j} - 9\hat{k}$

**6.** $R_1 < R_2$

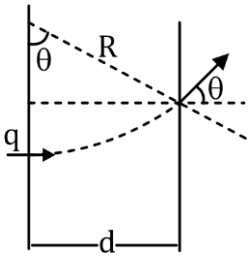
$\frac{m_1 v}{q_1 B} < \frac{m_2 v}{q_2 B} \quad \Rightarrow \quad \frac{m_1}{q_1} < \frac{m_2}{q_2}$

**7.** $R = \frac{mv}{qB} = \frac{p}{QB}$

$R = \frac{p}{qB}$

$\sin\ \theta = \frac{d}{R} = \frac{dQB}{P}$

$\sin\ \theta = \frac{dQ_B}{P}$ (A)



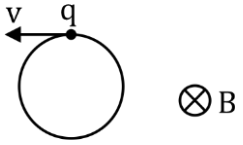

**8.** $\odot\ \vec{B}$ outward

$R = \frac{mv}{qB}$

$R \downarrow$ ses $\quad v \downarrow$ ses

**9.** $R = \frac{mv}{qB}$

$T = \frac{2\pi m}{qB}$



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$$f = \frac{1}{T} = \frac{qB}{2\pi m}$$

**10.** $R = \frac{mv}{qB}$

$$\sin\theta = \frac{d}{R} = \frac{dqB}{mv}$$

$$\frac{q}{m} = \frac{v\sin\theta}{dB}$$ (D)