DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 10

Topic :- MOVING CHARGES AND MAGNETISM

1 **(a)**

Magnetic field inside the conductor $B_{in} \propto r$ and magnetic field outside the conductor $B_{\text{out}} \propto \frac{1}{r}$

[where r is the distance of observation point from axis]

2 **(b)**

$r = \frac{\sqrt{2mK}}{qB}$ $i.e.$ $r \propto \frac{\sqrt{m}}{q}$

Here kinetic energy K and B are same

$\therefore \frac{r_e}{r_p} = \sqrt{\frac{m_e}{m_p}} \times \frac{q_p}{q_e} \Rightarrow \frac{r_e}{r_p} = \sqrt{\frac{m_e}{m_p}}\, [\because q_e = q_p]$

Since $m_e < m_p$, therefore $r_e < r_p$

3 **(c)**

$$r = \frac{mv}{Bq}$$

$$\Rightarrow r = \frac{v}{B\frac{q}{m}} = \frac{2 \times 10^5}{0.05 \times 2.5 \times 10^7}$$

$$= \frac{2 \times 10^7}{12.5 \times 10^7} = \frac{200}{12.5} \text{ cm} = 16 \text{ cm}$$

4 **(a)**

The force per unit length between two parallel wires carrying currents $i_1$and i_2 separated by a distance R is given by

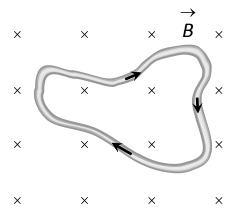
$\frac{F}{l} = \frac{\mu_0}{2\pi}\frac{i_1 i_2}{2}$

$\Rightarrow \frac{F}{l} \propto \frac{1}{R}$

Hence, graph between force per unit length and distance between wires is a straight line.

5 **(a)**

As shown in figure, since $\vec{L} = 0$



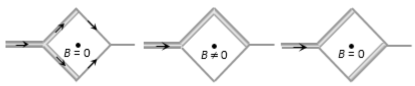
Hence according to $\vec{F} = i(\vec{L} \times \vec{B}) \Rightarrow \vec{F} = 0$

6 **(c)**

Current corresponding to the beams of protons and electrons are in opposite direction. Therefore, both will experience a force of repultion and therefore move more apart.

7 **(a)**

From figure it is clear that



$\sin\theta = \frac{d}{r}$ also $r = \frac{p}{qB}$

$$\therefore \sin\theta = \frac{Bqd}{p}$$

8 **(b)**

Magnetic induction at the center of circulre loop

$$B = \frac{\mu_0}{2} \cdot \frac{ni}{r}$$

Magnetic moment of the loop

$$M = niA = \frac{2BrA}{\mu_0}$$

$$= \frac{2 \times 0.1 \times 1 \times \pi \times (1)^2}{\mu_0}$$

$$= \frac{0.2\pi}{\mu_0} \qquad (\because r = 1)$$

9 **(a)**

$$dB = \frac{\mu_0(dq)}{2r}\left(\frac{\omega}{2\pi}\right)$$

$$B = \int dB = \frac{\mu_0\omega}{4\pi} \cdot \frac{Q}{\pi R^2} 2\pi \int_0^R \frac{rdr}{r}$$

$$B = \frac{\mu_0\omega Q}{2\pi R^2} . R$$

$$B = \frac{\mu_0\omega Q}{2\pi R}$$

$B \propto \frac{1}{R}$

10 **(b)**

The field at the midpoint of BC due to AB is $\left(-\frac{\mu_0}{4\pi}.\frac{i}{d/2}\hat{k}\right)$ and the same is due to CD.

Therefore the total field is $\left[-\left(\frac{\mu_0 i}{\pi d}\right)\hat{k}\right]$

11 **(d)**

$$B = \mu_0 ni = \mu_0 \frac{N}{L} i$$

13 **(b)**

$$\frac{\mu_0}{4\pi} \times \frac{2\pi i}{r} = H \Rightarrow \frac{(10^{-7}) \times 2 \times 3.142 \times i}{0.05} = 7 \times 10^{-5}$$

$$\therefore i = \frac{7 \times 0.05 \times 10^{-5}}{2 \times 3.142 \times 10^{-7}} = \frac{35}{2 \times 3.142} = 5.6\ amp$$

14 **(b)**

$G = 100\ \Omega$

$I_g = 10^{-5}$ A

$I = 1$ A

$S = ?$

$I_g \times G = (I - I_g) \times S$

$$S = \left(\frac{I_g}{I - I_g}\right) \times G = \frac{10^{-5}}{1 - 10^{-5}} \times 100$$

Or $= \frac{10^{-3}}{1 - 0.00001} = 10^{-3}\ \Omega$

15 **(d)**

When a charged particle moves inside a uniform magnetic field then the radius of the circular path is

$$r = \frac{mv}{Bq} = \frac{9.1 \times 10^{-31} \times 3 \times 10^7}{5 \times 10^{-4} \times 1.6 \times 10^{-19}} = 0.34 \text{ m} = 34 \text{ cm}$$

16 **(a)**

Biot-Savart's law in vector form is given as

$$\mathbf{dB} = \frac{\mu_0}{4\pi} i \frac{\mathbf{d1} \times \mathbf{r}}{r^3}$$

17 **(b)**

Because for inside the pipe $i = 0$

$$\therefore B = \frac{\mu_0 i}{2\pi r} = 0$$

19 **(b)**

For motion of a charged particle in a magnetic field, we have $r = mv/qB$ *i.e.* $r \propto v$

20 **(c)**

Time period of cyclotron is

$$T = \frac{1}{v} = \frac{2\pi m}{eB}$$

$$B = \frac{2\pi m}{e} v$$

$$R = \frac{mv}{eB} = \frac{p}{eB} \Rightarrow p = eBR = e \times \frac{2\pi mv}{e} R = 2\pi mvR$$

$$K.E. = \frac{p^2}{2m} = \frac{(2\pi m\, v\, R)^2}{2m} = 2\pi^2\, mv^2R^2$$

ANSWER-KEY										
Q.	1	2	3	4	5	6	7	8	9	10
A.	A	B	C	A	A	C	A	B	A	B
Q.	11	12	13	14	15	16	17	18	19	20
A.	D	A	B	B	D	A	B	D	B	C