DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

Solutions

Subject : PHYSICS
DPP No. : 5

Topic :- MOVING CHARGES AND MAGNETISM

1 **(d)**

Torque $\vec{\tau} = \vec{M} \times \vec{B}$ or $\tau = BM\sin\theta$, where $\vec{M}$ is perpendicular to the plane of the coil. Due to this torque, the coil will orient itself so that the torque on the coil is zero. ie, $\theta = 0^0$ .It means $\vec{M}$ is parallel to $\vec{B}$. So, the plane of the coil is perpendicular to this direction of magnetic field.

2 **(d)**

$B = \frac{\mu_0}{4\pi}\frac{2I}{r}$

or $B \propto \frac{1}{r}$

$\therefore \frac{B'}{B} = \frac{r}{2r}$

or $B' = B \times \frac{r}{2r} = 0.4 \times \frac{1}{2} = 0.2$ T

3 **(d)**

Magnetic force on straight wire

$F = Bil\sin\theta = Bil\sin 90° = Bil$

For equilibrium of wire in mid-air,

$F = mg$

$Bil = mg$

$\therefore B = \frac{mg}{il} = \frac{200 \times 10^{-3} \times 9.8}{2 \times 1.5} = 0.65$ T

4 **(a)**

$r = \frac{\sqrt{2mK}}{qB} \Rightarrow K \propto \frac{q^2}{m} \Rightarrow \frac{K_p}{K_\alpha} = \left(\frac{q_p}{q_\alpha}\right)^2 \times \frac{m_\alpha}{m_p}$

$\Rightarrow \frac{1}{K_\alpha} = \left(\frac{q_p}{2q_p}\right) \times \frac{4m_p}{m_p} = 1 \Rightarrow K_\alpha = 1\ MeV$

5 **(c)**

Magnetic induction at the centre of the coil of radius r is

$B_c = \frac{\mu_0 nI}{2r}$ ...(i)

Magnetic induction on the axial line of a circular coil at a distance x from the centre is

$$B_a = \frac{\mu_0 n r^2 I}{2(r^2 + x^2)^{3/2}}$$

Given $x = r$

$$\therefore \quad B_a = \frac{\mu_0 n r^2 I}{2(2r^2)^{3/2}} \qquad \text{...(ii)}$$

From Eqs. (i) and (ii), we get

$$\frac{B_c}{B_a} = \frac{2\sqrt{2}}{1}$$

6 **(b)**

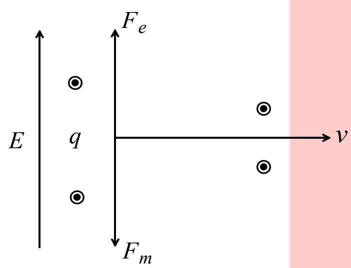
$Bev = mv^2/r$ or $v = Ber/m$

$$= \frac{10^{-3} \times 1.6 \times 10^{-19} \times 0.01}{9.0 \times 10^{-31}}$$

$= 1.77 \times 10^6 \text{ ms}^{-1}$

7 **(b)**

If both electric and magnetic fields are present and perpendicular to each other and the particle is moving perpendicular to both of them with $F_e = F_m$. In this situation $\vec{\mathbf{E}} \neq 0$ and $\vec{\mathbf{B}} \neq 0$.



But if electric field becomes zero, then only force due to magnetic field exists. Under this force, the charge moves along a circle

8 **(d)**

Magnetic force on straight wire

$F = Bil \sin\theta$

$\quad = Bil \sin 90° = Bil$

For equilibrium of wire in mid-air,

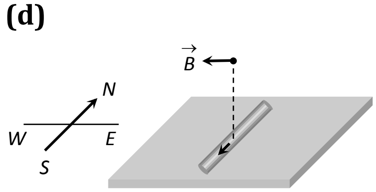
$F = mg$

$Bil = mg$

$$\therefore B = \frac{mg}{il}$$

$$= \frac{200 \times 10^{-3} \times 9.8}{2 \times 1.5} = 0.65 \text{ T}$$

9 **(d)**



10 **(a)**

$$F = \frac{\mu_0}{4\pi}\frac{2i_1i_2}{a} = 10^{-7} \times \frac{2 \times 10 \times 5}{0.1} = 10^{-4} N \text{ [Repulsive]}$$

