DPP
DAILY PRACTICE PROBLEMS

Class : XIIth
Date :

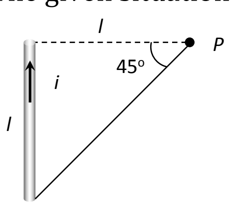
Solutions

Subject : PHYSICS
DPP No. : 9

Topic :- MOVING CHARGES AND MAGNETISM

1 **(c)**

The given situation can be redrawn as follows:



As we know the general formula for finding the magnetic field due to a finite length wire

$B = \frac{\mu_0}{4\pi} . \frac{i}{r} (\sin \phi + \sin \phi_2)$

Here $\phi_1 = 0°, \phi = 45°$

$\therefore B = \frac{\mu_0}{4\pi} . \frac{i}{r} (\sin 0° + \sin 45°) = \frac{\mu_0}{4\pi} . \frac{i}{\sqrt{2} l} \Rightarrow B = \frac{\sqrt{2}\, \mu_0 i}{8\pi l}$

2 **(d)**

$\tau_{max} = MB$ or $\tau_{max} = ni\pi r^2 B$. Let number of turns in length l be n, so $l = n(2\pi r)$ or $\alpha = \frac{l}{2\pi n}$

$\Rightarrow \tau_{max} = \frac{ni\pi B l^2}{4\pi^2 n^2} = \frac{l^2 iB}{4\pi\, n_{min}} \Rightarrow \tau_{max} \propto \frac{1}{n_{min}} \Rightarrow n_{min} = 1$

3 **(c)**

In magnetic field, the radius of circular path

$r = \frac{mv}{Bq} = \frac{v}{B(q/m)}$ $ie,\ r \propto 1/(q/m)$

4 **(c)**

Magnetic field due to solenoid is directed along its axis. The charged particle projected along the axis of solenoid does experience any magnetic force. So, velocity of charged particle remains unchanged.

5 **(b)**

$W = MB(\cos \theta_1 - \cos \theta_2)$

$= (NiA)B(\cos 0° - \cos 180°) = 2NAIB$

7 **(a)**

As revolving charge is equivalent to a current, so

$I = q\,f = q \times \dfrac{\omega}{2\pi}$

But $\omega = \frac{v}{R}$

Where R is radius of circle and v is uniform speed of charged particle.

Therefore, $I = \frac{qv}{2\pi R}$

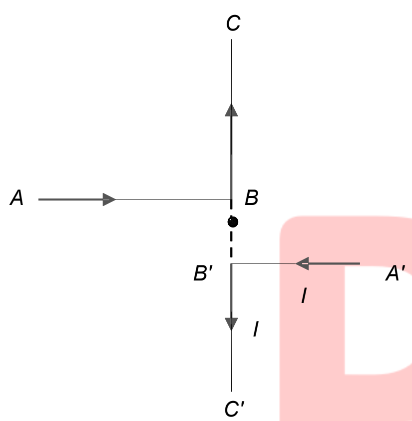
Now, magnetic moment associated with charged particle is given by

$\mu = IA = I \times \pi R^2$

or $\mu = \frac{qv}{2\pi R} \times \pi R^2 = \frac{1}{2} qvR$

8 **(b)**

Magnetic field $B = 2\left[\frac{\mu_0 I}{4\pi r}\right]$



9 **(d)**

The coil carrying current i, in clockwise coil have South polarity on that face of coil and other coil having current i_2 in counter clockwise will have North polarity on that face of coil. As south and north poles will attract each other, hence a steady attractive force acts between coils.