11 **(a)**

$r = \frac{mv}{Bq}$ or $r \propto \frac{m}{q}$ for the same value of v and B.

$$\therefore \quad r_P : r_d : r_\alpha = \frac{m_P}{q_D} : \frac{m_d}{q_d} : \frac{m_\alpha}{q_\alpha}$$

$$= \frac{m}{l} : \frac{2m}{l} : \frac{4m}{2l} = 1 : 2 : 2$$

12 **(b)**

$$B = \frac{\mu_0}{4\pi}\frac{\theta i}{r} = \frac{\mu_0}{4\pi} \times \frac{\pi}{2} \times \frac{i}{R} = \frac{\mu_0 i}{8R}$$

13 **(c)**

The magnetic induction due to both semicircular parts will be in the same direction perpendicular to the paper inwards

$$\therefore B = B_1 + B_2 = \frac{\mu_0 i}{4r_1} + \frac{\mu_0 i}{4r_2} = \frac{\mu_0 i}{4}\left(\frac{r_1 + r_2}{r_1 r_2}\right) \otimes$$

14 **(c)**

As, $qV = \frac{1}{2} m v^2$

Or $v = \sqrt{2qV/m}$;

So, $v \propto \sqrt{q/m}$ $\therefore \frac{v_2}{v_1} \propto \sqrt{\frac{2q/4m}{q/m}} = \frac{1}{\sqrt{2}}$

15 **(d)**

$M = niA = ni(\pi r^2) \Rightarrow M \propto r^2$

16 **(a)**

If the particle enters in the magnetic field parallel to the direction of the field, then it will move in a straight line.

17 **(b)**

Here, $2r = 0.1 \text{ nm} = 0.1 \times 10^{-9} \text{ m} = 10^{-10} \text{ m}$;

$$i = \frac{e}{T} = \frac{e\omega}{2\pi}$$

Now, $B = \frac{\mu_0}{4\pi}\frac{2\pi n i}{r} = \frac{\mu_0}{4\pi}\frac{2\pi n}{r}\left(\frac{e\omega}{2\pi}\right)$

$= \frac{\mu_0}{4\pi}\frac{ne\omega}{r}$

Or $\omega = B.\left(\frac{4\pi}{\mu_0}\right) \times \frac{r}{ne}$

$$= 14 \times \frac{1}{10^{-7}} \times \frac{(10^{-10})/2}{1 \times 1.6 \times 10^{-19}}$$

$= 4.4 \times 10^{16} \text{ rads}^{-1}$.

18 **(b)**

$$\frac{mv^2}{R} = qvB$$

For proton, $R_p = \frac{mv}{Bq} = \frac{\sqrt{2M_pE}}{q_pB}$

Similarly for deuteron and α-particle

$R_d = \frac{\sqrt{2M_dE}}{q_pB}$ and $R_\alpha = \frac{\sqrt{2M_\alpha E}}{q_\alpha B}$

According to the question

$\therefore R_p : R_d : R_\alpha$

or $\frac{\sqrt{M_p}}{q_p} : \frac{\sqrt{M_d}}{q_d} : \frac{\sqrt{M_\alpha}}{q_\alpha}$

$\therefore \frac{\sqrt{1}}{1} : \frac{\sqrt{2}}{1} : \frac{\sqrt{4}}{2}$ or $1 : \sqrt{2} : 1$

19 **(a)**

Charged particles deflect in magnetic field

20 **(d)**

$T = \frac{2\pi m}{qB} \Rightarrow T \ \alpha \ v^o$

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