10 **(a)**

The magnetic field at a point on the axis of a circular loop at a distance x from the centre is

$$B = \frac{\mu_0 i R^2}{2(R^2 + x^2)^{3/2}} \qquad \text{...(i)}$$

Given, $B = 54\ \mu\text{ T}$, $x = 4$ cm, $R = 3$ cm

Putting the given values in Eq. (i), we get

$$\therefore \qquad 54 = \frac{\mu_0 i \times (3)^2}{2(3^2 + 4^2)^{3/2}}$$

$$\Rightarrow \quad 54 = \frac{9\mu_0 i}{2(25)^{3/2}} = \frac{9\mu_0 i}{2 \times (5)^3}$$

$$\therefore \quad \mu_0 i = \frac{54 \times 2 \times 125}{9}$$

$$\mu_0 i = 1500\ \mu\text{T} - \text{cm} \qquad \text{...(ii)}$$

Now, putting $x = 0$ in Eq. (i), magnetic field at the centre of loop is

$$B = \frac{\mu_0 i R^2}{2R^3} = \frac{\mu_0 i}{2R} = \frac{1500}{2 \times 3}$$

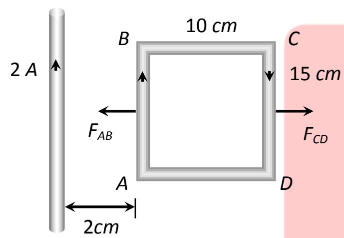
$$= 250\ \mu\text{T} \qquad \text{[From Eq. (ii)]}$$

11 **(c)**

$1\ tesla = 10^4\ gauss$

12 **(a)**

Force on side BC and AD are equal but opposite so their net will be zero



But $F_{AB} = 10^{-7} \times \frac{2 \times 2 \times 1}{2 \times 10^{-2}} \times 15 \times 10^{-2} = 3 \times 10^{-6} N$

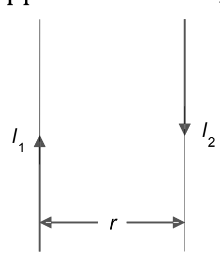
and $F_{CD} = 10^{-7} \times \frac{2 \times 2 \times 1}{(12 \times 10^{-2})} \times 15 \times 10^{-2} = 0.5 \times 10^{-6} N$

$\Rightarrow F_{net} = F_{AB} - F_{CD} = 2.5 \times 10^{-6} N$

$= 25 \times 10^{-7} N$, towards the wire

13 **(b)**

According to Fleming's left hand rule, if the two parallel conductors carry currents in opposite direction, they repel each other.



14 **(a)**

$B = \frac{\mu_0}{4\pi} \cdot \frac{2i}{r} \Rightarrow \frac{B_1}{B_2} = \frac{r_2}{r_1} \Rightarrow \frac{10^{-8}}{B_2} = \frac{12}{4}$

$\Rightarrow B_2 = 3.33 \times 10^{-9} tesla$

15 **(c)**

The magnetic field outside the cylinder at point P is

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

And inside the cylinder at point P

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

At the axis $r = 0$

So, the magnetic field at the axis of the conductor is zero.

16 **(b)**

As, $F = \frac{\mu_0}{4\pi}\frac{2i_1 i_2}{r}$ ie, $F \propto i_1 i_2$. Therefore force will becomes four time ie, $4F$.

18 **(a)**

$\vec{F} = q(\vec{v} \times \vec{B}) = -2 \times 10^{-6}[\{(2\hat{i} + 3\hat{j}) \times 10^6\} \times 2\hat{j}]$

$\vec{F} = -8\hat{k}$

19 **(b)**

Since, voltage remains same in parallel, so,

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

$$\Rightarrow \frac{i_1}{i_2} = \frac{R_2}{R_1}$$

$$\frac{i_1}{i_2} = \frac{\rho l_2/A_2}{\rho l_1/A_1} \qquad \left(\because R = \frac{\rho l}{A}\right)$$

$$\Rightarrow \frac{i_1}{i_2} = \frac{l_2}{l_1} \times \left(\frac{r_1}{r_2}\right)^2 \quad (\because A = \pi r^2)$$

$$\Rightarrow \frac{i_1}{i_2} = \frac{3}{4} \times \left(\frac{2}{3}\right)^2$$

Hence, $\frac{i_1}{i_2} = \frac{1}{3}$

20 **(b)**

$M' = \sqrt{M^2 + M^2} = \sqrt{2}M$. As magnetic moments are in a closed loop in Fig. (b)

$\therefore M = 0$

In Fig. (c) $M' = M - M = 0$

In Fig. (d)

$M' = \sqrt{M^2 + M^2 + 2MM\cos 60°} = \sqrt{3}M$

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